Abstract
As technology advances and business applications become more intelligent, your database must also transform if you want to take full advantage of these new capabilities. Oracle’s Converged Database is doing just that, helping organizations effectively use information to drive continuous innovation.

This 15-minute guide looks at how Oracle has transformed its database capabilities to help businesses like yours make full use of emerging technologies. It also explores the value that Dell Technologies brings to your Oracle environments with IT solutions that reduce TCO by simplifying today’s complex Oracle landscapes and are ready to run emerging Oracle applications and converged database working with AI, ML, blockchain and IoT.

May 2021
**Table of Contents**

- **Introduction** .......................................................... 3
- **Setting a flexible IT foundation** ................................. 5  
  - Embracing a cloud operating model ............................. 6  
  - Day-two operations .................................................. 8
- **Embracing an agile data strategy** ............................... 9  
  - Integrating applications and data .............................. 10  
  - Oracle data warehouse + data lake ............................ 11
- **Modern app development** ......................................... 13  
  - AI | ML | Containers with Oracle Database ............... 13  
  - Deploying containerized Oracle Database ................. 14
- **Taking the next steps** ............................................... 15
Introduction

Increasingly, next-gen intelligent data-driven applications are coming of age. They’re maturing at an accelerated pace, both in the consumer space and the business realm. And, with the rise of emerging technologies like artificial intelligence (AI) and machine learning (ML), Internet of Things (IoT), digital assistants, and blockchain, business applications — including finance, enterprise resource planning (ERP), supply chain management (SCM), and customer relationship management (CRM) — are rapidly becoming more intelligent.

A recent ESG study, commissioned by Oracle®, on the role of emerging technologies for ERP and financial applications, shows that 84% of organizations are using at least one emerging technology in production to enhance finance and/or supply chain operations.¹

84% of organizations are using at least one emerging technology — AI, IoT, digital assistants, blockchain — in production to enhance finance and supply chain operations.¹

Foundational to intelligent applications are the advancements in the database platforms they are built and run on. For decades, the database has been the backbone for operational data (OLTP) and data warehousing for reporting and some analytics (OLAP). But today, as organizations look for ways to unlock insights hidden in their structured operational data together with unstructured big data across different platforms and environments, relational database management systems (RDBMS) have responded with new architectures and capabilities.

¹ Oracle research in partnership with ESG, Emerging Technologies: Driving Financial and Operation Efficiencies, May 2020.
66% of IT strategies are using or planning to use virtualization or cloud solutions to reduce time and money spent on ongoing database management activities.²

### Table 1: Evolution of relational databases

<table>
<thead>
<tr>
<th>Legacy</th>
<th>Today</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Separated workloads</strong></td>
<td><strong>Mixed workloads</strong></td>
</tr>
<tr>
<td>• OLTP</td>
<td>OLAP</td>
</tr>
<tr>
<td>• Virtual</td>
<td>Physical</td>
</tr>
<tr>
<td>• Structured</td>
<td>• Structured and unstructured</td>
</tr>
<tr>
<td></td>
<td>• In-memory</td>
</tr>
<tr>
<td></td>
<td>• Multi-tenant</td>
</tr>
</tbody>
</table>

To this end, Oracle has evolved to a “converged database,” one that reduces IT complexity and addresses many applications with a single solution — driving continuous innovation and enabling intelligent applications, business processes and operations. Oracle’s Converged Database (beginning with Oracle 19c) has native support for all modern data types and the latest development paradigms built into one product, which makes it much easier to support mixed workloads and data types. This blog provides a good overview of Oracle’s Converged Database: [What is a converged database?](#)

Planning for the Oracle journey with Dell Technologies

In response to Oracle’s embracing of in-memory processing and working with AI, structured, unstructured, machine and IoT data, IT is now tasked with addressing end-of-life (EOL) deadlines for legacy applications and databases, driving new programs for upgrades and migrations to new versions of Oracle.

Whether you’re running older versions of Oracle Database or are planning to migrate to their Converged Database (Oracle 19c and above), critical to success is an IT foundation that reduces total cost of operation (TCO) for today’s complex Oracle landscapes and is ready to support future state capabilities and operating profiles.

When you’re designing an IT foundation to support your current state, make sure you do so with an eye to the future. Primary objectives should include:

- Elimination of siloed IT and operational complexity running traditional complex Oracle landscapes
- Support for traditional and emerging operating profiles enabled with Oracle’s Converged Database and applications working with AI, ML and IoT
- Support for an on-premises cloud operating model, with a future eye toward operating in a multi-cloud landscape

Finally, even if you run Oracle on-premises, your applications and data ecosystem must be able to communicate with other suppliers and partners within your network, wherever you’re running your core Oracle systems.

In this 15-minute guide, we will explore how Dell Technologies can partner with IT to unlock the value of Oracle with platforms and IT solutions that reduce TCO by simplifying today’s complex Oracle landscapes, and are ready to run emerging Oracle applications and Converged Database working with AI, ML, blockchain and IoT.

**Setting a flexible IT foundation**

Applications and businesses drive requirements

As IT plans a foundation for running Oracle, it is important to keep in mind application and business requirements today and in the near future. Our goal at Dell Technologies is to underpin your application and database transformation with an infrastructure that supports business and IT outcomes now and is ready to support emerging data drive scenarios. Table 2 below outlines several requirements shared by many businesses running Oracle applications and databases today and aligns to emerging Oracle technologies with AI, ML and cloud-native apps.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Consolidate “siloed” IT and simplify operations.</strong></td>
<td><strong>Embrace an agile data strategy.</strong></td>
<td><strong>Enhance developer productivity with data.</strong></td>
</tr>
<tr>
<td><strong>Modern IT supporting traditional and as-a-Service:</strong> Consumption models for infrastructure including lifecycle management for infrastructure running Oracle</td>
<td><strong>Connecting applications and data:</strong> Break down data silos, integrating on-premises and cloud-based Oracle and non-Oracle applications across the business ecosystem.</td>
<td><strong>Accelerating DevOps:</strong> Build and deploy new Oracle apps, leveraging containerization Oracle databases.</td>
</tr>
<tr>
<td><strong>Performance, protection availability:</strong> Efficient, intelligent systems that scale with workload demands, freeing database administrators (DBAs) and IT staff from repetitive tasks</td>
<td><strong>Streamline data ingestion and access:</strong> Ingest and unify data streams with unlimited retention, providing Oracle access to both real-time and historical events.</td>
<td><strong>Al-enabling infrastructure:</strong> Provide modern compute, GPUs, storage and network to ensure high performance for data-driven Oracle workloads with ML.</td>
</tr>
<tr>
<td><strong>Simplicity:</strong> Designed for ease of use, reliability and lifecycle management, to enable focus on business innovation instead of monitoring and management of IT operations</td>
<td><strong>Secure data with cyberconfidence:</strong> Protect Oracle apps and data with cyber-resilient IT and a path to recovery from ransomware and destructive cyberattacks.</td>
<td><strong>Advanced data management:</strong> Bridge the edge-to-core data gap with IT solutions enabling Oracle business workloads and database platforms to work with data regardless of location.</td>
</tr>
</tbody>
</table>

*Table 2: Application, database and business requirements drive IT requirements*
Embracing a cloud operating model
What path is best for your organization?
Dell Technologies recognizes that every organization is somewhat unique, depending on what Oracle (and non-Oracle) applications and databases you run today and what your strategy is moving forward. Ultimately, with an understanding of the business and application requirements for Oracle, IT can determine the best path(s) forward for planning and running Oracle.

- Move to modern infrastructure
- Leave in place
- Reassess later
- Retire
- Public cloud
- Private cloud
- Hosted/outsourced cloud
- Colocation

Earlier, we mentioned a survey of Oracle DBAs and IT managers, revealing that 66% are using or planning to use virtualization or cloud solutions to reduce time and money spent on ongoing database management activities.²

Also, while IT is looking to reduce cost and time managing Oracle, performance, reliability, availability and protection are important purchasing criteria, too.

Dell Technologies looks to blend CapEx and OpEx models, helping IT to achieve the right cost structure for running Oracle on best-in-class compute, storage, networking and data protection infrastructure. With wide-ranging consumption models — pay for technology as you grow it, as you use it, and as-a-Service — Dell Technologies offers flexibility and choice (illustrated below), supporting the various paths IT can employ for Oracle environments.
On-premises

**Dell EMC cloud-enabled infrastructure**: Run Oracle virtualized and non-virtualized, leveraging your preferred compute (rack or modular), storage (block, file, object) and data protection platforms. Deploy your preferred Oracle stack (virtualization, OS, management).

**DTCP APEX Private Cloud**: If you’re running Oracle with VMware, DTCP Private Cloud introduces a simple and scalable way for IT to build an on-premises cloud without the additional layer of deploying the VMware Cloud Foundation™ (VCF) software stack.

Hybrid cloud

**DTCP APEX Hybrid Cloud**: If you’re running Oracle with VMware, this offer delivers a simple path to hybrid cloud through automated operations and a single platform on which to run both cloud-native and traditional applications. DTCP Hybrid Cloud is a jointly engineered hyperconverged infrastructure (HCI) system (Dell EMC VxRail) with deep VMware Cloud Foundation integration.

Multi-cloud

**Storage and data protection**: A managed service that combines the benefits of Dell EMC storage and data protection platforms with the agility and flexibility afforded by a multi-cloud accessibility model for use cases such as DR, test/dev and analytics. This offering supports multi-cloud for Dell EMC PowerMax, PowerStore, PowerScale, Unity XT and PowerProtect Appliances.

**Protecting in-cloud workloads**: With IT management increasingly leveraging public cloud as an extension of data center operations, Dell EMC PowerProtect Data Manager provides a common self-service data protection solution for Oracle across on-premises and to/from the public cloud.
Day-two operations
Once you have the right IT foundation for Oracle, you want to make sure that you’re getting your Oracle DBAs and developers the right IT services. You especially want to support key objectives in maintaining, protecting and ensuring availability for mission-critical landscapes.

Operational priorities for Oracle
Database maintenance still takes too much DBA time, which cuts into an organization’s competitiveness. Even with database automation and cloud resources abundantly available on the market, many database managers still spend substantial amounts of time on low-level tasks. This is holding back progress.

In a recent survey of Oracle’s database administrators and IT managers,2 the costliest database management activities from an operational standpoint include:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applying upgrades, fixes and patches</td>
<td>66%</td>
</tr>
<tr>
<td>Maintaining uptime and availability</td>
<td>61%</td>
</tr>
<tr>
<td>Performance tuning and diagnosis</td>
<td>37%</td>
</tr>
<tr>
<td>Copying databases and maintaining copies</td>
<td>23%</td>
</tr>
<tr>
<td>Running backups, DR planning</td>
<td>20%</td>
</tr>
</tbody>
</table>

Enabling day-two services with Dell Technologies
Underpinning our IT solutions for Oracle is the Dell EMC software and infrastructure portfolio, which establishes the pillars for enabling IT operations running Oracle to address the challenges highlighted above. Working with Dell EMC Oracle specialists, we explore how our best-in-class infrastructure solutions enhance to Oracle environments:

- **Servers**: Address evolving compute demands for traditional and emerging Oracle use cases, including analytics and data scientists working with large structured, unstructured and IoT data sets.
- **Primary storage**: Provide the scalability, intelligence and cloud integration needed to unlock the value of your Oracle data while decreasing application outages and reducing storage requirements with advanced deduplication.
- **Unstructured data**: Enable Oracle data warehouse + data lake, managing the rapid growth of unstructured batch and streaming data with file and object storage at any scale.
- **Data protection**: Certified with Oracle RMAN, database administrators get direct control over backup and recovery, enabling self-service without any loss of visibility.
- **Cyber-recovery**: Protect critical data from cyberattacks and ransomware, identify suspicious activity and perform data recovery with easy-to-deploy management and automation software.
- **Hyperconverged infrastructure**: Transform operations with turnkey integrated systems that accelerate IT outcomes, or continue to leverage existing operating models while gaining HCI benefits through flexible, pre-validated HCI building blocks.
- **Converged infrastructure**: Simplify IT and transform operations by bringing together compute, storage, networking and data protection in fully engineered systems and validated designs from Dell Technologies.
Embracing an agile data strategy

In the digital era, no organization is an island. A truly agile data strategy for driving continuous innovation and intelligent process improvement must consider how IT can integrate and connect data and apps. Your business is generating a tremendous amount of data, both within and outside of your organization. Extracting value from that data requires productivity (the ability to analyze your data in real time) and visibility (access to all data).

Whether you’re developing new applications, designing new experiences or inventing new business models, time to market depends on how quickly you can integrate everything you’re developing with the applications and data you already have.

Connecting the digital business
Creating a fabric of connectivity within your organization, and extending to customers and partners, will allow you to unlock innovation across your digital ecosystem.
Data that operates in silos has proven ineffective compared to data that’s connected. Thus, a key component of creating an agile and effective strategy is a cohesive environment that connects all business applications and data. This includes data created, captured and stored in Oracle and non-Oracle sources in the core, at the edge, in data warehouses and across data lakes.

Integrating applications and data
Delivering the best possible experience and interactions for your customers and business-to-business (B2B) partners is a must for maintaining and growing business. While integrations between applications are often invisible to the end-users, this is not the case for application developers. Challenges include:

- Limited reusability of legacy integration processes, relying on custom code and scripting
- Cost of consulting and integration services to build and maintain APIs
- Lack of standards, governance and integration flows
- The ever-increasing volume and complexity of digital projects

Traditional IT functions cannot afford to be bottlenecks for innovative business initiatives. IT increasingly adopts Integration-Platform-as-a-Service (iPaaS), which provides a suite of cloud services enabling development, execution and governance of integration flows. iPaaS connects any combination of on-premises and cloud-based processes, services, applications and data within individual or across multiple organizations.

With iPaaS, companies can combine the rapid low-code development and deployment of APIs to power mobile and web applications safely and securely, reusing data and services from existing applications. Seamlessly configuring and deploying APIs from an iPaaS is essential for project success.
Accelerating delivery of integration projects

Dell Technologies Boomi AtomSphere iPaaS provides the key to success for accelerating delivery of integration projects with Oracle:

1. Quickly begin the build with a vast and growing library of application and technology integrators along with pre-built starter processes.
2. Deploy integrations in the most appropriate location for your business, behind the firewall or in a private or public cloud.
3. Centrally manage with the cloud-hosted dashboard for a thorough view and reporting on status and process details.

You can bring integrated experiences to life with one platform for data discovery, application/data integration, API management, data quality governance, B2B integration, low-code app development, workflow automation and more.

Boomi lets IT quickly and easily unite everything and everyone in your digital ecosystem across channels, devices, platforms, applications, systems and processes. It reduces IT complexity and ultimately breaks down the data silos that have plagued organizations in the past.

Oracle data warehouse + data lake

Another critical aspect of an agile Oracle environment is the ability to enable your Oracle enterprise data warehouse and data lake by corralling all data coming into the business from varying sources and in different formats (including structured and unstructured data).

Traditionally, an enterprise data warehouse (EDW) is a relational database that contains a company’s business data, including information about its customers, to perform queries and analysis often against large amounts of historical business data. It usually contains historical data derived from application transaction data, but it can include data from other sources. A data lake is a vast pool of raw data, the purpose for which is not yet defined.
Data virtualization is a critical part of the data warehouse + data lake architecture. It enables queries to be federated across multiple data sources, including traditional structured data sources, such as databases, applications, and data marts, and less traditional data sources, such as Apache® Hadoop®, NoSQL, web services, Software-as-a-Service (SaaS) applications, and so on — while still appearing as a single “logical” data source to the user.

The Dell EMC Streaming Data Platform provides the foundational component for a data lake, working with Oracle EDW. From the perspective of a data lake, data is coming from sensors, cameras, drones and logs, running either in the data center or at the edge. It is unstructured and comes in the form of a stream — data that is continuously generated.

A key part of solution architecture is a platform that supports the natural streaming of data, instead of artificially breaking it into files and objects. Using streaming data in its natural form enables a true data-first infrastructure that provides access to your data when and where you need it. It includes:

- **Historical retention and playback** for historical and real-time data, including tiered storage with unlimited retention and access.
- **Auto-scaling ingestion and analysis** dealing with endless flows of data and unpredictable volume, removing the need to predict that volume, and which guarantees that each event is delivered and processed exactly once (despite failures in clients, servers or the network).
- **Write efficiency** for IoT and time-sensitive applications by shrinking write latency to milliseconds, and seamlessly scaling to handle high-throughput reads and writes from thousands of concurrent clients.
- **Enterprise-ready platform**: Backed by the security that is expected of an enterprise-ready solution, the Streaming Data Platform persists and protects data before the write operation is acknowledged to the client.
Modern app development

The question that’s top of mind for many organizations today is, “How do I accelerate development and new apps to become a true data-driven business?”

Increasingly, enterprises pursuing digital transformation face the same challenges as internet consumer services and enterprise cloud apps, but with the additional burden of making sure these new systems interact with existing applications and databases.

Companies need to create consumer-facing mobile and web apps with the same rapid iteration and flexibility as the internet giants. They must provide IT services to multiple departments with the same agility as commercial SaaS providers. Plus, their existing enterprise systems must be able to use data from those new environments and contribute data back to them.

This is extremely difficult when each environment is built on different single-purpose databases with different operational, security and performance profiles. Organizations need a unified data tier supporting all of these apps, analytics and AI algorithms.

This has led to innovation in data management with Oracle’s Converged Database.

AI | ML | Containers with Oracle Database

A converged database is a multi-model, multi-tenant, multi-workload database. It supports the data model and access method each development team wants, without unneeded functionality getting in the way. It provides both the consolidation and isolation these different teams wish for but don’t want to think about. And it excels in all the workloads (like OLTP, analytics, and IoT) they require. Oracle Database 19c is the world’s first converged database.4

More than 25% of data created in the data global sphere will be real time in nature by 2025.5

---

5 IDC, Data Age 2025: The Digitization of the World from Edge to Core, November 2018.
Unlike single-purpose databases, Oracle’s Converged Database supports JSON, XML, relational, spatial, graph, IoT, text and blockchain data with full joins, transactions and other critical SQL features that enterprises rely on.

Also, containerized apps, which can disappear when no longer needed, and databases need to persist data with data durability and make it available for later use. The multi-tenant architecture of Oracle’s Converged Database allows a single container database to support multiple pluggable databases.

Deploying containerized Oracle Database

Why containerize with Dell Technologies?

Containers are popular for a number of reasons, including speed, efficiency and portability for agile development and DevOps strategies. But container adoption for databases, such as Oracle, has been hindered by:

- Lack of support for persistent storage of database files separate from ephemeral container files
- Difficulty in managing and ensuring code and data consistency between RDBMS and applications
- Concerns over compatibility with infrastructure components and software

Dell EMC infrastructure solutions with Oracle remedy these issues by bringing the power of persistent storage to a stateless platform. Our storage and container storage interface (CSI) plug-ins enable container orchestrators, such as Kubernetes®, to easily provision highly available and scalable container volumes for stateful containerized applications and databases.

- Quickly and easily deploy applications and databases consistently across multiple environments.
- Deliver secure, isolated development and test environments in seconds.
- Create persistent storage for stateful applications.
- Simplify provisioning, management and orchestration of container storage.
- Improve productivity and simplify application portability.
- Spend more time building new applications and competitive business services.
Taking the next steps

Regardless of whether you’re just beginning your database transformation or well into that journey, operating on-premises or in the cloud, Dell Technologies is here to help you optimize your solution for today’s needs and tomorrow’s objectives.

We can help your organization gain control and reduce IT complexity by running Oracle on a modern, secure IT foundation that supports traditional and emerging Oracle applications and containerized databases working with AI, ML and IoT.

Dell Technologies advantage

<table>
<thead>
<tr>
<th>Optimized IT operations</th>
<th>Enable agile data strategy</th>
<th>Becoming a data-driven business</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cloud operating model</td>
<td>Advanced data management, streamline data ingestion, and access secure data with cyber-confidence</td>
<td>Accelerating DevOps, connecting applications and data, AI-enabling infrastructure</td>
</tr>
</tbody>
</table>

Choice and flexibility, performance protection, availability, trusted simplicity

For more information about how Dell Technologies can support your Oracle environments, please visit DellTechnologies.com/Oracle.