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Executive Overview

Cloud computing is the most recent trend in enterprise computing and it is being adopted by organizations that want a cost-effective, quick and efficient computing platform. Leading analyst firms like Gartner and IDC are predicting high adoption rates for applications deployed on private and public clouds. While there is still some debate on when and how the different dimensions of cloud computing will become viable for different industries and businesses, there is broad agreement that it will have an increasing impact on nearly every IT organization.

Oracle is committed to delivering hardware and software solutions that are engineered to work together and builds on Oracle’s decade-long leadership in underlying technologies such as grid-computing, clustering, server virtualization and dynamic provisioning, SOA, identity management and large-scale management automation. The close integration of systems designed to work together is the mainstay of a true cloud computing solution.

This white paper describes the Oracle Consulting Cloud Services Framework that supports and guides organizations as they adopt cloud solutions. Cloud computing affects many dimensions across the enterprise, and not just IT. The organisation may need to adapt to new charging models, but also be able to exploit innovative ideas that become possible with the adoption of cloud computing. The framework is used to provide a structure to the multi-dimensional, multi-year nature of adopting cloud computing as part of an enterprise IT strategy. It draws on the experience of Oracle Consulting’s many engagements supporting customers and their implementation of complex cloud-based projects.

Introduction to Cloud Computing

The National Institute of Standards and Technology (NIST), an agency of the US department of Commerce, defines cloud computing as a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. According to NIST, this cloud model promotes availability and is composed of five essential characteristics, three service models, and four deployment models.

Essential Characteristics

The essential characteristics of cloud computing are detailed below. It is perfectly valid for a cloud solution not to exhibit all these characteristics and there may be business and technical reasons why an organisation has not gone to the full extent of deploying a fully mature cloud
platform. Indeed, achieving two or three of these characteristics will achieve significant benefits in themselves. The characteristics that an organisation will adopt first will be driven by individual business needs and the best ROI possible. There may be knock-on effects of fully supporting these characteristics that need to be managed carefully.

**Self-service Provisioning.** A consumer can unilaterally provision computing capabilities, such as server time and network storage as needed automatically, without requiring human interaction with each service’s provider. There are some challenges presented by providing a self-service capability. Strong governance over the ability to deploy applications is required if the organisation is trying to prevent the proliferation of many small applications. This could create “little islands of data” that would be difficult to manage and fragment the organisation’s business processes.

**Access via the web.** Capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms (e.g., mobile phones, laptops, and PDAs). Standard protocols should be used to promote broad adoption of the platform. While the services themselves are location transparent, the networking infrastructure needs to have the intelligence to identify and route traffic to the right targets. There are added complications when traffic needs to be separated for security reasons or when those services are elastic.

**Multi-tenanted.** The provider’s computing resources are pooled to serve multiple consumers using a multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand. There is a sense of location independence in that the customer generally has no control or knowledge over the exact location of the provided resources but may be able to specify location at a higher level of abstraction (e.g., country, state, or datacenter). Examples of pooled resources include storage, processing, memory, network bandwidth, databases, application servers and virtual machines. When pooling resources, additional constraints are placed on the underlying cloud infrastructure in that the resources need to be as similar as possible, or at least be known to behave in an identical manner, so that virtual resources can be switched between physical resources.

**Elastic.** Capabilities can be rapidly and elastically provisioned, in some cases automatically, to quickly scale out, and rapidly released to quickly scale in. To the consumer, the capabilities available for provisioning often appear to be unlimited and can be purchased in any quantity at any time. This requires sophisticated monitoring technologies to be able to trigger the expansion or collapse of those resources as required without impacting other users. Appropriate charging models should be in place so that consumers are only charged for what they use. Also, when a platform is expanded it is important that any dependent resources are
also scaled accordingly. Throttling techniques may have to be employed as the measure of last resort when system limits start to be reached. Capacity planning models linked to expected demand are also crucial to managing elasticity and IT needs to work with the business to develop these in line with business requirements and agreed SLAs and OLAs.

**Metered Resource.** Cloud systems automatically control and optimize resource use by leveraging a metering capability at some level of abstraction appropriate to the type of service (e.g., storage, processing, bandwidth, and active user accounts). Resource usage must be monitored, controlled, and reported which provides transparency for both the provider and consumer of the utilized service. This provides opportunities to change the charging model for the service, but that in turn means the IT provider needs to build charging and billing tools to support those activities, the cost of which need to be balanced with the benefits. Monitoring of allocated and consumed resources will also provide the data required to identify and clarify any SLA breaches, on the part of either the consumer or the provider.

**Service Models**

The three service models recognized by NIST help to characterise the services that might be deployed to a cloud. There is a sliding scale of flexibility for the consumers’ vs. ease of management for the provider.

**Cloud Software as a Service (SaaS).** The capability provided to the consumer is to use the provider’s applications running in a cloud. The applications are commonly accessed from various client devices through a thin-client interface such as a web browser (e.g., web-based email). The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, storage, or the platform of applications, with the exception of limited user-specific application configuration settings. A customer using Siebel CRM hosted by Oracle OnDemand is an example of this service model. The consumer is provided with the complete, fully capable application and accepts a near-vanilla, “out-of-the-box” configuration. Oracle OnDemand manages a single stack in the most cost-effective manner for the consumer that will also allow expansion and contraction of capacity.

**Cloud Platform as a Service (PaaS).** The capability provided to the consumer is to deploy onto the cloud platform consumer-developed or acquired applications created using programming languages and tools supported by the provider. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, or
storage, but has control over the deployed applications and possibly application hosting environment configurations. A common example of a PaaS is where an organisation deploys Oracle Database or WebLogic Server into a cloud so that development teams can provision test and development environments as necessary. This provides the best balance of flexibility for the consumer and manageability for the provider, compared with IaaS or SaaS.

Cloud Infrastructure as a Service (IaaS). The capability provided to the consumer is to provision processing, storage, networks, and other fundamental computing resources where the consumer is able to deploy and run arbitrary software, such as operating systems, application platforms and the applications themselves. The consumer does not manage or control the underlying cloud infrastructure but may be permitted to manage the operating system, deployed applications, and possibly has limited control of select networking components (e.g., host firewalls). Central to the deployment of an IaaS is the use of virtualization technologies such as Oracle Virtual Machine. IaaS gives maximum flexibility to the consumer, but the provider still needs to manage potentially competing resource demands, user provisioning etc.

Deployment Models

There are four recognized models for deploying a cloud and choosing the correct one will depend on a given scenario. It is quite feasible that large organisations will make use of all the models.

Private cloud. The cloud infrastructure is operated solely for an organization. It may be managed by the organization or a third party and may exist on premise or off premise.

Community cloud. The cloud infrastructure is shared by several organizations and supports a specific community that has shared concerns (e.g., mission, security requirements, policy, and compliance considerations). It may be managed by the organizations or a third party and may exist on premise or off premise. Specifically, for smaller size companies, this model creates a critical mass of infrastructure to produce the economies of scale in the cloud while still preserving some control of the environment.

Public cloud. The cloud infrastructure is made available to the general public or a large industry group and is owned by an organization selling cloud services. All the risk and effort of implementing and maintaining the cloud rest with the provider. Therefore there needs to be a
trusted relationship between the consumer and provider which is a high barrier to entry in this market. The consumer has little control over the standards and processes provided and accepts them because all the maintenance overhead is no longer their concern. However they will have a choice amongst cloud providers and will be able to find one that matches closely, if not completely, their desired set of standards and technologies.

**Hybrid cloud.** The cloud infrastructure is a composition of two or more clouds (private, community, or public) that remain unique entities but are bound together by standardized or proprietary technology that enables data and application portability (e.g., cloud bursting for load-balancing between clouds). Interoperability and integration will be on a macro-scale and in addition to linking the two clouds at both the application and management layers it will need to cope with the essential characteristics of the cloud, such as elasticity and metering.
Oracle Consulting Cloud Computing Services Framework

As shown in Figure 1, Oracle Consulting has developed a framework that is designed to help guide customers as they implement cloud computing solutions. The services offered by Oracle Consulting align with this framework thus making it easier to choose the appropriate support at any given stage along the cloud journey. At the beginning of this framework is the Roadmap phase where the strategy and roadmap are defined. The journey to cloud then goes through four additional main phases: Standardize-Consolidate-Automate-Optimize. Most customers start the journey to cloud using a standardization or consolidation project. However this may already have been completed in some areas of the IT estate and therefore a later phase may be the cloud entry point. It is also possible to iterate over these phases, repeating automation for example, for a number of consolidated cloud platforms. Indeed the entire framework may be repeated as multiple clouds are built. The implementation of these projects continues to be guided by the Oracle’s programme management methodology or Oracle Unified Method (OUM).

Roadmap Phase

The Roadmap phase is critical to the success of the cloud initiative. This phase sets the vision, strategy and roadmap for the cloud solution and defines a reference architecture that describes the services that will be offered from the cloud platform. This must be aligned to the business strategy otherwise there is no incentive for the business to adopt the platform. At this point a number of guiding tenets and principles for the cloud are laid down including key responsibilities for the cloud. For example, who will implement the platform services, who will deploy the consumer applications, who will operate the platform etc.
A number of key documents need to be produced and these will govern the cloud going forward. Many organizations will already be well advanced and have a mature understanding of the strategic direction and reasons for adopting cloud computing. However, there may be a need to develop or evolve the reference architecture to suit the cloud initiative or develop the roadmap itself. Oracle Consulting has a number of services focused on supporting customers in delivering these artefacts and through a variety of activities can prepare the organisation for the cloud initiative.

In other computing paradigms such as SOA it may have been possible to develop the roadmap as the programme proceeded, because after each small increment a review and a change in direction was possible and the underlying principles of an agile platform would allow that change. With cloud computing there may be a significant investment in the platform and changing the organisation to adopt cloud so changing the scope and purpose of that platform mid-delivery can be expensive and time-consuming. Therefore a strategy must be in place and have been widely communicated before embarking on the programme to realize its benefits.

The vision for the cloud strategy needs to be laid out because the full adoption of cloud computing may involve a number of key projects spread over a number of years and therefore a target for what the end-result will look like is important. It will contain a high-level description of the business needs and requirements, a description of how the cloud will deliver those and what services the cloud proposes to offer. It should also indicate where benefits will be delivered with each project, i.e. significant cost-reductions should be achievable early in the life of the cloud initiative and the organisation will not need to wait until the completion of the entire programme.

There may also be a need to scope the cloud initiative to a certain part of the business or certain technical areas that will be deployed. This also provides a document that can be used as an “elevator pitch” to sell and evangelize the cloud to other parts of the organisation. As discussed above, full adoption of cloud computing to realize its full potential will require awareness and changes in areas of the business other than IT and therefore an early communication of the cloud strategy is critical to its success.

Oracle has developed a domain model to describe the dimensions beyond IT that should be considered when adopting cloud computing. This is shown in Figure 2. “Oracle Cloud Domain Model” holds the vision and strategy effort and considers their alignment. The Organisation dimension considers the impacts on people, their roles and responsibilities and any training and education that may need to be delivered. Governance is an important consideration and needs to be enforced at every point where consumers and providers interact with the cloud. Services hold a description and a purpose for all the capabilities that are delivered within the cloud. The Operations segment considers how the business and IT processes might need to change following the adoption of cloud. The infrastructure in the cloud platform concerns the hardware and software assets. The cloud produces a lot of information, not only application data, but also meta-data about cloud usage and this needs to be managed and accessed securely, hence it has its own domain area. Lastly the cloud platform needs to be architecture-
led at the enterprise level to ensure that standards are adhered to and consistency is maintained.

Figure 2: Oracle Cloud Domain Model

The cloud strategy describes why a particular cloud solution is being adopted and how that aligns with the business strategy. It also helps scope the initiative. The strategy is as useful for the items that it includes as the items that it explicitly excludes because cloud computing means different things to different people and therefore clarifying its purpose is important. There are a number of strategies that might be adopted by the organisation depending on the business needs and the cloud implementation must be adapted to that. For example an organisation with a number of regional offices might deploy a SaaS platform, with an instance for each region to allow standardisation of processes and procedures, and allow autonomous growth or contraction of those regions. Another example would be the use of a database PaaS for development and testing needs. This provides fast provisioning and tear-down of environments for project teams. It provides flexibility for projects to build applications quickly to meet business needs, without constraining the applications they use. These are both cloud-based solutions, but quite different strategies.

The roadmap produced by this phase guides the long-term strategy by describing how it will be delivered, which capabilities need to be built first and which applications will be provided directly by the cloud first and which will be migrated into it at a later stage. Without a coherent roadmap, the investment plan is difficult to justify beyond the initial project, but by looking beyond the initial delivery there will be significant further ROI opportunities. The roadmap also
answers crucial scheduling and resourcing questions that will be asked. It does require some visibility from the business of the projects that are in the pipeline.

The last element of the roadmap phase is to produce a reference architecture that describes, at a high level, the platform to be built and the services that it will provide, not only to consumers, but to the operations staff who will manage the platform and developers writing applications to be consumed will need testing environments. The reference architecture will, in most cases, be an iteration of the organization’s existing enterprise architecture and describe how the cloud will integrate with the existing estate. The guiding principles and standard patterns for deployment are documented in the reference architecture. The architecture will continue to evolve and be governed as the platform is developed and new services, capabilities and applications are deployed to it. The reference architecture is also used by the application providers and IaaS/PaaS consumers to be able to deploy their solution in a compliant manner. More detail of how the architecture will be implemented will emerge during the standardization phase.

In addition to the elements mentioned above, there are other significant pieces of work that may be undertaken during the roadmap phase and the decision to carry these out rests on the scope of the cloud programme and the need to invest in the planning and justification for the cloud. For example it may be necessary to carry out a more formal cost/benefits case study to help decide which tools should be standardized in the cloud first, or understand the ROI of automating the provisioning of services by analyzing the costs associated with manual provisioning. The latter would then help scope the services that the cloud needs to offer. Other activities in the roadmap phase may include auditing the existing applications and projects to understand the range of databases or application servers in existence to help choose which could become the standard in the cloud.

Once the roadmap phase is complete the first standardization activities can commence. It is also worth stating that the roadmap activities and deliverables can be revisited during the next evolution of the cloud programme. This phase only needs to cover enough to deliver the scope of the current standardize-consolidate-automate-optimize iteration.

**Standardization Phase**

The definition and deployment of standard platforms and services is a prerequisite for the adoption of cloud computing. Without convergence towards a single solution for a given problem or a single application to deliver a particular function then there will be no reduction in complexity or cost. For example, if the current heterogeneous IT landscape was to be run in a cloud then the task of managing and provisioning all those different software and hardware solutions would be prohibitively expensive and impossible to manage. In this phase the standard platforms to build a cloud environment are designed in detail and implemented. The aim is to define and adopt consistent approaches and patterns to solving technical problems and delivering applications and have these deployed to a cloud. This is more relevant in a
private cloud because in some public clouds there may be a number of standard offerings in order to attract as many customers as possible.

The scope of what can be achieved in the standardization phase needs to be made clear at the beginning of the project. The standardization phase is not attempting to force all applications to use a single database version from a particular vendor. There may be pockets of applications that for strong business reasons, e.g. the potential ROI would be negligible, or an OEM COTS application vendor may never certify against that application, will never adopt the corporate standard. It is however aiming to set a gold-standard and deploy it in a cloud environment and in the consolidation phase applications that will benefit from the cloud can migrate to that standard.

The standardization phase consists of three core activities; an analysis phase to decide on the standard to adopt; a design phase to architect and describe the implementation and deployment of that standard, and a deployment phase where the standard is deployed, possibly already containing the first application or, in the case of SaaS, the first user population.

There are three major inputs to the analysis phase. The standard that is going to be adopted for this cloud implementation is driven by the strategy that has been set out in the roadmap phase and the requirements of the business. The next input is what already exists within the organisation, i.e. are there skills within the IT team to manage the target platform? Can the applications that are targeted for deployment on this platform be migrated easily? Answering these questions may lead to a deeper analysis and understanding of what currently exists in the IT landscape. Lastly the capabilities of the software to be deployed to the platform need to be considered. For example does it conform to the principles in the reference architecture, can it be upgraded over time, is there a certification matrix to guide the deployment of other applications to this platform etc. These may have been considered in the roadmap phase, but usually this sort of detail is finalized during the initial standardization project.

The standard platform is then designed and its capabilities described. These capabilities may be inherent in the products to be deployed or it is possible that some custom development is required. For example, the deployment scripts for repeatably building this environment might need to be bespoke. Any, security, monitoring and management capabilities should be considered here as well.

Once the platform has been designed, it can be built and deployed for the first applications, and users can then start migrating onto it. This migration activity is carried out in the consolidation phase of the framework. It is common for the standardization and consolidation phases to happen back-to-back, however this may not necessarily be the case and there are already benefits that can accrue at the end of the standardization phase.

It may be tempting to deploy a significant level of automation capabilities in terms of allowing users to manage and provision the platform themselves. This runs the risk, however, of not supporting applications and users that consolidated onto this platform in the future. That tooling would then need to be redeployed and adapted incrementally which is more expensive
than deploying it once. Also, there is the risk of providing a patchwork of capabilities where some consumers can auto-provision and some consumers can’t, which risks alienating those consumers and may require manual processes to support them. Therefore it is recommended that the bulk of the automation activities happen once the majority of applications and or users have migrated to the standard platform.

Consolidation Phase

Once a standard platform, application or set of infrastructure has been defined, the consolidation phase is when disparate applications are migrated to the standard. The number of applications in existence that might be delivering the same function is reduced as consumers migrate to share the same platform. Here an analysis phase is important to define which applications are suited for migration and to understand the ROI of moving them. Some of this may already have been completed in the roadmap phase if the scope of the cloud initiative was intended to reach as far as consolidation. It may also be necessary to increase the resource pools that underpin the cloud to ensure there is enough compute capacity to support the additional load as new users come onto the cloud platform. This is really only a consideration in private cloud environments. Planning the migration is an obvious step in the process and needs to encompass not just data and user account information, but training needs analysis for users of the new platform and testing the integrity of data once it has been migrated.

When consolidating applications it is important to consider that it is not just the applications that are being lifted and migrated to the new standard platform. The people and processes that were involved in originally supporting that application or service now need to adapt to the new platform. There may be new roles in deployment and provisioning of these platforms that now need to be assumed by developers. Indeed when developers create applications for the cloud they often have to assume responsibility for operating and supporting them. The cloud providers, especially in public clouds, will often have little knowledge of the detail of the applications running above the services that they provide and therefore developers are taking on operational duties as well. This new role is known as DevOps and highlights the need to consider operational aspects when looking at how applications will be supported in the cloud. It is worth pointing out that the cloud providers will enforce and constrain what is deployed to their cloud through tools and by limiting the APIs available to the developers.

Many organizations choose to use virtualization technologies to allow sharing of resources at the hardware level. Indeed this may be the first stage of a consolidation project where arbitrary applications are deployed to a single hardware platform by virtue of a virtualization technology such as a hypervisor e.g. Oracle Virtual Machine. The adoption of virtual compute nodes allows the infrastructure resources to be pooled and shared amongst consumers. It is important to extend the sharing and consolidation initiative beyond just the infrastructure otherwise the heterogeneous applications deployed in this manner continue to provide a significant management overhead. The ease with which virtual machines can be created may actually increase the rate of proliferation of these applications and the initial savings are
quickly eroded by the management overhead. It is therefore important to continue through a number of iterations of consolidation beyond just the infrastructure level. Oracle’s experience is that much more significant ROI is achieved in consolidation of platforms and applications than with just hardware.

**Automation Phase**

During the automation phase, inefficient human-centric processes for managing and evolving the cloud are automated and replaced by tools. These tools also need to manage cloud-specific use-cases such as enforcing policies around usage of the cloud, managing resource pools and providing management capabilities to end consumers of the cloud. The focus of the activities in this phase is on reducing human costs rather than IT software and hardware costs. This implies changes to the organization’s processes and procedures and there needs to be a willingness for the organization to change and adopt these processes if the investment in automation is going to be worthwhile.

After the consolidation phase, and once there is a sufficient critical mass of applications deployed to the cloud, the investment in automating processes can be made. Again it is important to consider the ROI aspects of these activities. If there is still a high degree of heterogeneity across the PaaS or the IaaS then it may be too early to invest in many different tools to provide the desired automation capabilities. The investment may be better employed in further consolidation activities.

The automation tools will likely build on scripts and deployment capabilities that may have been introduced in the standardization phase to consistently and automatically deploy software. They are specifically focused on manual operations that relate to manual activities to support the cloud. Public cloud providers will choose to build these tools based on the perceived demands of their paying consumers; within the private cloud context - providers will respond to cost savings gained through reduced staffing levels.

There are two tactics for reducing the management overhead of a cloud infrastructure, the first is to push all the responsibility to the consumer and the second is to automate all the activities so reducing the overhead of the provider. Most organisations will employ a combination of both, depending on the cloud strategy and such things as the security and governance requirements.

By considering the Oracle cloud conceptual reference architecture in Figure 3 it is possible to see some of the new operational aspects of cloud computing that will be the targets for automation.
Starting with the cloud management area, there are four major concerns, security, governance, capacity management and model management. Security concerns are paramount in the cloud environment where assets are shared between different sets of users. Therefore the ability to monitor and manage security centrally gives an operator confidence that they have control over the access to data and applications while also being able to monitor activities. Tools such as Oracle Identity Management Suite can help customers come to grips with these issues. It is possible to automate the provision of a number of user accounts when deploying a new instance of a database, or it may be necessary to give the consumer rights to create their own users. Hence the balance of control vs. flexibility needs to be considered carefully in each case.

Capacity management will always be a key activity for the cloud provider. The changes in demand can be quite sudden as new consumers join the platform and deploy new applications. This deployment activity must be governed very closely to ensure that new applications do not make use of more resources than are available, hence impacting other users. Segregating their resource usage requires sophisticated resource management tools and alerts might need to be generated when users exceed their quota. Alternatively it is
possible using Oracle VMServer for SPARC to enforce those quotas and then alert consumers and providers when applications are getting close to their capacity.

Any process that is supported by automated tooling still needs to be governed. In the past these activities may have been governed by virtue of being manual, but if, for example the deployment of an application is carried out by a consumer then there may need to be some workflow implemented to approve that the application can be deployed, the consumer has funds to pay for usage etc. The integration of these processes into a BPEL process manager for example, will enable explicit approvals to be routed and handled by providers.

A centralised portal gives providers and consumers access to these tools. For example, consumers and providers may wish to view the service usage over a period of time, but the provider may have access to many consumers’ usage data to be able to charge consumers for their usage. The integration of this portal with the deployment, provisioning, capacity management and charging tools will need to be built and customized according to the needs of the organisation. This implies that the operational model needs to be well understood and it is likely that the organisation may need to adapt its processes and procedures to make the best use of the cloud.

Optimization Phase

The final phase of the framework contains activities that will enable the most efficient use of IT resources and allows new business models to emerge. Again, the main focus in this area will not be on changing hardware and software, but on optimizing it and enabling the business to innovate. Non-IT benefits can start to be realized as the agility and flexibility of the platform starts to allow new business models to evolve.

When an Oracle customer has developed a cloud solution there is a need to optimize that platform and tune it to deliver the best possible outcomes. Oracle Consulting supports organizations with on-site support in these optimization activities, but also provides optimization guides in order that organizations can take these steps themselves. The result is a finely tuned system aligned to a best-practice operational model that provides the most efficient and cost-effective cloud implementation for the organisation.

The implementation of sophisticated chargeback models is also achieved during the optimization phase. Charging consumers for what they use allows them to use operating expenditure rather than capital expenditure. This change from using capital expenditure (CAPEX) to using operational expenditure (OPEX) has significant advantages because in the
United States OPEX is deductible from taxable income. This is achievable where an organisation has a clear understanding of the costs associated with providing a certain level of service and can therefore charge for that appropriately. Consumers can then choose the level of service they require based on their business need. This ultimately makes the best use of the cloud resources, but requires that consumers can attribute the value that their use of IT provides with the value that they add to the organisation. There are significant challenges to the organisation in moving to a chargeback model. Providers must have a good understanding of the costs associated with providing a service and consumers must have a good understanding of the value the service provides in order to balance the costs and the benefits. In addition to the issues of the cost/benefit analysis, the practical aspects of metering the service and being able to charge the appropriate users for what they use. Auditing of both consumers and providers may be very important as there may also be SLA guarantees that need to be enforced and measured just in case there is a dispute when the consumers claim they did not receive the service they paid for.

Some further opportunities are available to organizations using a fully cloud-capable platform, namely in being able to expose the services that they offer internally to the outside world. For example Amazon.com was originally set up as an online retailer of books, but the expansion of their business to many other products required extra computing capacity that was often only used during peak trading seasons. Therefore they developed the sophistication to offer this computing capacity to let other people use it in the form of Amazon Web Services and their EC2 offerings. This would not have been possible without the sophisticated knowledge and expertise that they had built internally over time. The other example to consider is spotcloud.com, an online “Cloud Capacity Clearing House” that matches organisations with spare computing capacity with organizations that need to use that capacity. The provider organisation then sells that capacity to the consumer organisation with the entire transaction cleared by SpotCloud. Again this monetization of the cloud asset is made possible through the optimization of the private cloud.

At this stage, in the roadmap to cloud, an organisation may repeat the phases on another area of the IT estate that would benefit from adopting cloud computing. For example, the first foray into cloud computing might be to develop a SaaS platform, and after learning some of the best practice lessons and realizing the benefits an organisation might look to develop a PaaS to support bespoke applications. It is also worth noting that organizations may never feel the need to deploy fully optimized cloud services because the current business need does not make the case for making investments beyond the consolidation or automation phases. However, by at least understanding that these stages are possible and by providing an open cloud strategy, these opportunities may be picked up at a later stage when the business case can be made.
Conclusion

Cloud computing is a major driver in IT and as organizations look to achieve the cost-efficiencies and flexibility promised by this new paradigm it is important they have the right partners and tools to help them with that journey. Oracle Consulting has developed this framework to guide customers in adopting the correct cloud strategy to support their business.