Landmark Earth® Engineered Appliance - On-Premise Cloud Platform for Geoscience Application Delivery
Business Imperatives for Oil & Gas

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Source: IDC FutureScape Worldwide Oil and Gas 2019 Predictions

- **UPSTREAM PLATFORM**: By 2019, 70% of upstream oil and gas organizations will have deployed a cloud-based platform to support applications such as land management and hydrocarbon accounting.

- **SUBSURFACE DIGITAL TWINS**: By 2024, over half of exploration companies will have developed a unified digital twin capability that spans geographies and the entire organization.

- **IOT DOWNSTREAM**: Over 50% of downstream operations will deploy IoT in isolated functional silos until 2021, when IoT platforms will be deployed to unify data governance and workstreams.

- **CLOUD INFRASTRUCTURE**: By 2020, 100% of oil and gas companies will have invested more in cloud-deployed applications than in supporting or acquiring on-premises applications.

- **EDGE COMPUTING**: By 2021, over 40% of data generated in oil and gas production plants and in the field will be collected and orchestrated on IoT edge devices, with data historians as the core repositories.

- **AI ASSET DECISIONS**: By 2024, 60% of production asset maintenance decisions will be made by AI operators, without human intervention.

- **EV & RENEWABLES INVESTMENT**: By 2023, 100% of the supermajors and midstream companies globally will have invested in renewables and started deploying charging infrastructure to retailers to offset declining fossil fuel revenues. (EV = Electric Vehicle)
Cloud Computing-ABC’s

Cloud - Delivered as a Service
- Infrastructure
- Software
- Platform

Platforms
- Private – on premises
- Public – off premises
- Hybrid or Multi-Cloud
- Edge

Public Cloud Offerings
- Microsoft – Azure
- Amazon – Amazon Web Services
- Google – Google Cloud Platform
Cloud Computing Benefits

- No longer have to ‘build your own’
- Removes legacy application silos
- Consumption based
- Faster time to production
- Optimized application workload performance and delivery
- Improve operational efficiency
- Can reduce overall TCO
- Critical step toward Digital Transformation
Cloud First - What Customers Want

- Access to Cloud Delivery Platforms – Flexibility to choose
- As-a-service Delivery model
- Off premises and managed services alternatives to reduce IT costs
- Ability to Manage their own data
- Vendor Choice – Avoid ‘lock in’
- Leverage In-House and/or Open systems technologies
- Perform Cloud Native Development CI/CD
- Customer Managed and Vendor provided solutions
- Manage workloads across all cloud platforms through a single, simplified management plane
Our Findings in the Industry

- Not all application workloads run efficiently in the public cloud; geoscience
- Reliable public cloud service is not currently available everywhere across the globe
- Don’t forget about the data
- Commercial benefits of public cloud not always realized
- Some workloads are now ‘repatriating’ back from the public cloud
- The industry is evolving toward a ‘multi-cloud’, ‘platform agnostic’ environment, different workloads running on different cloud computing platforms
- Toolsets and technologies are evolving rapidly to simplify the deployment and management of multi cloud environments
## Private Cloud Offerings

<table>
<thead>
<tr>
<th>Public Cloud</th>
<th>Private Cloud</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amazon Web Service</td>
<td>Outposts – coming soon</td>
</tr>
<tr>
<td>Microsoft Azure</td>
<td>Azure Stack</td>
</tr>
<tr>
<td>Google Cloud Platform</td>
<td>TBD – partner led</td>
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</tbody>
</table>

- **Integrated system**
- **Closed system**
- **Hyper-converged**
- **Scale out building blocks**
The Landmark Earth® Appliance Story

- Landmark/EMC Partnership began in 2014
- Initiated to simplify, stabilize and speed up deployment of DecisionSpace® Software
- Signed OEM Partnership Agreement in 2015
- Collaboration and testing began on EMC Converged Infrastructure; Vblock
- First Landmark Earth® Appliance deployment in Ecuador July 2015
- Deployed iEnergy® Cloud in North America 2016
- Created Landmark Earth® Appliance Blueprint and Management Portal 2017; differentiating IP
- Developed Lifecycle upgrade to Landmark 2.0 incorporating VxRail 2017
- Included VMware Horizon for VDI component and more standardization
- Deployed 15 Landmark Earth® Appliances globally
- Creating multi-tent SaaS delivery for in-country deployments
Landmark Earth® - GTM

- Developed a ‘sell to’ and ‘sell through’ approach
- Leverage global ‘in region’ resources to sell, deploy and support
- Ensure global best practices and standards are delivered and maintained
- Delivered on premises or ‘as a service’
What is Landmark Earth®?

- Co-Engineered Appliance for Exploration and Production (E&P):
  - Hyper-Converged Infrastructure + E&P Blueprint™ + Automated Updates

- Includes Out-of-the-Box Best Practices for:
  - Exploration, Reservoir, Well Construction, Production, Information Management

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**INNOVATIVE**

- Dell EMC industry-leading hyper-converged architecture and storage
- Landmark E&P software pre-installed and optimized

**EFFICIENT**

- Account for heterogeneous customer environments: Landmark and non-Landmark products
  - “Single pane of glass” to manage the entire solution
- Automated updates to reduce the time and cost of providing the latest capabilities to the end users
- One support number to call for the entire solution

**AGILE**

- Co-Engineered Appliance for Exploration and Production (E&P):
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**Halliburton**

**Dell Technologies**
Landmark Earth® – Unique Business Value

Digital Transformation Across Exploration and Production (E&P) Workstreams

- Optimized Application Performance and Reliability
- Accelerated Time to Value for E&P Business Operations
- Reduced Total Cost of Ownership
- CAPEX or OPEX delivery via an On-Premise Cloud
Performance and Reliability

Traditional Client/Server

Key Characteristics

- Performance impacted by separation of compute and storage
- Hundreds of client devices to manage
- Performance and stability issues from multiple vendors
- Multiple-vendor support complexity
Optimized Performance and Reliability

Landmark Earth®

Differentiators

- Industry-leading VxRail hyper-converged infrastructure by Dell and VMware
  - Hardware and systems management components designed to work together
  - Full lifecycle management
- Optimal deployment with Landmark E&P Blueprint®
  - E&P software optimized for the infrastructure
- Single support number to call for software or hardware issues
  - Rapid incident resolution
Accelerated Time to Value

Traditional Approach (Months)

- Size for Applications
- Procure, assemble, install, configure h/w
- Install & Configure All Software
- Test, Tune etc.
- Update Process - Restart

Landmark Field to Cloud Computing (Days)

- Install
- Configure
- Test
- LIVE

A mistake or failure anywhere in the process can derail the deployment and may not be found until the end.
Landmark – E&P Blueprint®

- Created using a collaborative effort by subject matter experts (SMEs) from multiple areas: deployment, Infrastructure, 3D, data management
- Provides IT infrastructure prerequisites (such as storage, connectivity, processors, and memory)
- Provides deployment guidelines and best practices for E&P software, such as governance using IT best practices (including separation of configuration, no local storage, and no local accounts)
- Provides product-compliance guidelines for E&P products
- Provides integration guidelines for Landmark and third-party software
- Defines prerequisites, OS, DB, VM sizing, specifications, and product versions (.NET, JRE)
- Provides guidelines for performance benchmarking and technology evaluation
- Provides a list of pre-installed and pre-validated software (Landmark and third party)
Landmark Earth® User and Admin Consoles
Reduce Total Cost of Ownership

Cost Savings Over Three Years (TCO)

- 21% Savings
- 37% Savings
- 50% Savings

Delivers Cost Savings

- **Reduced administration**
  - Hardware (HW) and software (SW) both managed through a “single pane of glass” by fewer resources
  - HW upgrades streamlined through pretested, compatible components
  - SW upgrades streamlined through auto-update process

- **Reduced downtime**
  - HW components engineered to work together
  - Applications pretested on the same environment
Landmark Earth® Engineered Appliance – Private Cloud Drivers

- Availability of public cloud services for petrotechnical application delivery
- In-country data security and compliance
- Geographic availability of cloud technology skills and services
Landmark Earth® Engineered Appliance – Customer Example

Consortium organization operating across the Americas

CHALLENGES

• Need to reduce petrotechnical IT costs significantly, yet deploy Landmark applications in locations across Americas (e.g., in Quito, Ecuador, and in Houston, Texas)
• Reduction in IT staff impacted the consortium’s ability to manage complex IT infrastructure
• Effectiveness of 50+ E&P personnel was at risk

SOLUTION COMPONENTS

• Landmark Earth® Engineered Appliance hosted in a private cloud
  – Twenty 3D users
  – Thirty 2D users
  – Five years of onsite administration

RESULTS

• Users accessing Landmark applications through the cloud environment are getting supreme performance and reduced processing times
• Projects have been made more efficient with the deployed integrated E&P lifecycle management

Consortium is paid based on its G&G analysts’ ability to drive production optimization across four fields
Landmark Earth® Engineered Appliance – Customer Example

Consortium organization operating across the Americas

Reservoir Simulation

- Dynamic Modeling
  - Simulating about 15,584 days with 6,933,680 data cells (cubes)
- 16 CPUs used
- Finished in 27 hours, over 1.5 times faster than previous methods
Landmark Earth® Appliance Customer Example

- Faster time-to-geoscience value
- More tasks executed in same time frame
- Significant increase in productivity
- Can now execute both 2D & 3D models
Landmark Earth® Appliance Customer Example

- Enhanced geoscience software performance
- Reduced IT costs and overall cost of ownership
- Better Integrated Oil lifecycle workflows
- Environment that promotes co-worker collaboration
- Faster and more effective Team-based decisioning

- Private cloud hosting environment powered by Landmark Earth®
- Capability to deliver effective resources to:
  - 20 3D users
  - 30 2D users
- Scalable and available infrastructure despite where it is accessed from
- Enhance application performance
- Collaborative and integrated workflows
- Do more with reduced IT staff
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