CLOUD COMPUTING WITH A MODEL FUTURISTIC MATURITY

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ABSTRACT

The need for a specification for Cloud Computing has emerged. The commoditization of the term "Cloud Computing" for various marketing purposes has diluted and in some cases compromised the underlying intent of Cloud Computing. However, the recognition of the foundational computing model inferred by the generic term as a significant technique for computing in the 21st century is clear. Cloud Computing represents a disruptive, watershed event no less significant that the compute model revolutions that preceded it. This paper presents a futuristic maturity model for Cloud Computing with the goal of providing an engineered description of the concept. A by-product of creating this specification is an applied analytical method for understanding Cloud Computing within any business setting. This method can be used by technical and business professionals to assist in the design of an appropriate Cloud Computing strategy for their particular enterprise uninfluenced by marketing hype, misinterpretation of the term, or inappropriate architectural decisions based on incomplete knowledge. This neutralizing approach drives the organization to a set of features that can then be aligned to products that meet requirements and solve mission issues or provide competitive value. Only through an engineered perspective can realization of holistic end to end architectural specification for Cloud Computing be achieved. This will allow for the compartmentalization of the various vendor and product types into a common framework structure that can be used to understand and apply the concepts as needed. The audiences for this specification are the architects and engineers building and integrating these components as well as the owners and managers who will be seeking the benefits and promise of Cloud Computing.

Keywords: CCMM, Architecture, Maturity Model

1. INTRODUCTION

Cloud Computing has recently seen enormous attention in the trade press around the world, and has become the latest "next-thing" in computing today. Large public and private enterprises have begun to recognize the significance of the Cloud Computing concept by the documented successes of Amazon and others in the hardware infrastructure arena. Success of newcomers like Google Apps and Amazon EC2, as well as those who have been operating for more than ten years like Salesforce.com, in the software area indicate the evolving cloud trend has arrived as a significant market force.

Cloud computing, with the revolutionary promise of computing as a utility, has the potential to transform how IT services are delivered and managed. Yet, despite its great promise, even the most seasoned professionals know little about cloud computing or how to define it. A recent study revealed that 41% of senior IT professionals admit that they "don't know" what cloud computing is. This research follows a similar survey highlighting that two-thirds of senior finance professionals are confused about cloud computing (Version One, 2009).

The reasons for the increasing interest among government agencies are myriad. To begin, cloud computing offers an entirely new way of looking at IT infrastructure. From a hardware point of view, cloud computing offers seemingly never ending computing resources available on demand, thereby eliminating the need to budget for hardware that may only be used in high peak timeframes. Cloud computing eliminates an up-front commitment by users, thereby allowing agencies to start small and increase hardware resources only when there is an increase in their needs. Moreover, cloud computing provides the ability to pay for use of computing resources on a short-term basis as needed (e.g., processors by the hour and storage by the day) and release them as needed (Berkeley, 2009).As for the bottom line, cloud computing enables governments to lower the expense of existing IT services and to cost-effectively introduce enhanced services. Moreover, government agencies not only benefit from increased productivity engendered by cloud computing, but citizens as well benefit from the more efficient use of tax dollars (IN PUT , 2009). Costs associated with IT operations in many cases decrease significantly, because services can be purchased on-demand. Finally, administrative time spent attending to the needs of the IT infrastructure can be reduced, with personnel freed to devote more time to an agency's core mission objectives.

1.1 Understanding the Cloud Computing Specification

Complete understanding of a contemporary Cloud Computing specification requires knowing the evolution and roots of the concept. Historical understanding helps frame a vendor neutral scoping of a cloud endeavor for any particular entity today. Cloud Computing is far easier to declare once the fundamental components are recognized and understood. The following are key milestones shaping today's Cloud Computing components.

Technological advancement in the areas of hardware, software and network have today enabled the new compute model called "cloud". On this new model hardware, software, and their related aspects of orchestration, infrastructure and platform reside. They are provided as services, meaning from a business perspective, cost is based on a lease model as opposed to an owned model. This distinction is proving revolutionary in the marketplace as cost drivers and efficiencies from this new technical style provide significant motivation towards a cloud computing model. From a technical perspective services imply decoupled highly distributed components reminiscent of Service Oriented Architectures (SOA) which Cloud Computing may actually be compared. This confluence of technology has enormous implications for all firms in the future.

Because these advances have allowed the ability to leverage heretofore owned elements as a service, significant cost options now enter into the cost/benefit trades of technology portfolios. Having an entire development model cloud resident in a secure cloud through a browser without the encumbrance of hardware elements engenders a far different software construction environment than traditional coding tethered to a developers machine. Significant cost savings due to massive economies of scale disrupt traditional software license models and the flexibility of extending and contracting compute power as needed present enormously compelling cost savings drivers.

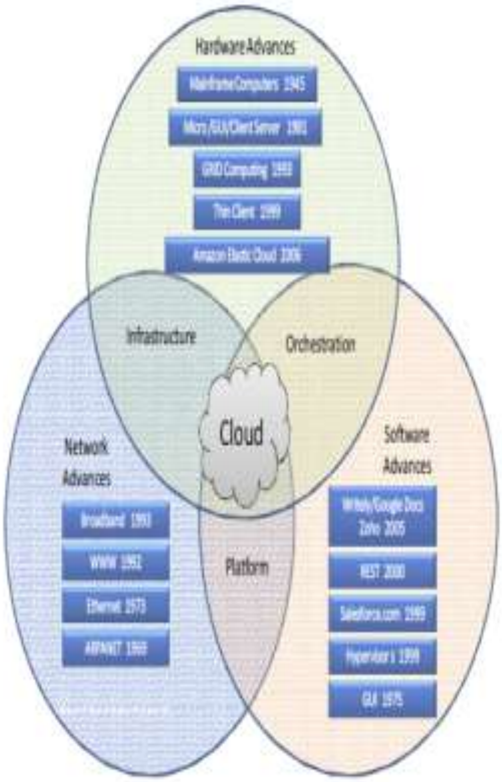

Figure 1: Historical component evolution forming today's "Cloud"

1.2. Contemporary Technology Forecasts

As shown in the historical tracing, maturation of various technologies has given rise to a new product types and styles. The general idea of remote computing power leveraging the Internet, Internet technologies or similar technology is the common complexion of this style called Cloud Computing. Generally speaking the ability to lower costs and increase utility is the driving factor that will be very disruptive to traditional client server, and fat1 client based software.

1.3. Engineering a Cloud Computing Specification

There are historical thresholds marked by advances in technology and computing styles that lead to today's Cloud Computing furor. Because of the resulting economies engendered by many aspects of Cloud Computing, enterprises are attempting to adopt a Cloud Computing strategy for their organizations. However there is no roadmap to successfully engineering a viable solution. Thus it becomes vitally important to recognize and orient to the proper perspective when engineering any particular Cloud Computing initiative.

There can generally be identified three core elements of a Cloud Computing system that mirror traditional computing components. The hardware, the software and the transport mechanism characterize the fundamentals of any computer system. Data of course, is the common component being transported, stored or manipulated into knowledge. There is nothing new within these fundamental components. However the Cloud Computing style provides new options in transporting, storing and manipulating data. Recognizing these foundational elements, understanding the elemental core precepts of Cloud Computing, and aligning them to contemporary cloud computing styles is required when considering the engineered decomposition of a particular cloud solution.

But what is cloud architecture, and more importantly what is the right answer for any particular organization relative to the Cloud Computing style? Determining this requires applied analytics within a framework that can assist in determining the correct solution for any particular firm.

II CLOUD COMPUTING MATURITY MODEL

The establishment of a cloud computing maturity model (CCMM) provides a framework for successful implementation. This paper proposes a phased approach to the CCMM, encompassing five key components:

- Consolidation
- Virtualization
- Automation
- Utility
- Cloud

Step 1: Consolidation

An agency’s migration towards cloud computing begins with the consolidation of server, storage, and network resources, which works to reduce redundancy, decrease wasted space, and increase equipment usage, all through the measured planning of both architecture and process.

Consolidation is achieved primarily through virtualization but can also be approached by the use of denser computing hardware or even high performance computing. By boosting the speed of critical processes and enabling greater flexibility, the consolidation of data centers and desktops allows agencies to do more with fewer resources – a significant concern in today’s economic environment. Moreover, the shift to a unified fabric provides both physical and virtual access to the storage area network (SAN), creating greater efficiency and cost savings by allowing more storage to be consolidated in the SAN.Network and application modernization is also an important initial step in enabling the transition to a cloud computing environment. A viable alternative to replacing infrastructure components or rewriting critical applications, modernization promotes communication between older systems and newer solutions, all while preserving the value in existing IT systems. Freed from the bonds of a mainframe environment, critical applications modernized through a service-oriented architecture provide agencies with the increased ability to leverage newer technologies. As for security concerns surrounding cloud computing, modernization actually works to enhance the security of sensitive information stored on critical applications. When established properly, the cloud platform provides security of all data in motion, traveling between the cloud and the desktop, and all data at rest in cloud storage.

Step 2: Virtualization

Virtualization forms a solid foundation for all cloud architectures. It enables the abstraction and aggregation of all data center resources, thereby creating a unified resource that can be shared by all application loads. Hardware such as servers, storage devices, and other components are treated as a pool of resources rather than a discrete system, thereby allowing the allocation of resources on demand. By decoupling the physical IT infrastructure from the applications and services being hosted, virtualization allows greater efficiency and flexibility, without any effect on system administration productivity or tools and processes.

By separating the workload from the underlying OS and hardware, virtualization allows extreme portability. When extended to every system component, desktop, network, storage, and servers – it enables the mobility of applications and data, not only across servers and storage arrays, but also across data centers and networks. Moreover, through consolidation – one of the critical applications of virtualization – agencies can regain control of their distributed resources by creating shared pools of standardized resources that enable centralized management, speeding up service provisioning and reducing unplanned down time. Ultimately, the result is increased use of assets and simplified lifecycle management through the mobility of applications and data.

Although many agencies turn to virtualization to improve resource usage and decrease both capital and operating costs, the ultimate goal in cloud computing is the use of the abstraction between applications and infrastructure to manage IT as a Service (IaaS) in a true cloud environment.

Step 3: Automation

In this stage, automation optimizes an agency's virtualized IT resources. Through a transformative procedure, the infrastructure is automated, and critical IT processes become more dynamic -- and greater control is achieved by trusted policies. With automation, data centers can systematically remove manual labor requirements for run-time operations. Among the various forms of automation in practice today, provisioning automation is perhaps the best known and most often implemented. Rather than managing underlying infrastructure, agencies in pursuit of cloud computing need to move toward managing service levels based on what is appropriate for the application users, whether it's minimum tolerable application latency or the availability level of an application – whatever are deemed critical factors. In this regard, automation becomes an essential element. With centralized IT and self-service for end users, automation helps agencies to disentangle themselves from the burden of repetitive management procedures, all while enabling end users to quickly access what they require. Ultimately, automation can help agencies to reduce their operating expenses by:

• Reallocating computing resources on-demand

•Establishing run-time responses to capacity demands

•Automating trouble-ticket responses (or eliminating trouble tickets for most automated response scenarios)

• Integrating system management and measurement

Step 4: Utility

In addition to automation, both self service and metering -- feedback about the cost of the resources allocated – are necessary requirements in creating a cloud service. With breakthrough capabilities for end users and agencies, self service and metering facilitate not only better IT management but the further extension of the user experience.

In the cloud, there is no intermediary between the user of a resource and the processes for acquiring and allocating resources for critical mission needs and initiatives. Since the user initiates the service requests, IT becomes an on demand service and the costs of operation drop significantly, because costs are incurred only when the service is used and fewer dollars are spent attending to the needs of the infrastructure.

Essential to IT administration is the question of how to maintain service delivery in a fully virtualized, multi-tenancy environment while at the same time providing the highest levels of security – especially for information and services that might leave the data center. A private cloud utility model answers the question, by enabling agencies to retain the data within their network security while scaling and expanding as user demands change, pooling IT resources in a single operating system or management platform. As a result, anywhere from tens to thousands of applications and services can be supported – and new architectures that target large-scale computing activities easily installed.

Step 5: Cloud

Through cloud internetworking federation, disparate cloud systems can be linked in such a way as to accommodate both the particular nature of cloud computing and the running of IT workloads. This federation allows the sharing of a range of IT resources and capabilities – including capacity, monitoring, and management – and the movement of application loads between clouds. Moreover, since federation can occur across data center and agency boundaries, it enables such processes as unified metering and billing and one-stop self-service provisioning.

With cloud computing, communication increases significantly, as data sharing between previously separate systems is fully enabled – and collaboration within and between government agencies grows exponentially. Ultimately, rather than each agency operating in isolation, constricted by the boundaries of its own data center, not only can services be shared among groups, but also costs can be shared and lessened.

III CONCLUSION

With its convenient, on-demand model for network access to a shared pool of configurable computing resources, cloud computing is rapidly emerging as a viable alternative to traditional approaches – and is carrying a host of proven benefits to government agencies.

Costs are being significantly reduced, along with personnel time spent on computing issues. Storage availability increases, high automation eliminates worries about keeping applications up to date, and flexibility and mobility are heightened, allowing workers to access information anytime, anywhere. Cloud computing can be rapidly provisioned and released with minimal management effort or service provider interaction. Ultimately, with its offering of scalable, real-time, internet-based information technology services and resources, the cloud can satisfy the computing needs of a universe of users, without the users incurring the costs of maintaining the underlying infrastructure.

IV FUTURE ENHANCEMENT

"Anything"-as-a-service offerings need time to develop.

The hype is strong around "*anything*"-as-a-service, but given the fact that your peers are adopting it very slowly, it makes sense to wait on this. It's likely to be several years before offerings are mature, so don't rush into anything here. That said, the pain of keeping up with storage growth is real, so momentum could gather around a successful offering quickly. When thinking about anything-as-a service, consider the following:

Fit with business processes is critical.

Storage capacity alone is not enough to be compelling in this space. Figuring out how storage-as-a-service offerings will integrate with your existing applications and processes is a key consideration. For storage-as-a-service to be successful, they need to do a better and cheaper job of solving real business problems. So far, the case for offerings meeting these criteria is questionable.

Backup-as-a-service does make sense.

Improving backup of critical data is a key priority for many IT organizations, and a backup- as-a-service offering can offer a lower capital intensive path to improving capabilities than going it alone. If you don't have an effective plan to get data to a second site, a cloud offering might make sense for PC backup corporate wide or server backup for smaller systems or systems in remote offices.

Measure the cost over time.

The point of leveraging a service instead of building it yourself is to get better capabilities at a lower cost. Compare the total cost of running storage internally with the total cost of getting capacity as a service over several years, at least three.

If the numbers don't add up, then you might want to wait until the offerings are more mature and the cost has declined even further.

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