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Next generation tools for Oil and Gas Companies? – Cloud Computing

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***Abstract*- Technology is a game changer in the oil and gas industry. Risk management, seismic interpretation, discovery, well placement, reservoir modeling, plant management and production control, all these domains have been deeply impacted and notably improved by the software solutions proposed by the likes of Schlumberger, Paradigm or Landmark Graphics (now Halliburton). From Exploration and Development through Drilling and Production, Processing and Transportation, Oil and Gas companies rely on a diverse set of business line applications to fulfill their mission. However due to the very nature of the oil & gas business, one of the challenges they face stands in their ability to deploy and provide access to these applications in some of the furthest and most hostile locations on Earth.**

Oil and gas operations present several challenges to mobile computing hardware and software, ranging from the types and volumes of data, to the simple fact that mobile devices have to be able to tolerate extreme conditions. A shiny off-the-shelf commercial tablet probably would have a very limited life expectancy on a busy drilling rig or production site, and the mobile applications written for the typical consumer likely would be grossly inade-quate for oil and gas, given the complex nature of the workflows.

INTRODUCTION

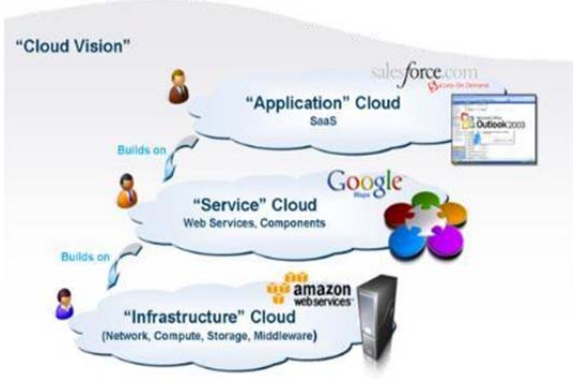
The new era is realized by designing IT as a system that incorporates Big Data for better decision making, Optimized Systems for superior economics and Cloud to reinvent business processes and drive innovation. Any enterprise can enter this new era by architecting an IT infrastructure that is designed for data, tuned to the task and managed in the cloud.

However, the basic hardware and soft-ware components to make mobile and cloud computing a reality in exploration and production are rapidly coming to market, with new devices and application options available seemingly by the day. A case in point is a variety of purpose-engineered ruggedized tablets that are designed to withstand the elements present in even the world's harshest operating extremes, including Arctic climates and hazardous environments.

Cloud computing is simply like utility computing where the resources, software, information and other demanded devices are shared. It works on a pay-by-use basis that involves delivering hosted services over the Internet. It concentrates on extending ITs existing capabilities without the software or hardware been installed on company premises. Cloud is changing the way vendors develop their products and IT procure their resources. Organizations adopt cloud for various reasons,

- Cost reduction by leveraging the economies of scale beyond the four walls of the data center
- Reduce capital expenditures and provision IT resources (license, storage, computing, bandwidth) on a per need basis
- IT agility to respond faster to changing business needs
- 100 per cent resource utilization

Cloud is an elastic delivery model that enables businesses to become more adaptable and interconnected. It can relate to many things (storage-as-a-service, Computer-as-a-service, application-as-a-service). Cloud is built on the premise that you're running in a virtualized world and virtual computing is nothing more than big data files.



Cloud computing provides all of the scalability benefits of clusters and distributed computing with none of the downside. Through a thin client device such as an iPad or laptop, users can enjoy an elastic capacity of on-demand data and computer power, zero maintenance costs, and significantly reduced capital expenditure requirements. It also can lead to a much more integrated and seamless workflow. Gone are the days where huge datasets need to be transferred to different sites and time lags were common between different applications. With cloud computing, reservoir modelers can enjoy real-time collaboration across different projects and access information from a single truly scalable system.

Despite the popularity of the cloud in some applications, cloud computing has still not aggressively penetrated the oil and gas industry relative to the pace of adoption in other Industries. According to IDC's 2010 Vertical Group Survey, 10.3% of oil and gas companies are currently using or implementing cloud computing and 7% have cloud computing on their technology road map.

METHODOLOGY

Cloud services to be business and consumer products, Services, and solutions delivered and consumed in real time over the Internet. The public cloud is a deployment model that entails the cloud being open to a largely unrestricted universe of potential users; designed for a market, not for a single enterprise. Whereas, the private cloud deployment is designed for restricted access to a single enterprise (or extended enterprise); an internal shared resource, not a commercial offering; an IT organization as "vendor" of a shared/standard service to its users. Given the current investment and existing IT of the right deployment model is influenced by a number of factors including cost, manageability, integration, security, compliance and quality of service.

Choosing for oil and gas companies first and foremost requirement is security of data, manageability and quality of service. The following data showing the different attributes for deployment. infrastructure, and the concerns has already made. For security when sharing information, the private cloud is the strongest direction for oil and gas companies. The choice

Attribute	Deployment Model			
	Private Cloud	Hybrid Cloud	Public Cloud	Non Cloud
Upfront Costs	High	Medium	Low	High
Ongoing Costs	Low	Medium	High	High
Security	High	Medium	Low	High
Compliance	High	Medium	Low	High
Quality of Service	High	Medium	Low	High
Integration	High	Medium	Low	High
Configurability	Medium	Medium	Low	High

Source: Oracle business intelligence 2010

Based on the above it can be inferred that although cloud computing offers compelling benefits in terms of high efficiency, high availability, elastic scalability and fast deployment for Oil and Gas communities.

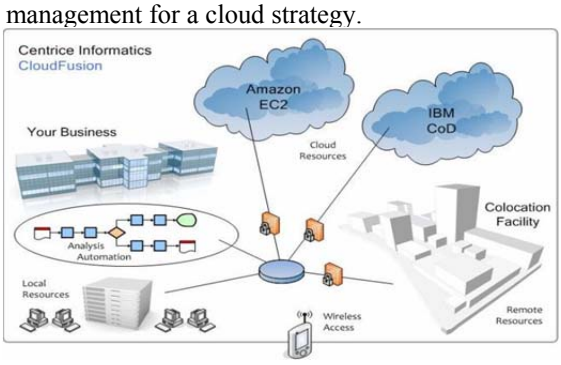
Looking an impossible task for management point of view to put exploration data on private/public cloud via internet, its true on some extends as exploration and production depends on 3D rendering and graphics accelerators, which have yet to make it off of the workstation because of the size of the files and speed required for viewing.

Source: Energy Digital el. Green technology

There is also an issue of scale for some applications. These barriers point to greater adoption by oil and gas of the private over the public cloud. In fact, many companies are already taking the first step to the private cloud through server and storage virtualization as a means to make better use of system resources and lower the overall costs of operating the infrastructure. Oil and gas companies need environments with higher performance for large-scale applications The "Private Cloud" is the evolution of "IT as a Service" as the next wave of isolation from hardware. And, just-in-time provisioning and scaling are key aspects of the private cloud. The most significant drivers for a private cloud approach in oil and gas include: Lower IT costs, Eliminating lag time to launch applications & Interoperability between applications on private, public and on-premise applications. Many companies are already taking the first step to the private cloud through server and storage virtualization as a means to make better use of system resources and lower the overall costs of operating the infrastructure.

The evolution of service delivery models over time is significantly influenced by the level of business and technology innovation that occurs in the marketplace. The above figure justify that adoption a cloud for organization is a big challenge and to start migrating to cloud consider on emerging technology with proper security and cost factor. Clients will need to change their sourcing strategies, and providers will need continued investment in select emerging technologies in order to capture the promised benefits of new service delivery models.

There are several methods to adopt while choosing between Public/Private clouds using virtualization - there is rapid growth in spending for virtual machines. Virtualization has brought cloud computing opportunities to the forefront. Oil and gas companies that have a virtualization strategy are better positioned for configuring, protecting data (not just back-up and stores), and as well as how to automatically provision for a cloud strategy. For oil and gas companies, some of the key concerns are identity federation (private VLANS and firewalls), security (shared hardware pools), and management for a cloud strategy.



Source:CentriceInformatics

Oil and gas companies need environments with higher performance for large-scale applications. Virtualization permits workstations to run two separate operating systems concurrently, each running high-end, petro-technical applications at near native dedicated performance.

Exceed on Demand offers the ideal combination of technology and services that can help Oil and Gas industry players turn their cloud strategy into reality. Exceed onDemand plays a critical role in the success of cloud computing projects by offering the application delivery backbone that will create the link between the cloud and the users. It is an ideal application delivery solution for organizations looking to switch their infrastructure to the cloud or offer their own cloud-enabled solutions.

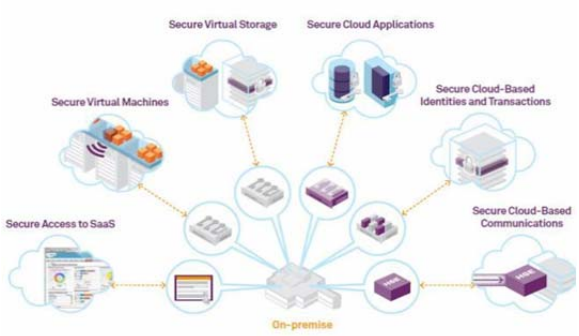
Migration Strategy moving to cloud

Defining a migration strategy involves understanding the various migration options available, establishing business priorities, and evolving a strategy that offers a fine balance between costs and meeting business priorities. Fundamentally, enterprises have the two following options with a cloud infrastructure - private or public. Against these, they have the following migration paths to consider - IaaS, SaaS or PaaS. The choice is driven by priorities such as elasticity, business model, go-to-market strategy and constrained by factors such as technical feasibility, security, migration costs, etc. It's not uncommon for a large enterprise to leverage a hybrid approach in any of the above migration options and paths. Issues arising out of the migration of hardware infrastructure and architecture should be uncovered and dealt with as part of the implementation strategy. For an Exploration and production company where large storage requires and interpretation on high- end workstation from different geographic locations by nos. of users on same database is done on SaaS application (Software as a Service).

Migrating applications to SaaS architecture and hosting it on a shared services model gives true multi-tenant cost advantage to an enterprise. It helps rationalize a portfolio by removing redundant applications offerings similar services across geographies or lines of business in favor of a single multi-tenant application shared across all its users. However, enabling SaaS architecture on an existing application could be a daunting task as most of the existing applications are designed to be single tenant. The main principle that lay the foundation for this model is in maintaining a single code base of applications for all its tenants and allowing pluggable mechanisms to address tenant-specific extensions. Thus, a convincing ROI is essential to move directly toward a SaaS approach. In one example, a gas well project in Australia using software as a service application has 2,350 users from 89 companies.

Resource Integration & Cyber Security

With the demand for oil at an all-time high, the Oil & Gas industry is challenged with exploring, developing, refining, and sharing critical information across the organization with the many experts and engineers around the globe. The sheer amount of data being collected is vast and the collaboration requirement is critical for better insight and increase productivity - directly relating to operational costs. Today's Oil & Gas Corporation faces many integration challenges; source : Safenet Inc.



When organizations migrate data that is sensitive or regulated by mandates into these environments, they can confront several tough questions: How do you keep information isolated and secure in remote, multi-tenant environments, where many traditional security controls can't be employed? How do you protect against unlimited copying of virtual instances? How do you gain the fundamental visibility required to understand how virtual instances are being used? How do you enforce the separation of duties and granular controls needed to mitigate the threat of cloud administrators abusing their super-user privileges?

To address these issues, organizations need to safeguard virtual instances and the sensitive assets they contain. Organizations need to retain the requisite security controls to ensure only authorized users access the sensitive data held in virtual instances at any given time. For these reasons, encryption is increasingly being recognized as one of the fundamental security controls for organizations migrating to the cloud. Through encryption, and associated secure key and policy management, organizations can safeguard stakeholder trust when adopting cloud offerings.

Organizations must ensure corporate and governmental rules and regulations are represented to support the security and management of corporate information. Global operations and systems are difficult to integrate and maintain Security seems to be the number one barrier. To reach a level of trust, it is helpful to distinguish between public and private clouds. Whereas a public cloud entails the cloud being open to a largely unrestricted universe of potential users, the cloud also can be restricted to a single company with the same robust security as internal IT servers. In fact, while larger operators are likely to be most concerned about security, they also have the resources and expertise to put internal clouds in place.

Security concerns of the application and associated data have held oil and gas companies back from adopting a cloud-computing model for data management. Similar types of security practices applied to inside-the-firewall applications can be applied to cloud computing based applications to mitigate these risks and history-matching cluster-enabled software runs on the Linux platform, based on a thin-client architecture, which lends itself well to the elastic scaling of cloud-based virtual servers.

Another consideration is the sunk investment in legacy IT applications and infrastructure that the industry, secondly there are several areas that are considered problematic. So there is reluctance in the industry to have data stored

outside of the firewall. There is a concern not only with intrusions that could compromise IT, but also with protection of trade secrets, especially when it comes to sensitive areas such as well logs.. The security of data for such companies is really a serious threat, not only for particular company, but for that country as a whole. But thanks to high speed computer algorithms installed on storage location of different Servers all over the world, which control or minimized such security risks by location unknown to even for their system administrators.

Challenges preventing us from moving forward with cloud computing within exploration?

The adoption of cloud computing is an emerging challenge that enterprises face in the near-term as the economics of cloud computing become more attractive over time due to economies of scale and competition amongst providers. There is an opportunity for the research community to address this demand by providing independent and impartial advice, tools and techniques to enterprise users who are interested in cloud adoption. The adoption of cloud computing in enterprise environments is non-trivial. Understanding the organizational benefits and drawbacks is far from straightforward because the suitability of the cloud for many classes of systems is unknown or an open-research challenge; cost calculations are complicated due to the number of variables comprising inputs to the utility billing model of cloud computing; the adoption of cloud computing results in a considerable amount of organizational change that will affect people's work in significant ways and corporate governance issues regarding the use of cloud computing are not well understood. There are various reasons why Oil and Gas companies are not adopting fully on cloud.

Cost Calculations: Understanding the operational costs of private cloud is also becoming increasingly difficult due to the increasing significance of energy costs and carbon emissions. Concerns for rising energy costs that may be exacerbated by government led carbon taxes. For example, it is predicted that, by 2015, the operational costs of IT infrastructure could exceed its initial capital purchase costs over a 5-year lifecycle. This research challenge is particularly important to cloud computing as its centralized resource-sharing paradigm could be leveraged to optimize energy efficiency.

Organizational Change : Understanding the significance and the extent of the organizational changes associated with cloud adoption is a difficult challenge. We argue that enterprises need to understand the breadth of changes and the effort required to make these changes in order to understand their benefits, risks and effects. The success of cloud adoption ―is as much dependent on the maturity of organizational and cultural (including legislative) processes as the technology. The process is likely to be prolonged and some predict that it could take between 10 to 15 years before the typical enterprise makes this shift.

System support will change because administrators will no longer have complete control of a system's infrastructure anymore. Their work could increasingly involve contacting cloud providers and waiting for them to look into system problems. Such a scenario was recently reported by Jesper5 whose application, which was running on Amazon EC2, came under a denial of service attack and had to wait over 16 hours before the problem was fixed.

Large Oil and Gas enterprises inevitably have highly interconnected infrastructures comprising a large number of computing systems that have been developed over a long period of time. These depend on different technologies, have different, owners within the enterprise and have complex dependencies both between the systems themselves, the data that they process, the middleware used and the platforms on which they run.

Cloud adoption decisions are challenging because of a range of practical and socio-political reasons. It is unlikely that all organizations will completely outsource their back-end computing requirements to a cloud service provider. Rather, they will establish heterogeneous computing environments based on dedicated servers, organizational clouds and possibly more than one public cloud provider.

The other major challenges for exploration companies moving to cloud computing: network access and bandwidth, and the need for high-performance 3D visualization.

Network access and bandwidth - as resource explorers often find in remote locations, with poor or no internet connectivity. This is changing, but in many parts of the world the improvements are slow in coming. At the same time our need to be connected to interpret and collaborate around data continues to increase, and Internet connectivity is certainly a requirement for cloud-computing. So what we are seeing is greater separation between exploration data collection (in the field, disconnected or poorly connected), and data interpretation (in the office, well connected to the Internet). As a result, field data collection systems and processes continue to improve together with methods to efficiently send data back to the "office" for interpretation.

The demand for 10Gigabit Ethernet is growing significantly in the Enterprise and in Data Centers. Enterprises are rapidly adopting cloud technologies and WAN applications driving an increased need for high performance networking, inline DPI and compression. Furthermore, traditional firewalls are not sufficient any more since many applications have evolved and now require the need for sophisticated DPI solutions for detection. In the Data Center market convergence of Network and Storage is increasing the demand for TCP optimization, iSCSI Offload, File and Block level Compression, Virus-Scanning, RAID and De-duplication solutions. Additionally, Solid State Drives (SSD) deployment is on the rise requiring superior fail-over mechanisms.

Nearly all WAN optimization appliances store and use previously transferred network data to achieve high compression ratios, while leveraging advanced compression routines to improve application performance. Most compression capabilities on WAN optimization devices are statically configured. This means the algorithm, whether optimal for the network link and conditions or not, is always applied to the data being transferred across the WAN.

3D Visualization - The Earth is three-dimensional, and explorers need to work with data and visualize prospects in 3D. Today, 3D graphics cannot be performed efficiently, or within a shared environment, on servers. Computing workstations are still required to take full advantage of 3D graphics capabilities. This is a very real consideration when architecting cloud-based solutions for explorers. For example, VOXI inversion (a software provided by Geosoft service to tap into servers for the heavy number-crunching, it relies on the desktop platform for the critically important3D user interface. This requires cleverness in compressing and moving quite large volume data between desktop and server environments.

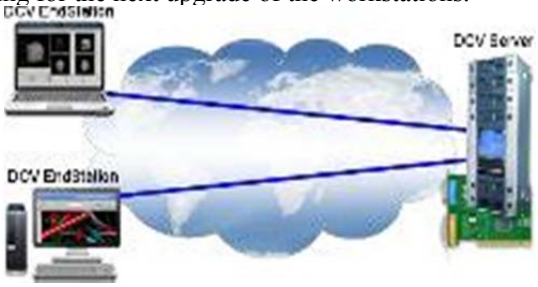
Source : DataViz Inc

Examples

Cloud Computing services are particularly useful for managing high speed/resolution graphics data which people from different companies are working on, because it avoids the need for one person to get behind another company's firewall. Companies might end up mixing public 'cloud' data with more sensitive data on their own servers.

For example the company iStore has a service which can combine a cloud database with data about 3 million US wells, together with a company's proprietary seismic software.

Many companies are providing the solution for high speed graphic speed for 3D visualization for Seismic interpretation world-wide with low bandwidth and high latency network. DCV (Desktop Cloud Visualization) is the remote 3D visualization technology that enables Technical Computing users to connect to OpenGL applications running in a data center. Engineers and scientists are immediately empowered by taking full advantage of high-end graphics cards, fast I/O performance and large memory nodes hosted in "Public or Private 3D Cloud", rather than waiting for the next upgrade of the workstations.



Source: NICE

The DCV protocol adapts to heterogeneous networking infrastructures like LAN, WAN and VPN, to deal with bandwidth and latency constraints. DCV multi-session capability allows IT Administrators to consolidate multiple users and/or application services into one node, or perform effective collaboration among multiple users. G & G users can remotely work on 3D interactive applications, fully accelerated by high end GPUs on workstations, blades or servers. No matter if you are accessing high-end OpenGL modeling applications or the simple viewers, it connect quickly and securely from anywhere and experience high frame rates, even with low bandwidth standard Internet connections.

The product supports both Microsoft and Linux systems, enabling collaborative capabilities in heterogeneous environments. Moreover, it is perfectly integrated into EnginFrame Views, leveraging 2D/3D capabilities over the Web, including the ability to share a session with other users for collaborative or support purposes.

Microsoft, together with partners, installed a system for BP in the Gulf of Mexico, which would take together data from 30 different sources, some public, some proprietary, some from cloud systems – and gather it together to provide early warning systems, which would provide BP with more advance knowledge about a hurricane building up so it could start planning the evacuation.

Among the largest members of the cloud community are familiar companies such as Amazon.com, Apple, Facebook, Google, Hewlett-Packard, IBM, Microsoft, Twitter, and Yahoo, whose services are used by all industries, including oil and gas. Signaling a trend that cuts across all industries, these companies have consolidated their information on huge arrays of servers—servers capable of increasingly high-speed processing—housed in gigantic data centers ranging in size from 50,000 sq. ft to half a million or more sq. ft. These nine companies among them own or lease 47 data centers, most in the US.

Cloud Computing – A tool for next generation

For the company to succeed in today's tough energy market, it is crucial for these end users to communicate quickly and efficiently anywhere, anytime with data acquisition, processing and interpretation. That is no easy proposition. That new approach comes just in time for an industry that has some of the biggest management problems on the planet. Wild swings in supply and demand, volatile prices and shifting worldwide energy policies have made exploration and production more complex than ever. And like companies in virtually every industry, energy firms are struggling with a global recession.

Indeed Cloud Computing is the next generation tool for Oil and Gas Company besides all odds. The issue of Organization change, bandwidth, security and high speed graphic visualization Finally, energy firms should have seamless access to software experiences across multiple screens and connected by cloud-based services. Microsoft's new Windows Azure platform incorporates a cloud services operating system, a Web-based relational database, and

robust connectivity and interoperability solutions.
Those capabilities support the shift toward a hybrid combination of online services and on-premises software. This approach incorporates a set of development tools that span the client, server and Web. It offers the convenience of automated service management, the economy of pay-as-you-go pricing, and the security of service-level agreements and support. And it creates a cloud that can scale — easily and automatically, up or down — to meet the fast-changing business needs of the energy marketplace.
Today, companies across the oil and gas sector — including both energy firms and technology suppliers — are leveraging collaboration iStore (the Information Store) recently introduced the industry's first digital oilfield visualization solution across a public cloud, paving the way for new dimensions of exploration computing delivered on-premises or over the Internet.

Cloud Solutions

The hardware is only part of the picture, of course. Longer term, cloud computing solutions are expected to play a central role in allowing mobile computing to reach its full potential in upstream oil and gas. One of the most appealing aspects of cloud computing is also what makes the concept so difficult for potential oil and gas users to wrap their heads around, according to Barbara Murphy, chief marketing officer at Panasas.
"It seems that the cloud is whatever you want it to be," she states. "Clouds are engineered to provide accessibility anywhere on demand, and are both highly scalable and highly virtualized. These key attributes are consistent between public and private cloud definitions. In fact, the difference between public and private is almost irrelevant to users."
From the Panasas perspective, the value driver for the oil and gas industry is in cloud computing's potential to bring together massive compute and storage power for far better performance and efficiency. "In this industry, we have to de-sign for peak loads. Many smaller independent compute clusters, each designed for peak load, can never be as economical as one centralized resource," Murphy ex-plains. In computing circles, the oil and gas industry is synonymous with massive data processing, storage and visualization requirements, according to Murphy.

Cloud computing offers the potential to bring together massive compute and storage power for improved performance and efficiency in the oil and gas industry.

While storage is certainly a key part of the cost equation, she says the biggest price tag is associated with the cost of the CPUs.
"In a typical high-performance cluster environment with 10,000-30,000 cores, storage is about 25 percent of the total system cost, while compute cores can be closer to 50 percent," notes Murphy. "One of the major drivers behind private clouds is the desire to make the most efficient use of the cores, which represent the majority of the capital investment in high-performance clusters. If you can improve the utilization of compute resources from 40 to 80 percent across a company while still delivering superior performance, the savings are tremendous."
Private clouds also enable consolidation. Murphy gives the example of Leicester University, which had multiple individual departments managing smaller high-performance computing systems for scientific applications. By aggregating them into a single managed resource, it allowed the university to gain enormous efficiencies and significant cost savings,shesays.
Two other trends impacting private cloud computing are segregating high-and low-value computing jobs, in which the highest-value hardware and software are deployed to the highest-value jobs, and "parallelization" of applications to complete computational-intensive tasks significantly faster. "Both of these trends are driven by the desire to solve complex big data computing problems faster and more cost efficiently," Murphy details. "The next generation of computing will be all about parallelism, in particular."
As far as the public cloud, Murphy says users primarily are looking for cost efficiencies for general purpose computing and data storage capacity. "At the same time, they are very clear about not wanting to process massive data sets or sensitive data in the public cloud," she observes. "Not only are they concerned about se-curity, but data sets that are tens to hun-dreds of terabytes in size simply cannot move across a wide-area network in a cost-effective manner. More importantly, applications with a high data-to-compute ratio remain a challenge for public clouds, since they cannot deliver the performance required."

Storage systems serving a high-performance private cloud must have several key characteristics, starting with a dedicated high-bandwidth connection between the compute resources and the storage system, Murphy advices. Storage also must be continuously available and have the ability to scale out seamlessly without ever going offline.

CONCLUSIONS

Oil & Gas Industry can definitely benefit from the Cloud Technologies especially with their requirement of ever-growing infrastructure. From our point of view, what would benefit them most would be a mixture of private and public clouds. With home-grown applications deployed in a private cloud, additional processing power can be achieved

by utilizing/adding a public cloud for computing purposes alone. With this mechanism, security can be thoroughly defined since applications are accessible only through the private cloud. To make the cloud infrastructure cost effective, it can utilize the Linux-based cloud systems which can be added (using an API like Delta cloud) to supporting public. Managers and employees are given a venue to communicate regularly; even those who are in far away remote sites or oil rig stations. Cloud computing allows them to access the company database wherever they are, preventing any possible communication breakdown.

Companies that fail to adapt will not survive the coming industry shakeout. In contrast, the next generation of cloud computing winners will focus their product development pipelines, marketing strategies, exploration and production approaches on the segments that they are best equipped to address. In the process, they will widen their lead against the competition.

To achieve the goal of intelligent computing, successful companies are taking a new approach to designing their IT infrastructures. These forward thinking organisations are designing, tuning and managing their IT infrastructure to make it designed for data, tuned to the task, and in the cloud. And as a result these companies are make breakthroughs in efficiency that allows them to focus on the task of real business innovation. Deploying cloud computing solutions requires both a short-term and a long-term strategy. For example, besides the improved scalability and reliability provided by the cloud, which organizations may achieve through the initial transition, re-engineering some components to take advantage of the parallelism provided by the cloud could improve system performance and overall scalability further.

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