

ORACLE

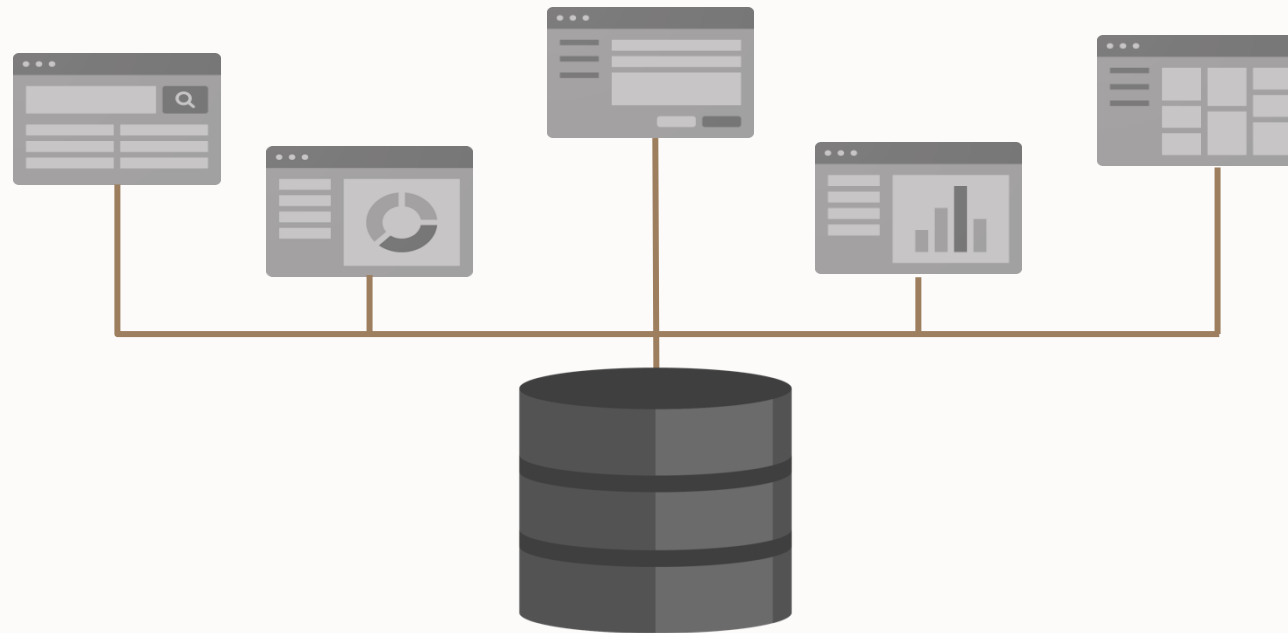
# Converged Oracle Database MAA in the world of hybrid cloud and multicloud deployments

**Glen Hawkins**

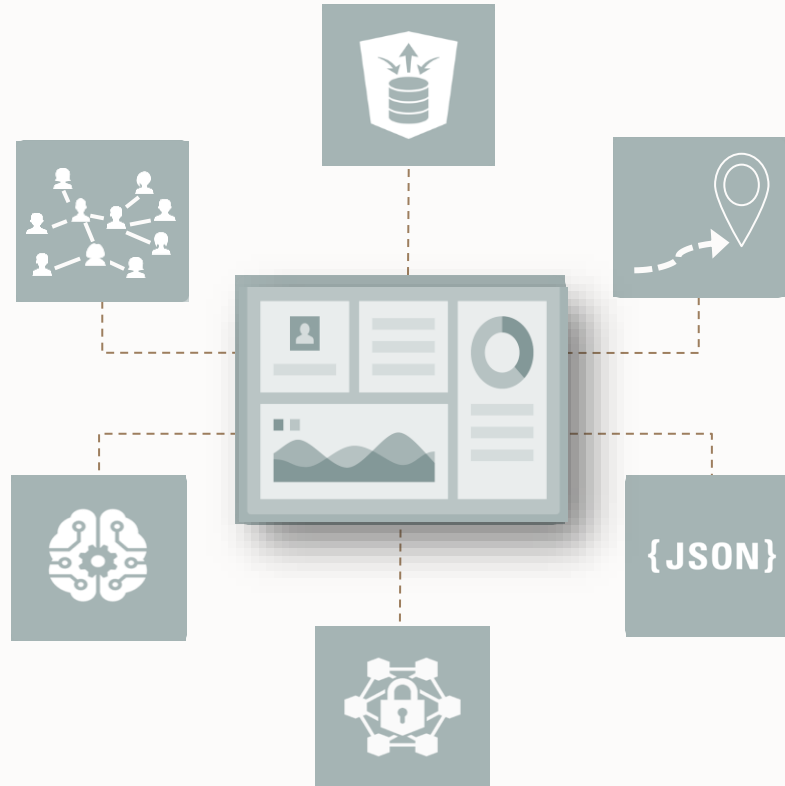
Senior Director of Product Management  
Oracle Maximum Availability Architecture & Data Guard



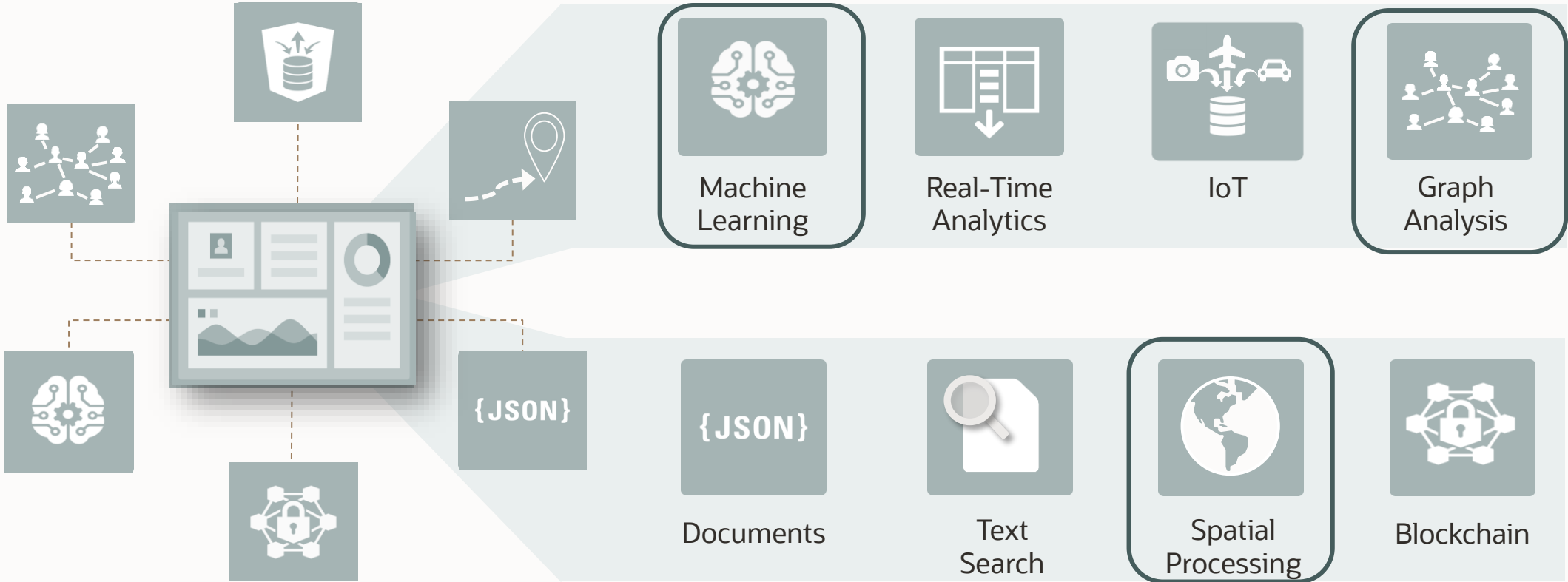
# History lesson: Developers built applications using a single development platform and data store



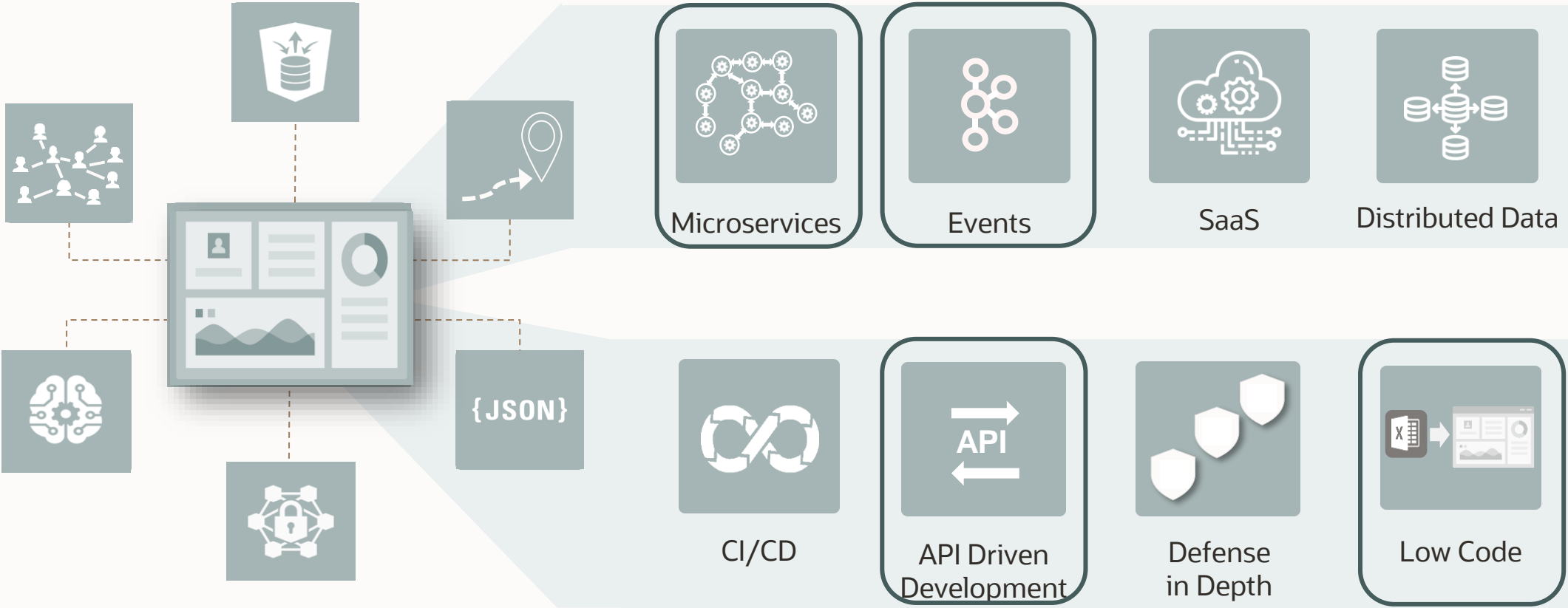
# Modern Apps Need To **Generate Value From Data in New Ways**



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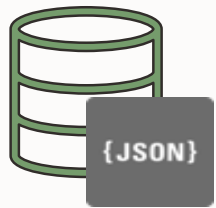


# Modern Apps Are **Built Using New Development Methodologies**



# Modern App Requirements **Lead to an Alternative Approach** Advantage

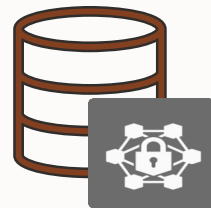
Run **Single-Purpose**, "best-of-breed" database for each data type and workload



Document



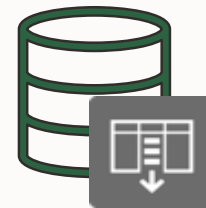
Spatial



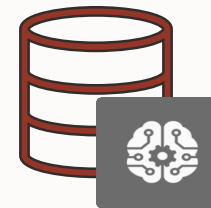
Blockchain



Text  
Search



Reporting



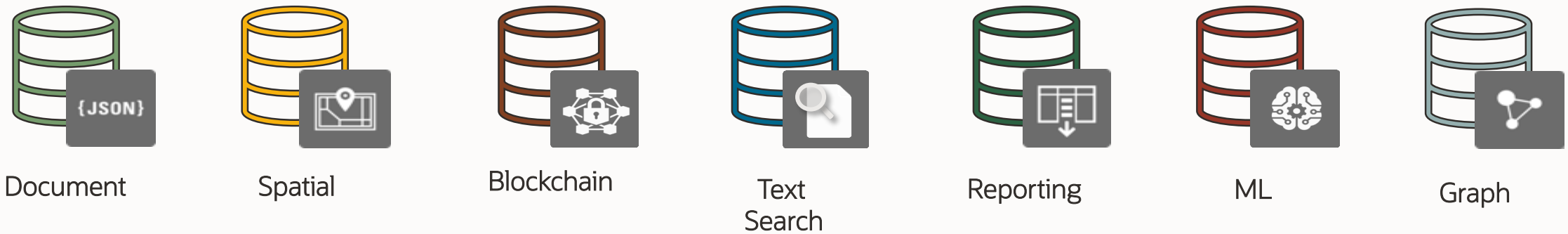
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Graph

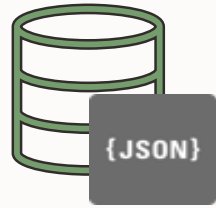
# Modern App Requirements **Lead to an Alternative Approach** Advantage

Run **Single-Purpose**, "best-of-breed" database for each data type and workload

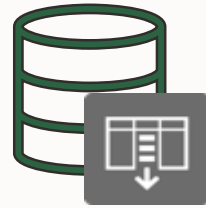


Each database offers a convenient data model that fits the purpose and has easy to adopt APIs for developers that seem natural for that data model

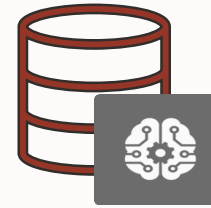
# Modern App Requirements **Lead to an Alternative Approach** Disadvantage



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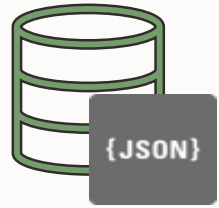


Graph

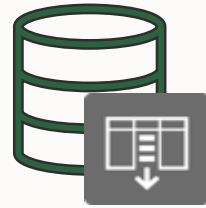
Even small apps need multiple data types and workloads, so you will need multiple single-purpose databases, **fragmenting** the data



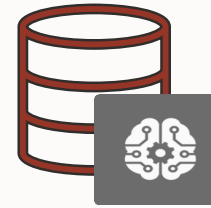
# Modern App Requirements **Lead to an Alternative Approach** Disadvantage



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Graph

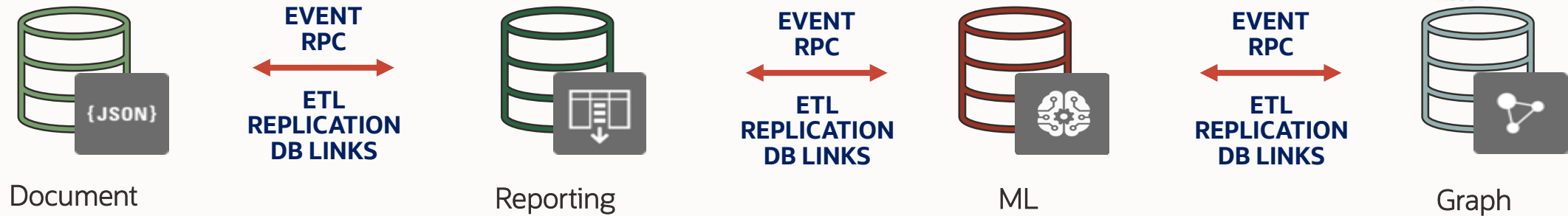


**Fragments development**, locks-in app to one single-purpose database



# Modern App Requirements **Lead to an Alternative Approach**

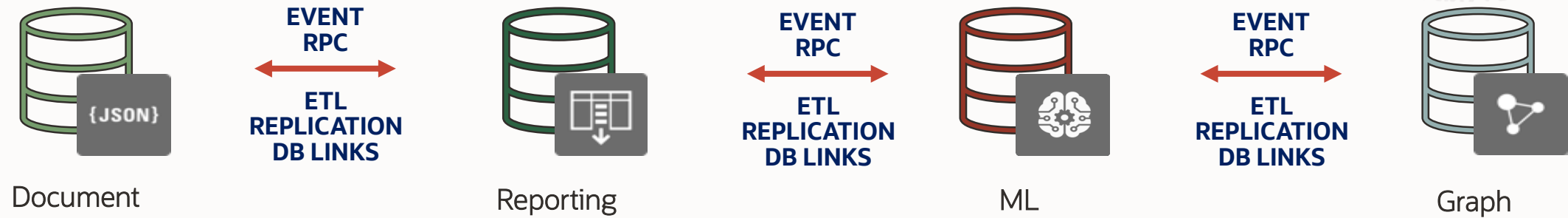
## Disadvantage



Every App Requires **distributed execution** and **data movement** across multiple fragmented databases

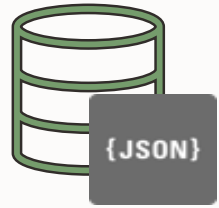
Inherently difficult and causes **unavoidable data delays** and data **divergence**

# Modern App Requirements **Lead to an Alternative Approach** Disadvantage

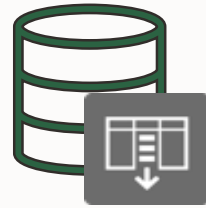
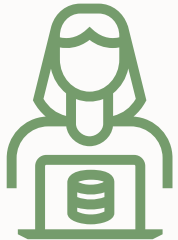


Developers become focused on **Integrating fragmented databases** to create a complete, available, secure, and scalable solution, instead of **innovating**

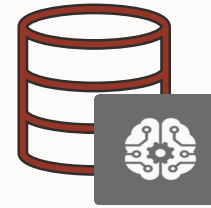
# Modern App Requirements **Lead to an Alternative Approach** Disadvantage



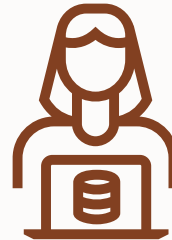
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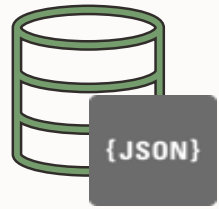
Graph



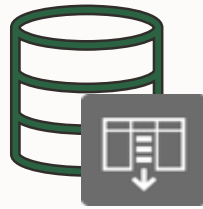
Each single purpose database requires **specialized skills and unique management**



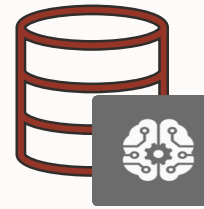
# Modern App Requirements **Lead to an Alternative Approach** Disadvantage



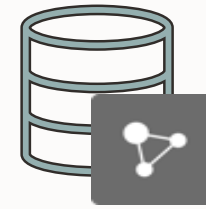
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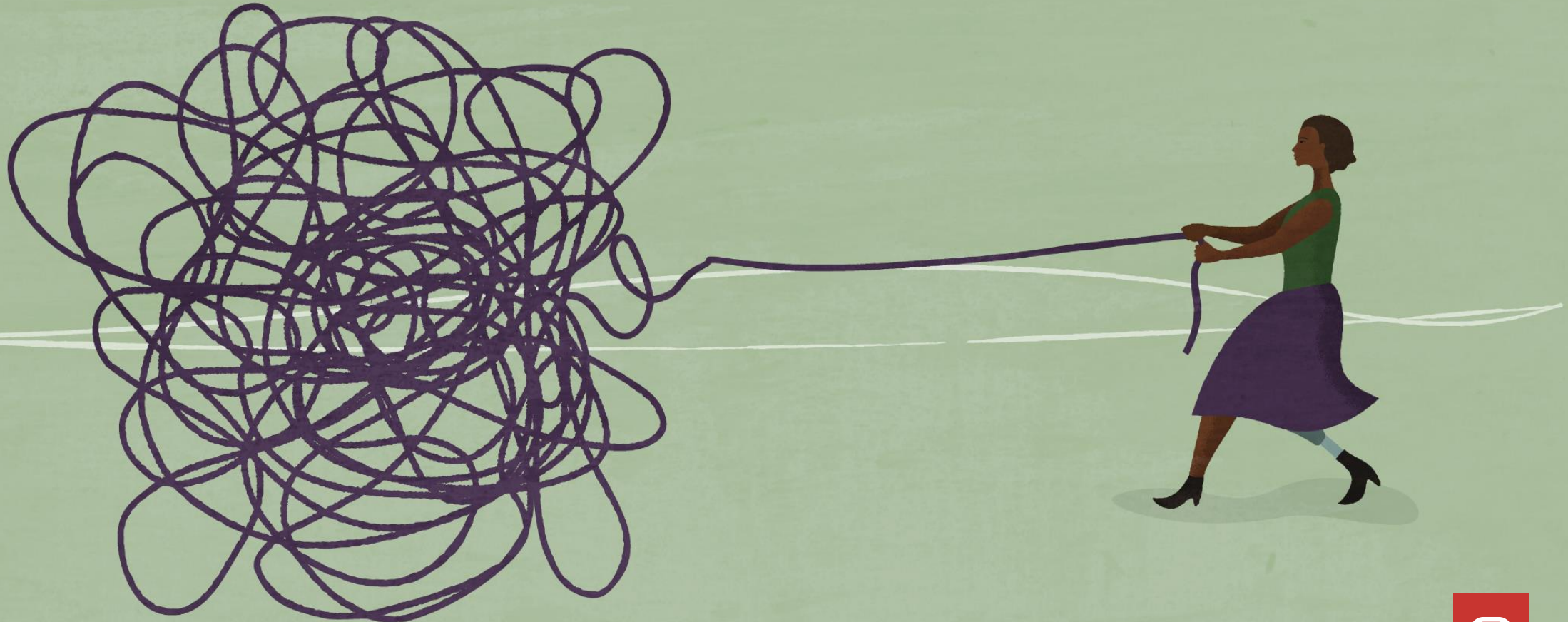


Graph



In addition, each of these specialized databases routinely has a **completely different security, high availability, and disaster recovery paradigm** creating operational silos into the architecture usually leading to complex maintenance operations, more downtime, and prolonged recovery in the case of a disaster event

# How Do you Manage This Level of Complexity?



# The Easier Way



Simplifying new development methodologies with synergistic data technologies





# The Easier Way



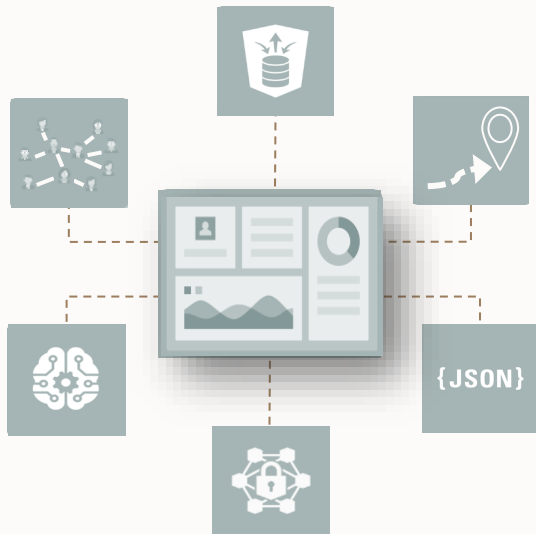
Simplifying new development methodologies with synergistic data technologies

Eliminating data fragmentation with a single Converged Database for all data types and uses





# The Easier Way

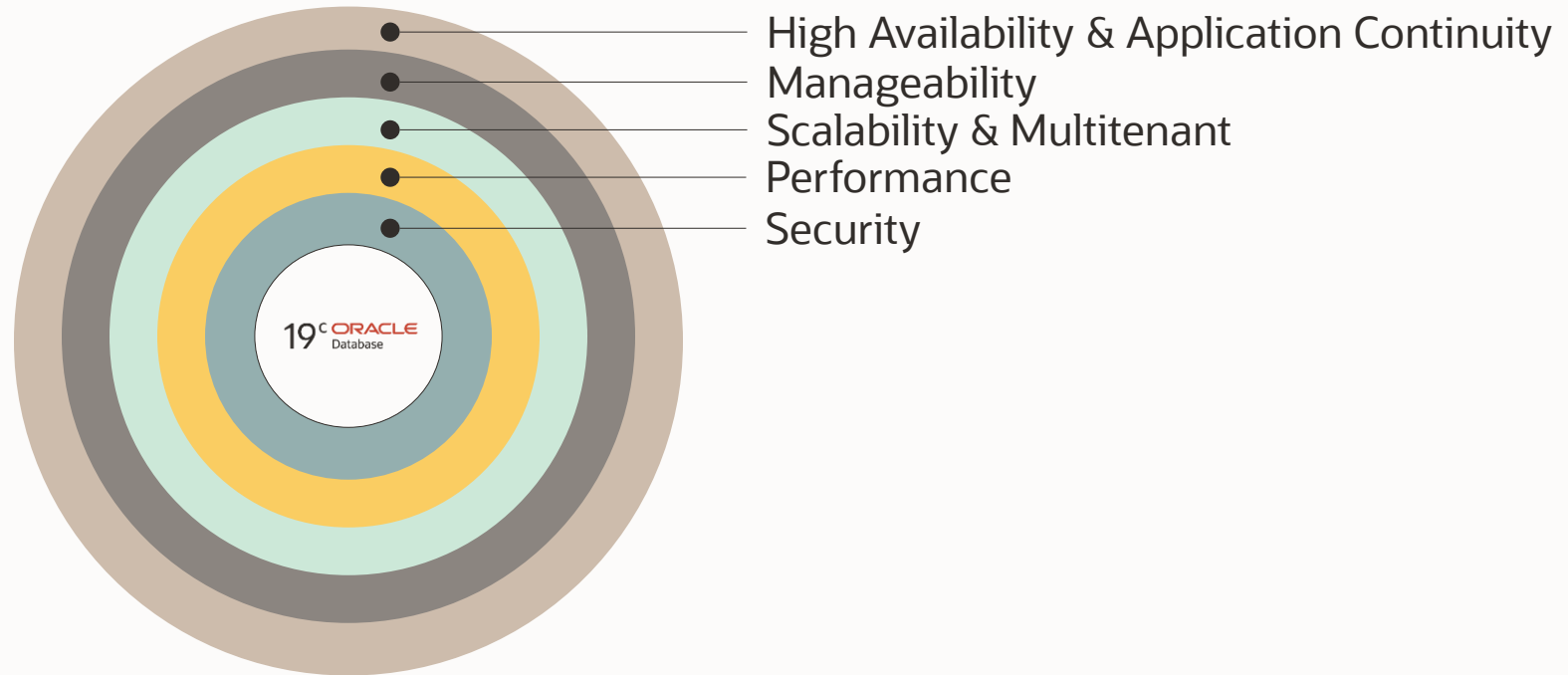


Simplifying new development methodologies with **synergistic data technologies**

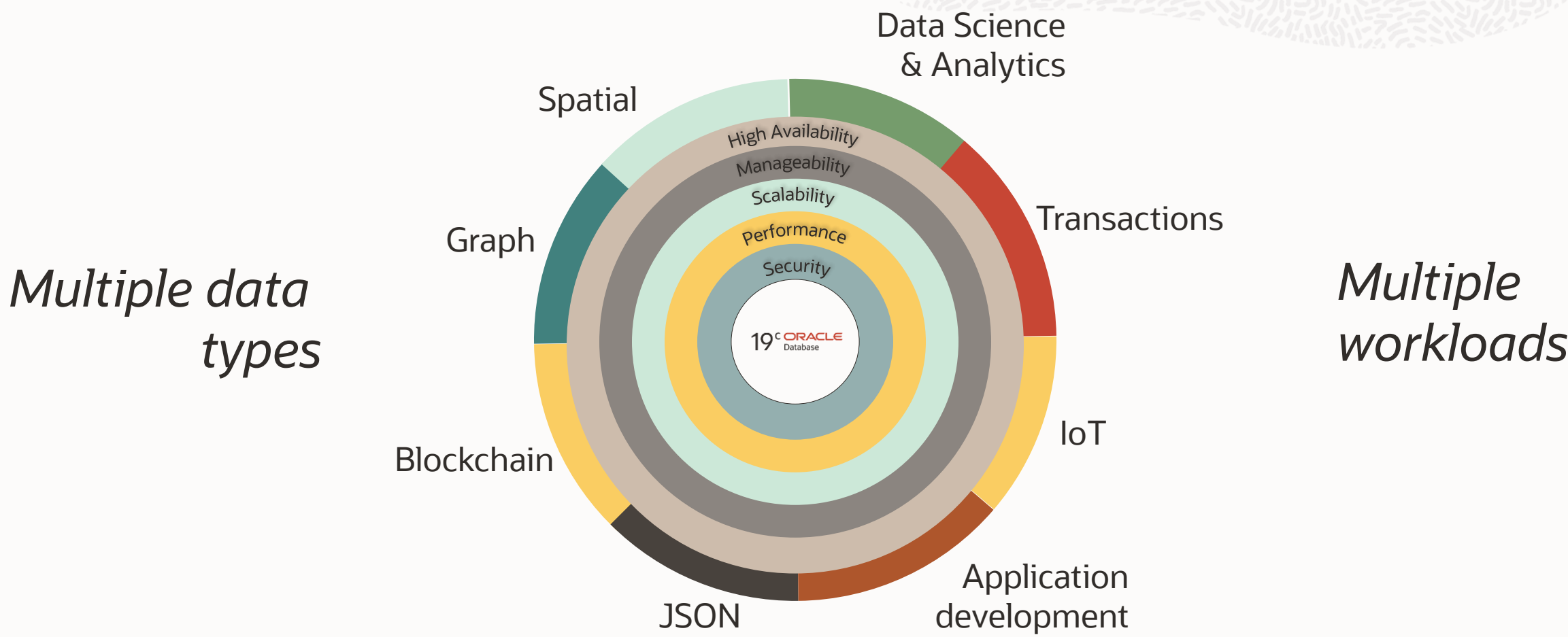
Eliminating data fragmentation with a single **Converged Database** for all data types and uses

Providing easy to use **declarative implementations** of the new data uses and types in the core database

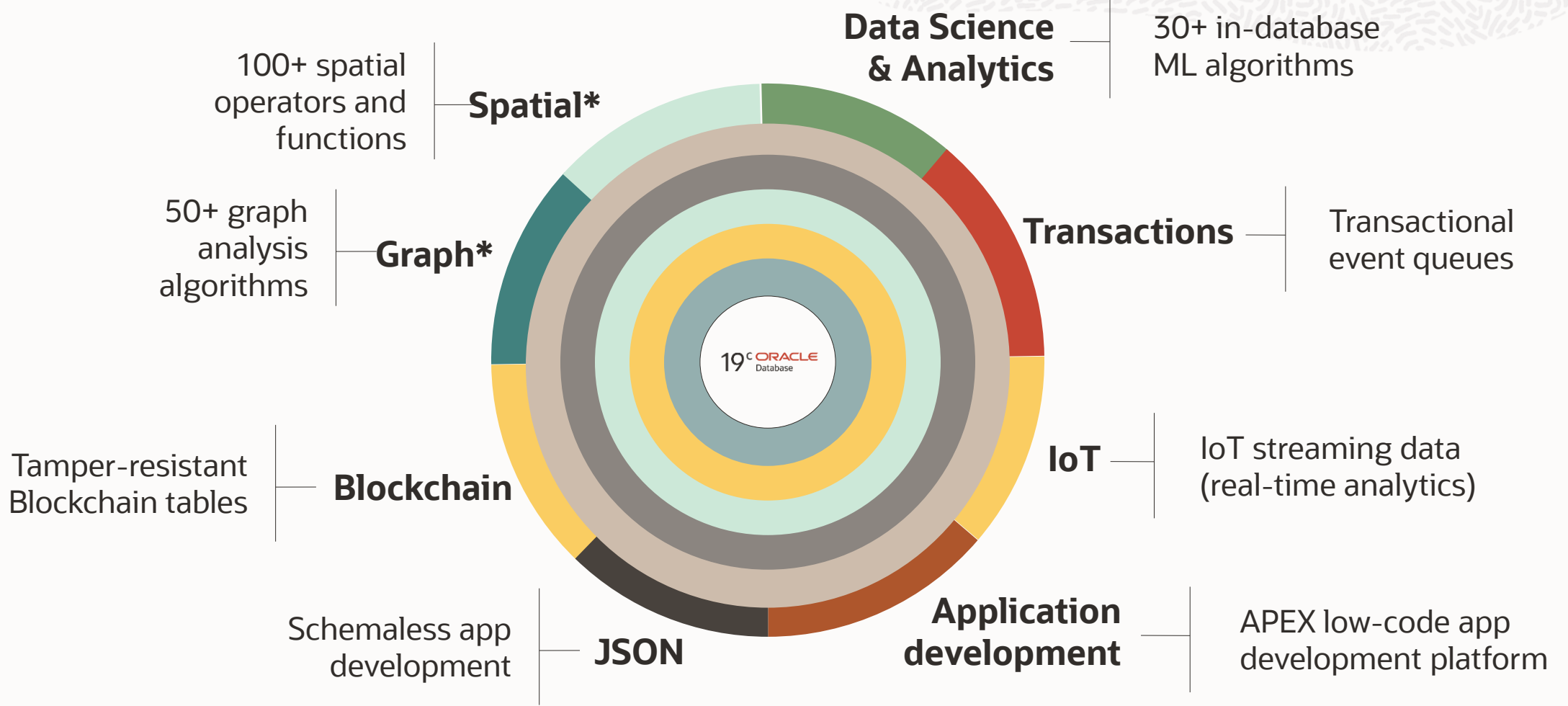
# Oracle Database – core, user-driven capabilities



# Oracle Database – converged by design



# Oracle Database – all-inclusive and converged by design



# Oracle's converged database - enabling the data-driven enterprise



## Do more with less

A **unified approach** to data management means more opportunity for **data synergies**, and less maintenance overhead

## Shorten time to value

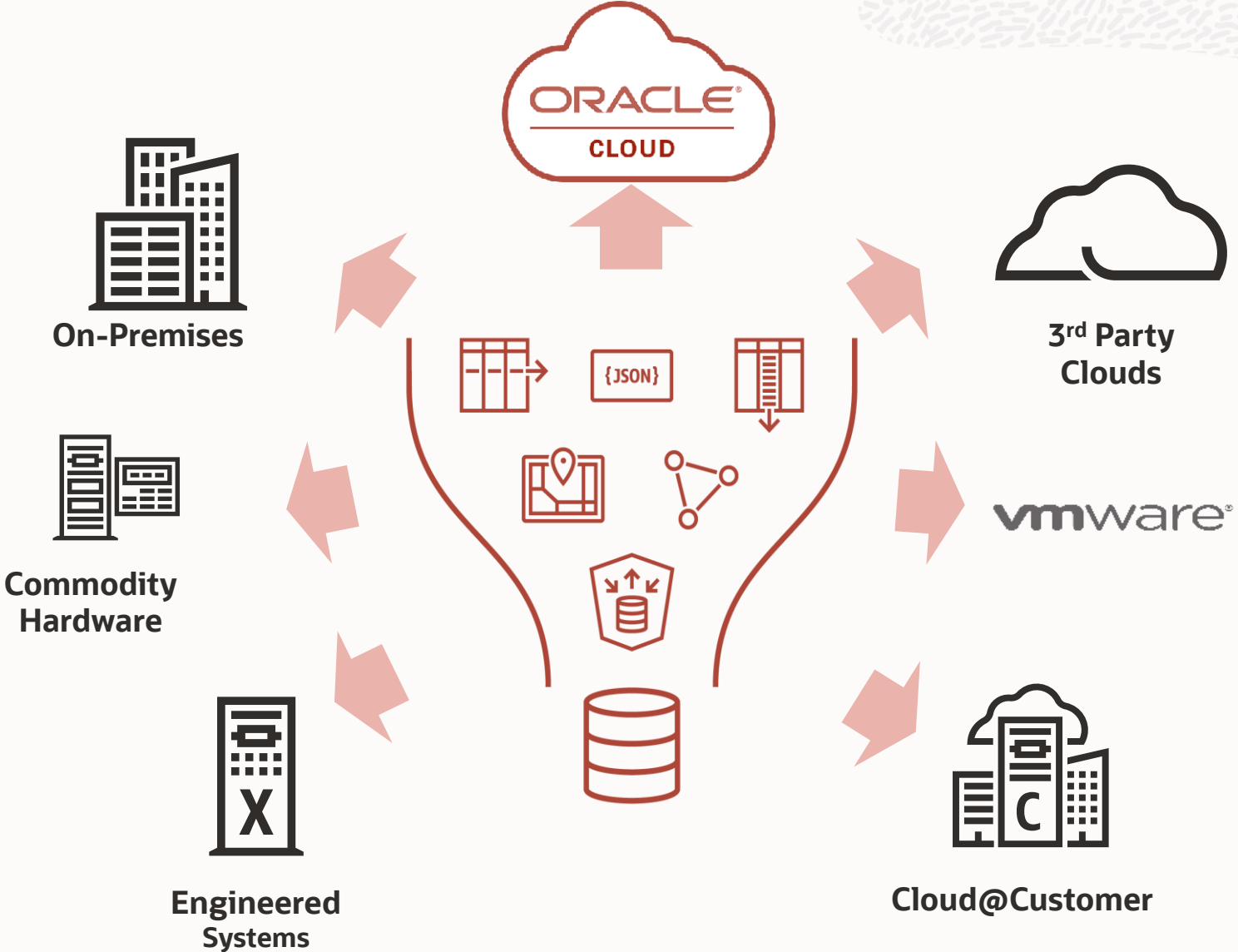
**Accelerate** application development – with **easier data access** and support for the **latest development methodologies**

## Modernize workloads

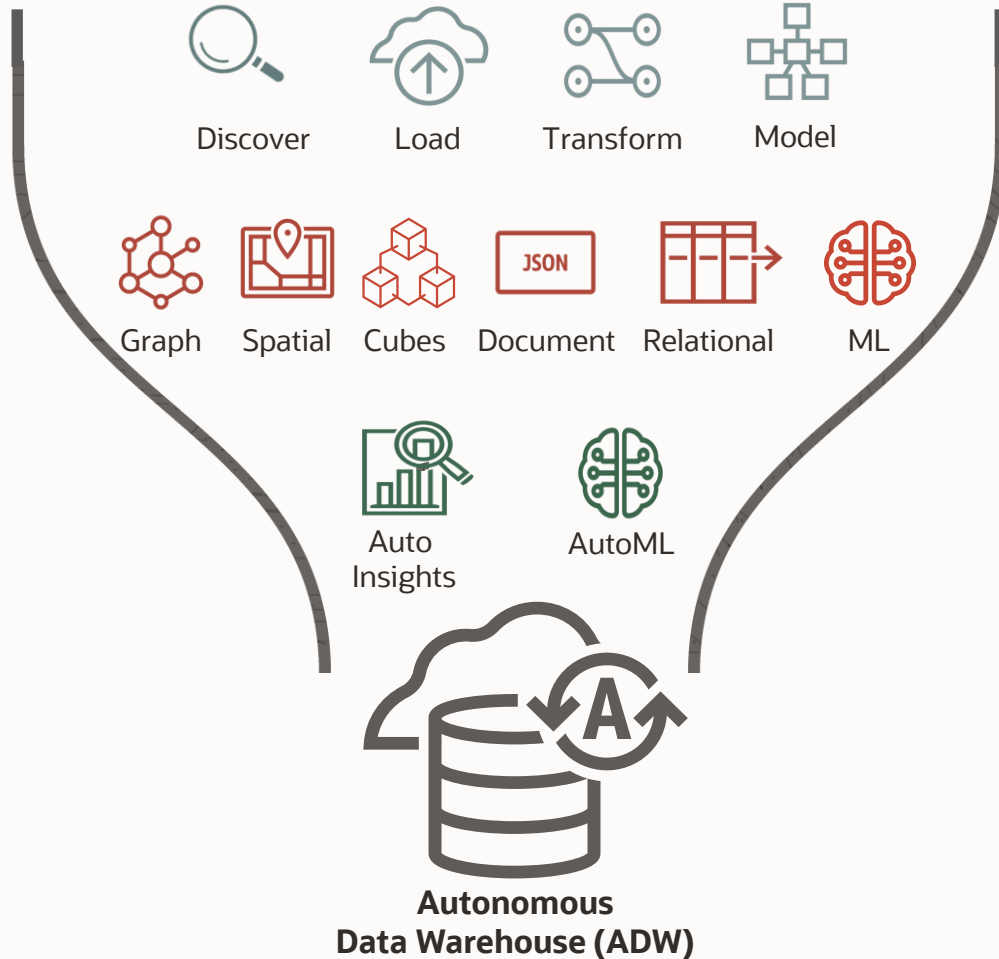
**Flexible deployment options** to meet your specific needs, and **ease of movement** between those deployment options



# Oracle Database, The Converged Database is Available Everywhere



# Autonomous Data Warehouse Delivers Fast and Easy Data Driven Insights



## Built-In Data Acquisition

Discover and Extract data from hundreds of sources including Object Store, Drag-n-drop tools for Bulk & Real-Time Load and Transformation

## Embedded Analytic Engines

Graph Analytics, Spatial Analytics, Cube (Multidimensional) Analytics, Document Analytics, Relational Analytics, and Machine Learning

## Automated Analytics

Automatically creates business models, discovers hidden insights, and builds machine learning models

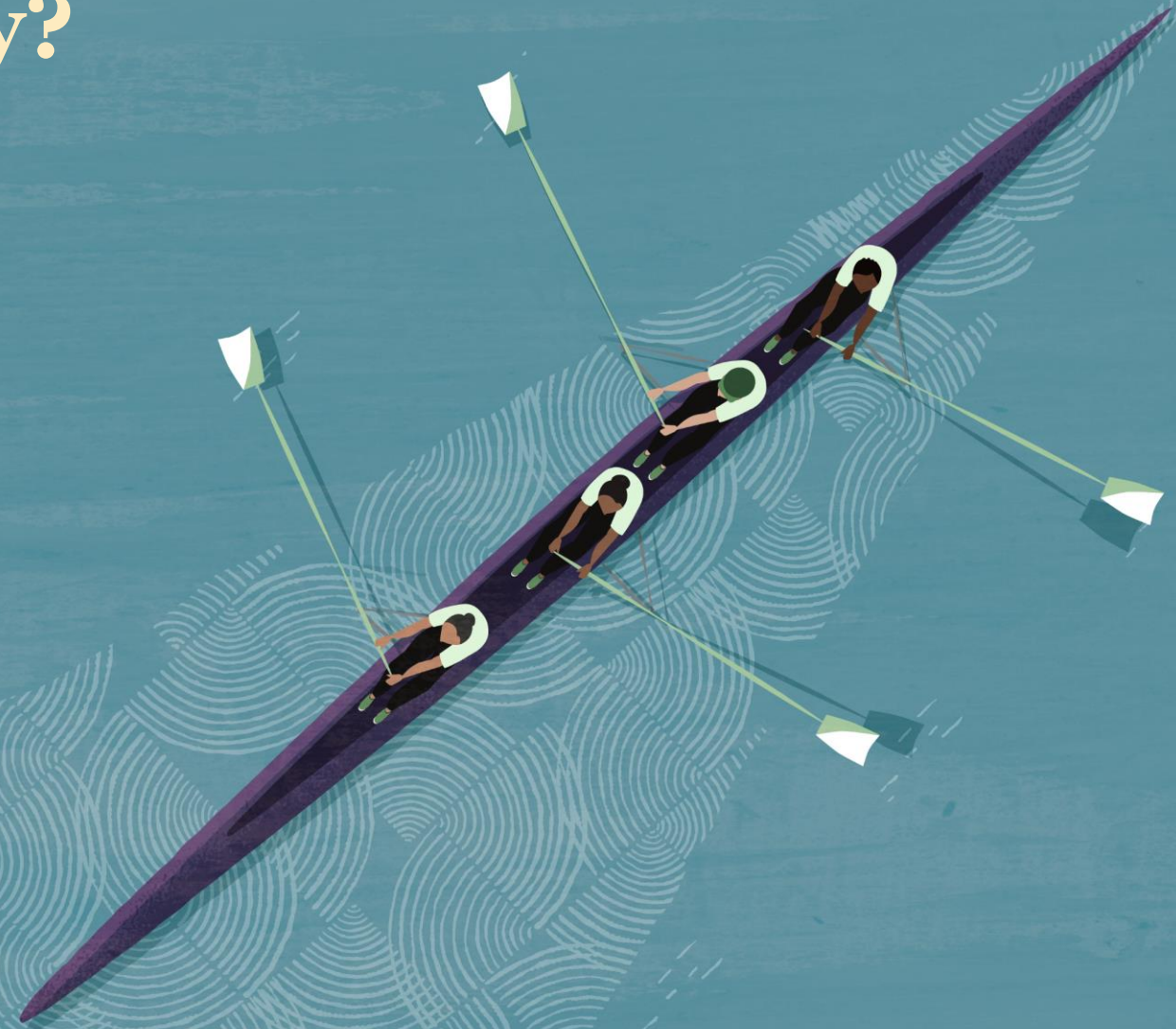
## Autonomous with Converged Architecture

Simplicity of automated full stack analytics enables business users and data scientists to quickly unlock value from data





# How Does the Converged Database Ensure Business Continuity?





# Key terminology



## High availability

A system type with redundant components that provides consistent and uninterrupted service, even in the event of hardware or software failures.



## Scalability

The ability to add additional nodes to database environments thereby maintaining and achieving improved performance.



## Rolling updates/patches

The process where software is developed continuously, and the updates are released in between the major releases. These updates are compatible with earlier versions where complete re-installation of the software is not required.



## Disaster Recovery

A method of protecting computer systems from failure, in which standby equipment automatically takes over when the main system fails.



## Recovery Point Objective (RPO)

Tolerance for data loss (sec's, hours, days); determines frequency of backups and replication approaches.

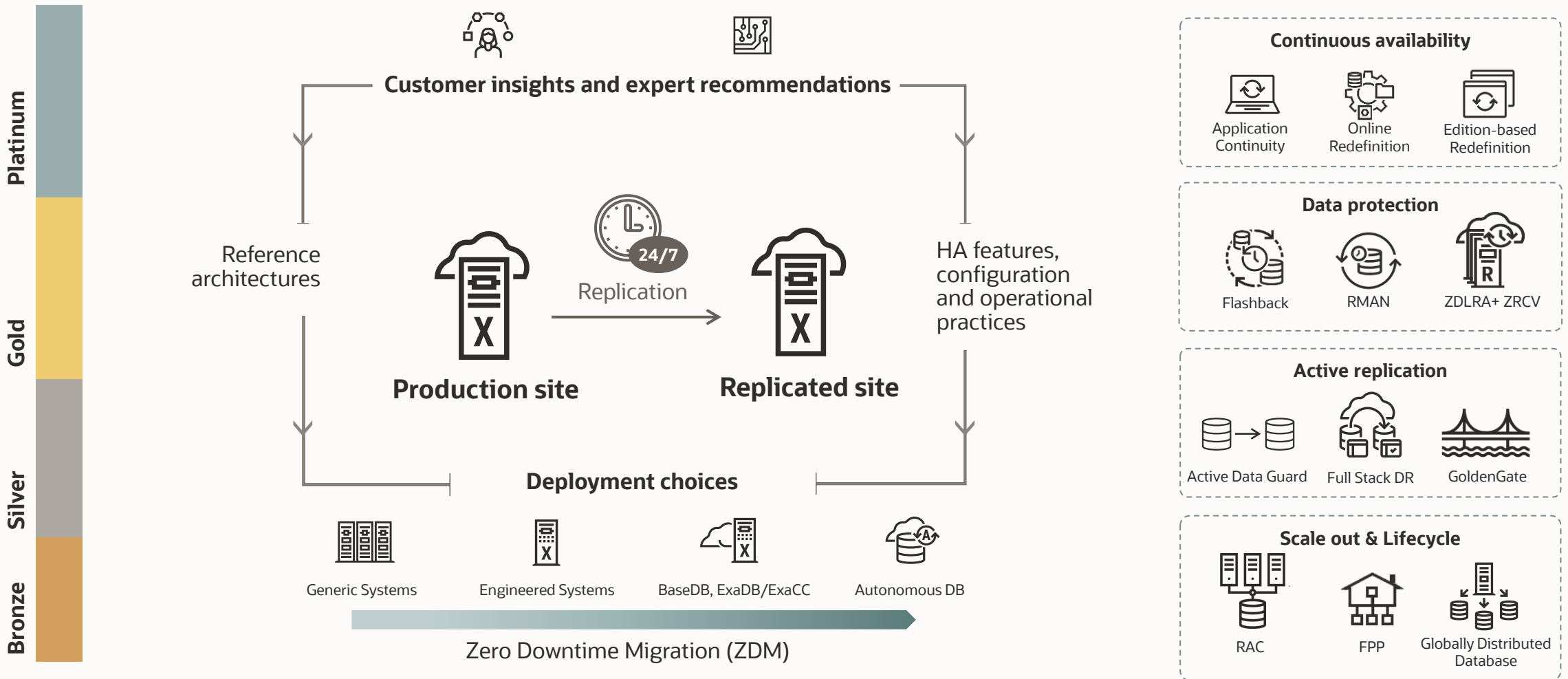


## Recovery Time Objective (RTO)

The shorter the Recovery Time Objective (RTO) the quicker you get back to business.

# Oracle Maximum Availability Architecture (MAA)





## Standardized Reference Architectures for Never-Down Deployments



# MAA reference architectures

## Availability service levels



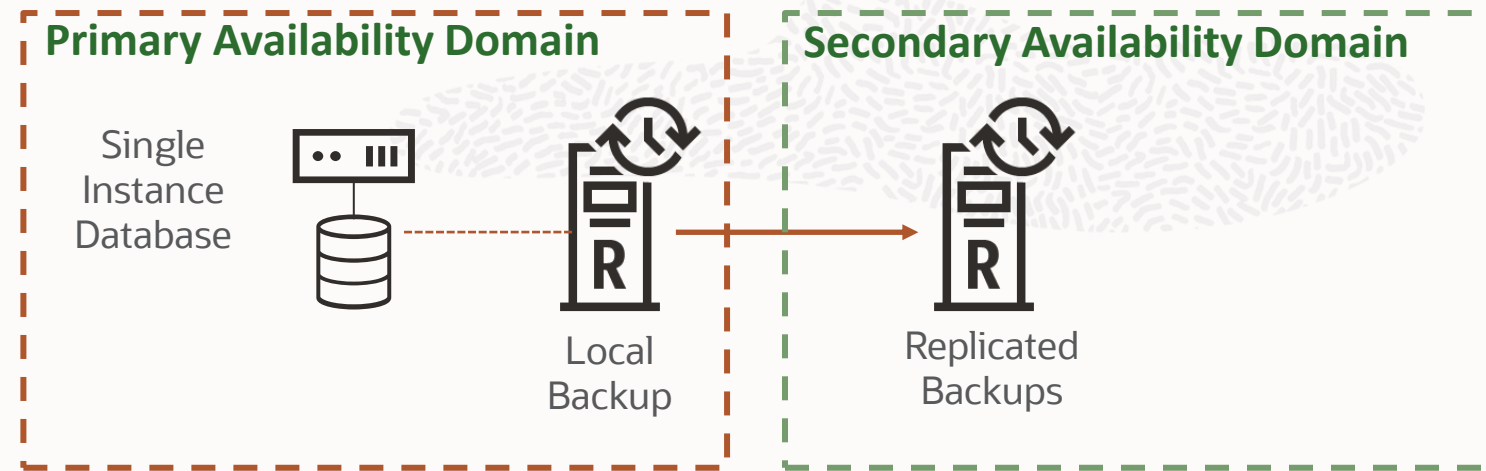
Bronze	Silver	Gold	Platinum
<b>Dev, test, prod</b>	<b>Prod/departmental</b>	<b>Business critical</b>	<b>Mission critical</b>
	<b>Bronze +</b>	<b>Silver +</b>	<b>Gold +</b>
Single instance DB	Database HA with RAC	DB replication with Active Data Guard	GoldenGate
Restartable	Application Continuity		Edition Based Redefinition
Backup/restore	Optional - Exadata		
Optional - ZDLRA 			



# BRONZE

**Dev, Test, Prod** - Single Instance or Multitenant Database with Backups

- Single Instance with Clusterware Restart
- Advanced backup/restore with RMAN
  - Optional ZDLRA with incremental forever and near zero RPO
- Storage redundancy and validation with ASM
- Multitenant Database/Resource Management with PDB features
- Online Maintenance
- Some corruption protection
- Flashback technologies



## Outage Matrix

Unplanned Outage	RTO / RPO Service Level Objectives (f1)
Recoverable node or instance failure	Minutes to hour (f2)
Disasters: corruptions and site failures	Hours to days. RPO since last backup or near zero with ZDLRA
Planned Maintenance	
Software/hardware updates	Minutes to hour (f2)
Major database upgrade	Minutes to hour

f1: RPO=0 unless explicitly specified  
 f2: Exadata systems has RAC but Bronze Exadata configuration with Single Instance database running with Oracle Clusterware has highest consolidation density to reduce costs



# SILVER

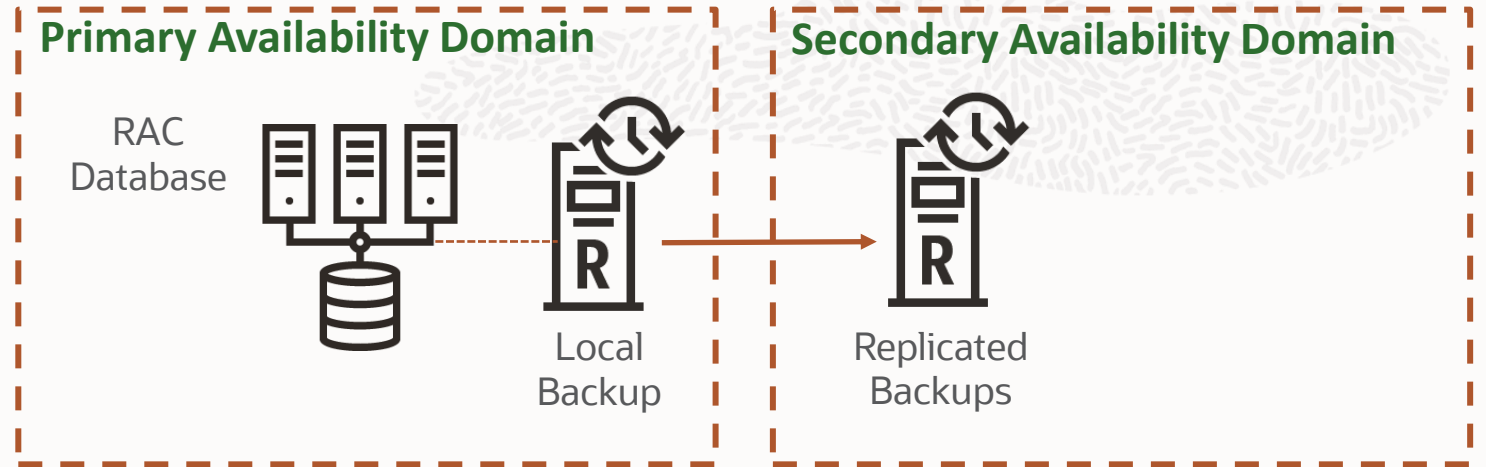
## Prod/Departmental

### Bronze +

- Real Application Clustering (RAC)
- Application Continuity
- Sharding (Optional)
  - Provides fault isolation, scalability and geographical distribution

## Checklist found in MAA OTN

<https://www.oracle.com/a/tech/docs/application-checklist-for-continuous-availability-for-maa.pdf>



## Outage Matrix

Unplanned Outage	RTO/RPO Service Level Objectives(f1)
Recoverable node or instance failure	<b>Single digit seconds</b> (f2)
Disasters: corruptions and site failures	Hours to days. RPO since last backup or near zero with ZDLRA
Planned Maintenance	
Software/Hardware updates	<b>Zero</b> (f2)
Major database upgrade	Minutes to hour

f1: RPO=0 unless explicitly specified

f2: To achieve zero downtime or lowest impact, apply application checklist best practices; Batch jobs should be deferred outside planned maintenance window.



# GOLD

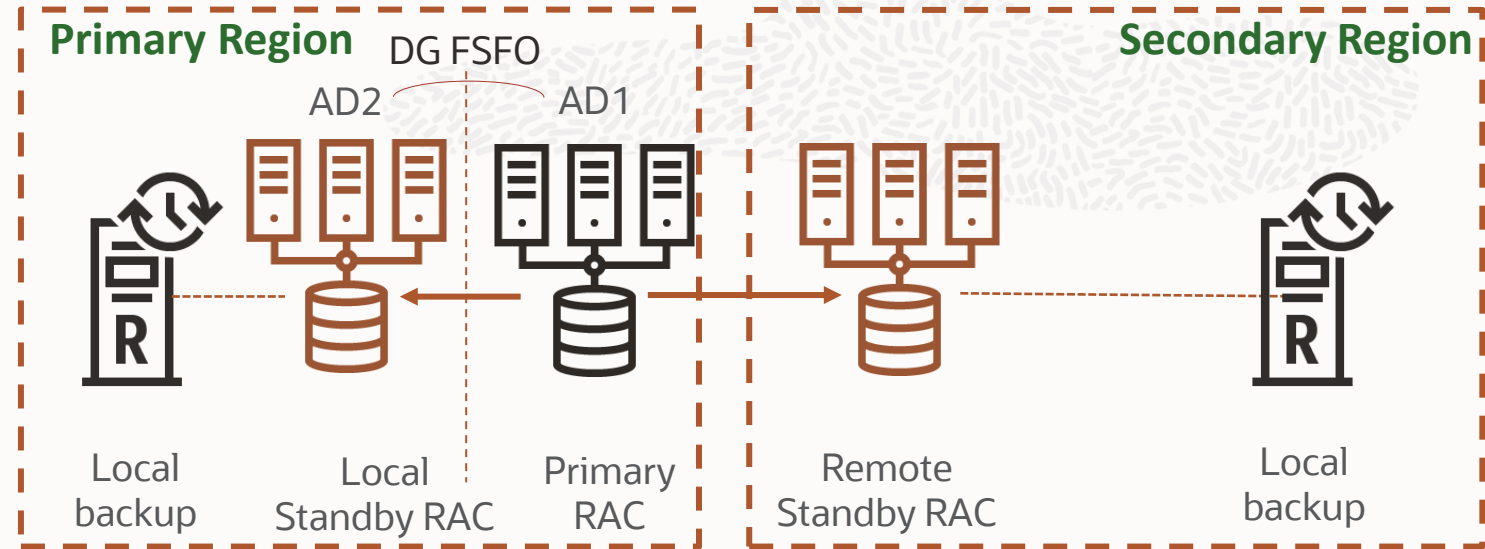
## Mission Critical

### Silver +

- Active Data Guard or Data Guard
- Comprehensive Data Protection

### MAA Architecture:

- At least one standby required across AD or region.
- Primary in one data center (or AD) replicated to a Standby in another data center
- Data Guard Fast-Start Failover (FSFO)
- Local backups on both primary and standby



## Outage Matrix

Unplanned Outage	RTO/RPO Service Level Objectives (f1)
Recoverable node or instance failure	Single digit seconds (f2)
Disasters: corruptions and site failures	<b>Seconds to 2 minutes. RPO zero or seconds</b>
Planned Maintenance	
Software/Hardware updates	Zero (f2)
Major database upgrade	<b>Less than 30 seconds</b>

f1: RPO=0 unless explicitly specified

f2: To achieve zero downtime or the lowest impact, apply application checklist best practices; Batch jobs should be deferred outside the planned maintenance window.



# PLATINUM

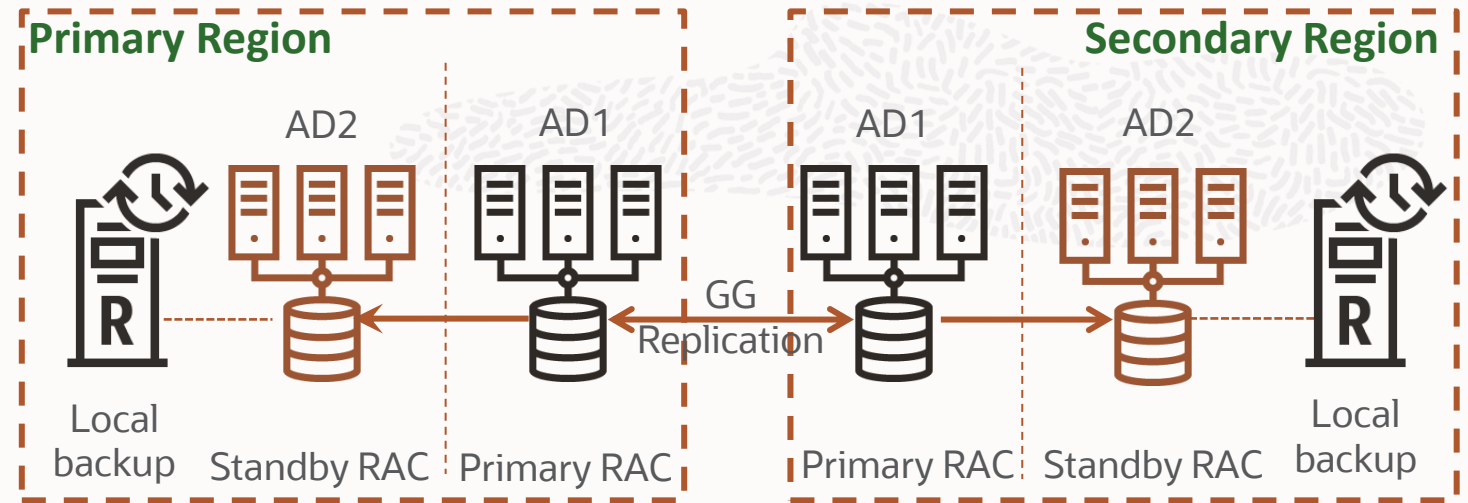
## Extreme Critical

### Gold +

- GoldenGate Active/Active Replication
- Edition-based Redefinition (Alternative)

### MAA Architecture:

- Each GoldenGate “primary” replica protected by Exadata, RAC and Active Data Guard
- Primary in one data center (or AD) replicated to another Primary in remote data center (or AD)
- Oracle GG or Edition-based Redefinition for zero downtime application upgrade
- Local backups on both sites
- Achieve zero downtime through custom failover to GG replica



## Outage Matrix

Unplanned Outage	RTO/RPO Service Level Objectives (f1)
Recoverable node or instance failure	<b>Zero or single-digit seconds (f2/f3)</b>
Disasters including corruptions and site failures	<b>Zero (f3)</b>
Planned Maintenance	
Most common software/hardware updates	Zero (f2)
Major database upgrade, <b>application upgrade</b>	<b>Zero (f3)</b>

f1: RPO=0 unless explicitly specified

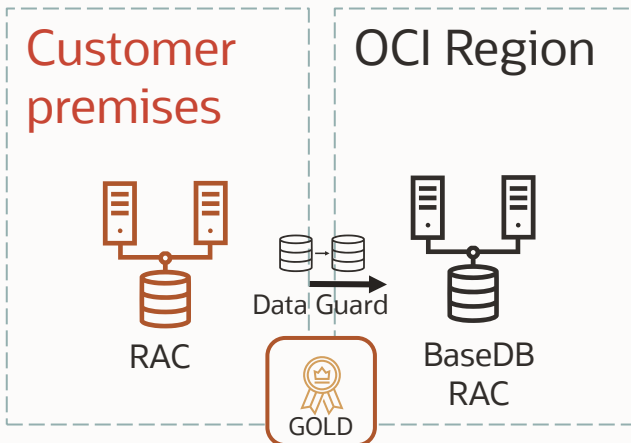
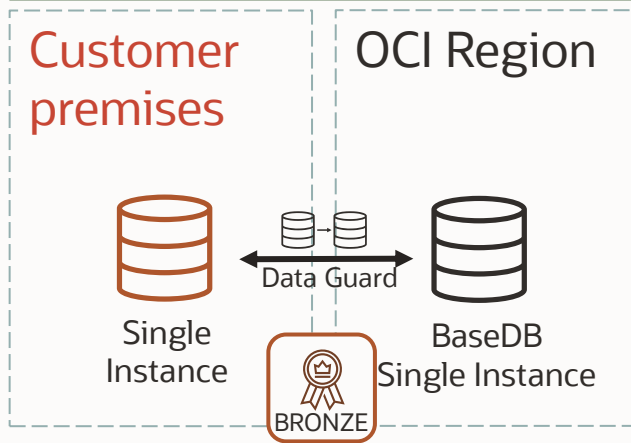
f2: To achieve zero downtime or lowest impact, apply application checklist best practices

f3: Application failover is custom or with Global Data Services

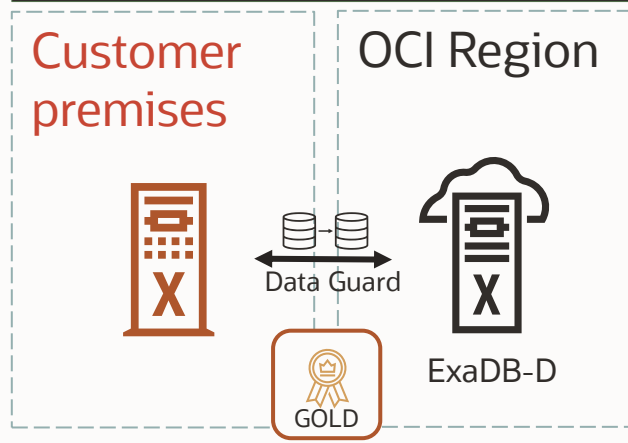


# Hybrid Cloud: recommended hybrid sources/destinations

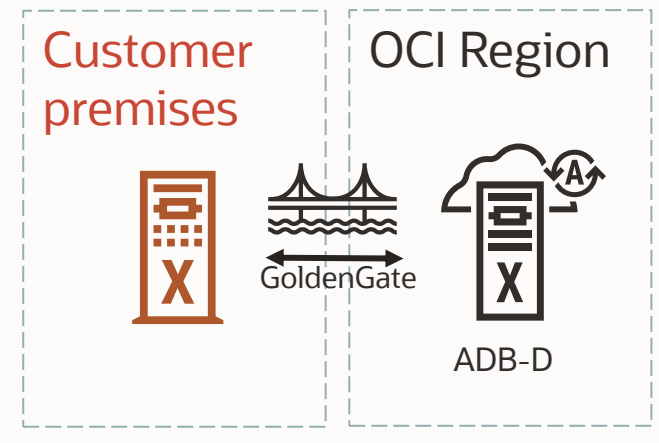
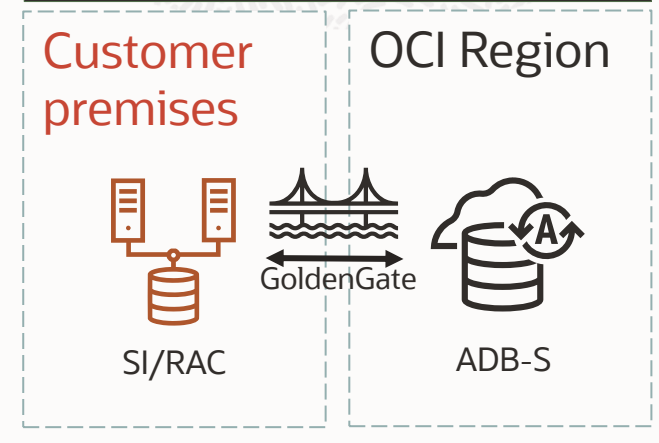
## To BaseDB



## To Exadata Cloud



## To Autonomous




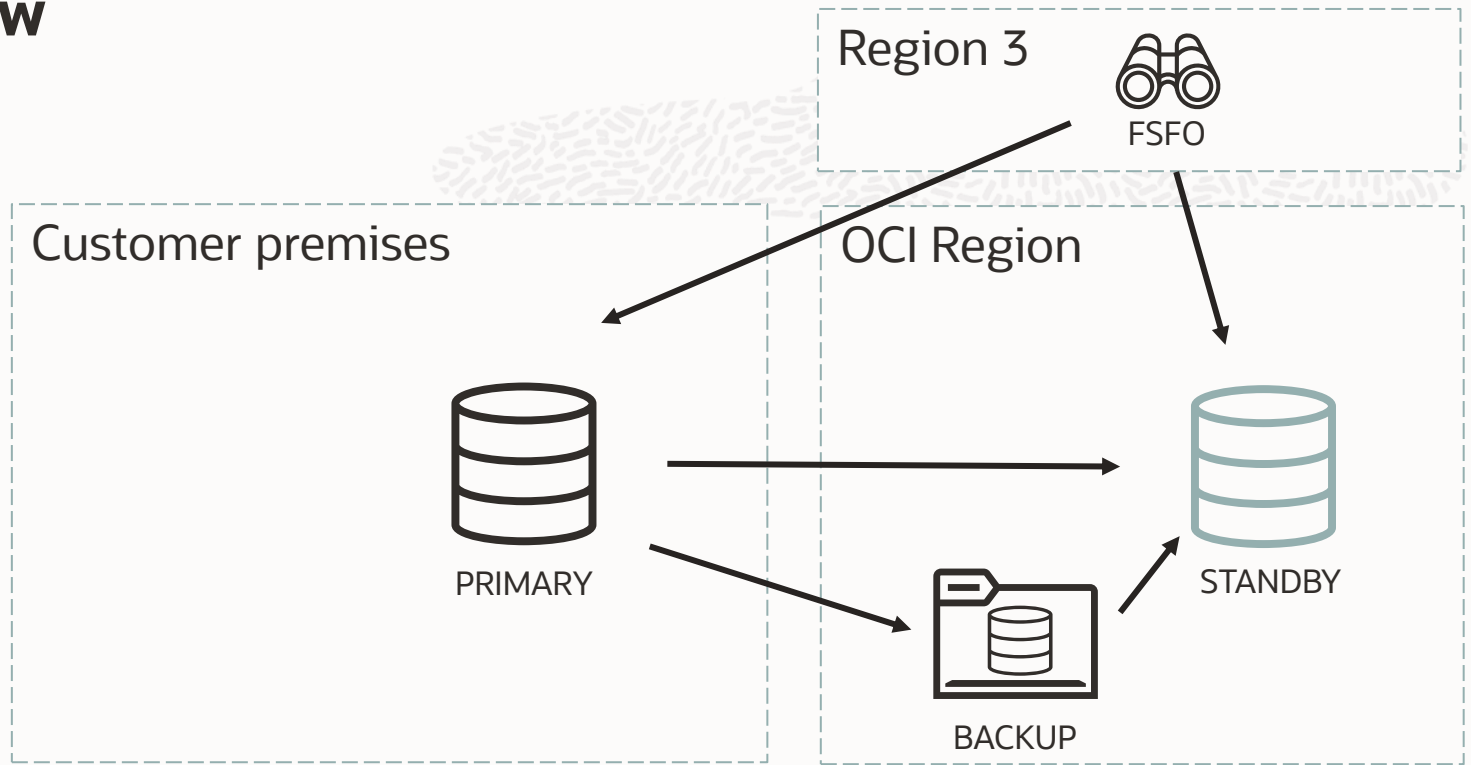
- All Hybrid configurations are achieved manually: no Control Plane automation
- On-premises non-Exadata to ExaDB-C@C/ExaDB-D is possible but beware of exclusive features













# Hybrid Data Guard: overview

AVAILABILITY / AUTOMATION (1)	
 RMAN	Backup to the cloud
 RAC	Customer-specific
 ACTIVE DATA GUARD	Instantiate & operate Data Guard configuration
 GOLDENGATE	Manual (capture & delivery)
MAA LEVEL	 SILVER  GOLD  PLATINUM
	Customer responsibility.

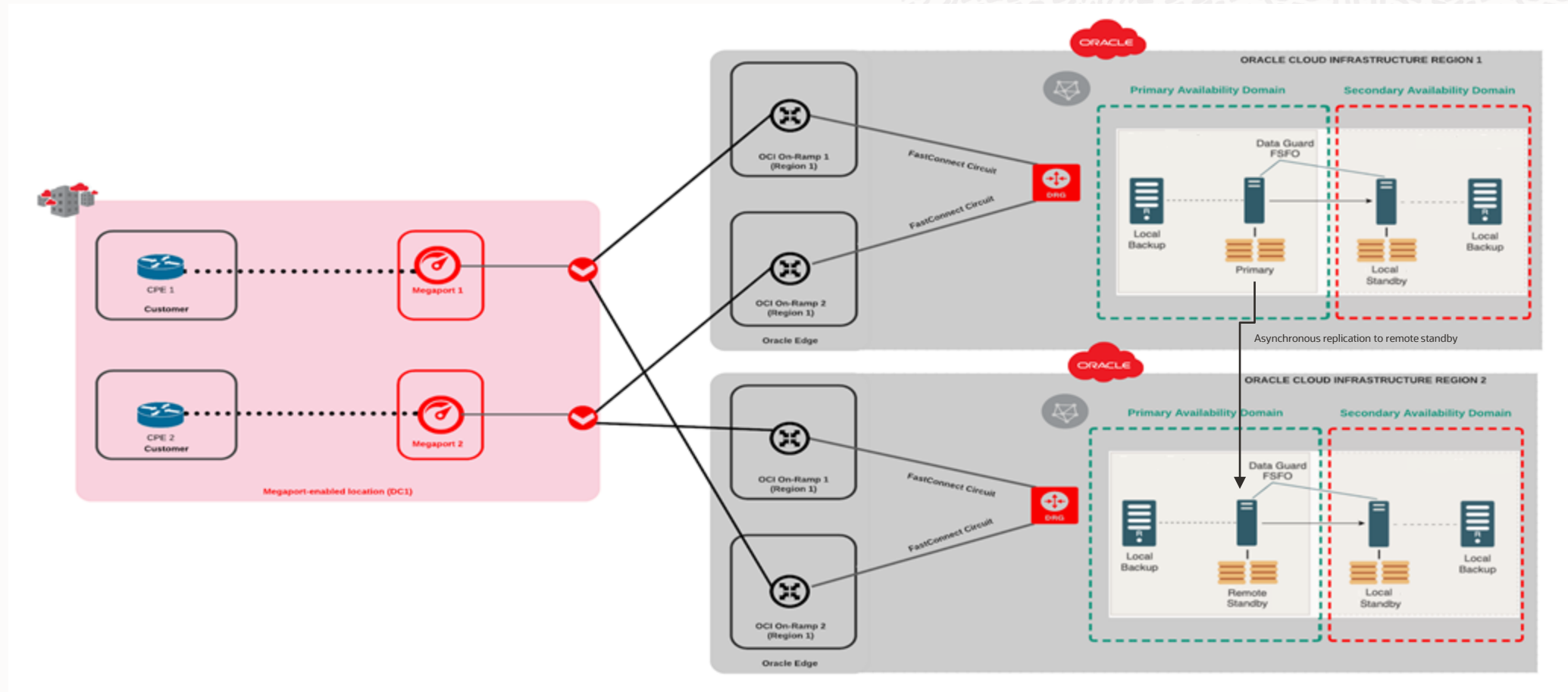


Gold Outage Matrix (2)		
	PLANNED MAINTENANCE	ZERO  ZERO
	RECOVERABLE FAILURE	ZERO  SECONDS
	UNRECOVERABLE FAILURE	ZERO  SECONDS
	UPGRADE	ZERO  SECONDS

(1) Customer responsibility  
 (2) Best case scenario (FSFO + SYNC or FAR SYNC)



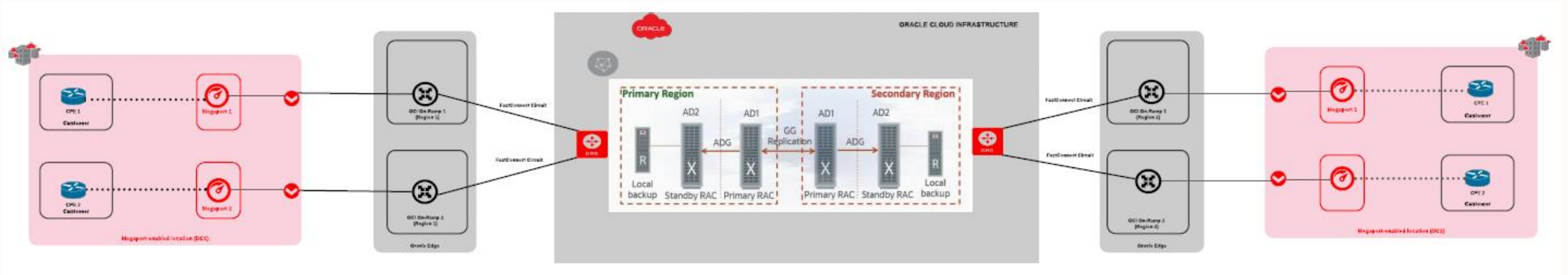
# Multicloud MAA Gold Tier Example



- All multicloud configurations are achieved manually: no Control Plane automation
- Azure Interconnect available in some regions



# Multicloud MAA Platinum Tier Example



- Oracle GoldenGate Hub in a high availability configuration would be manual in Oracle Cloud
- Azure Interconnect available in some regions
- All multicloud configurations are achieved manually: no Control Plane automation



# How does the MAA team ensure Oracle Database availability, performance and scalability?





# MAA & Chaos Engineering – Breaking things to ensure your peace of mind



***Chaos Engineering*** is the art form of experimenting (i.e. proactively breaking things) on a system in order to build confidence in a system's resilience to withstand turbulent events in production

*In today's digital age, this may include but is not limited to:*

- Network, server & storage failures
- Human errors & data corruption
- Data corruption
- Power failures or site failure (i.e. *Godzilla attack or hurricane*)
- Application, database & server software updates
- Data reorganization or changes
- Application changes and optimizations

# Summary



1

Oracle makes it simple to build Data Driven Apps by providing **Synergistic Data Technologies** for each modern Development Methodologies

2

One Converged Database for all data types and model engineered so they all work together enables **Cross Data Synergy**

3

One Converged Database **greatly simplifies development, operations and overall architecture including high availability, disaster recovery and security.**