Get Ready for an Autonomous Data-Driven Future

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Autonomous
Database

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Safe Harbor Statement

The following is intended to outline our general product direction. It is intended for information purposes only, and may not be incorporated into any contract. It is not a commitment to deliver any material, code, or functionality, and should not be relied upon in making purchasing decisions. The development, release, timing and pricing of any features or functionality described for Oracle's products may change and remains at the sole discretion of Oracle Corporation.

DATA – The World's Most Valuable Resource*

> "Computing hardware used to be a capital asset, while data wasn't thought of as an asset in the same way. Now, hardware is becoming a service people buy in real time and the lasting asset is the data."
>
> – Erik Brynjolfsson, Director, MIT Initiative on the Digital Economy

MIT INITIATIVE ON THE DIGITAL ECONOMY

*The Economist

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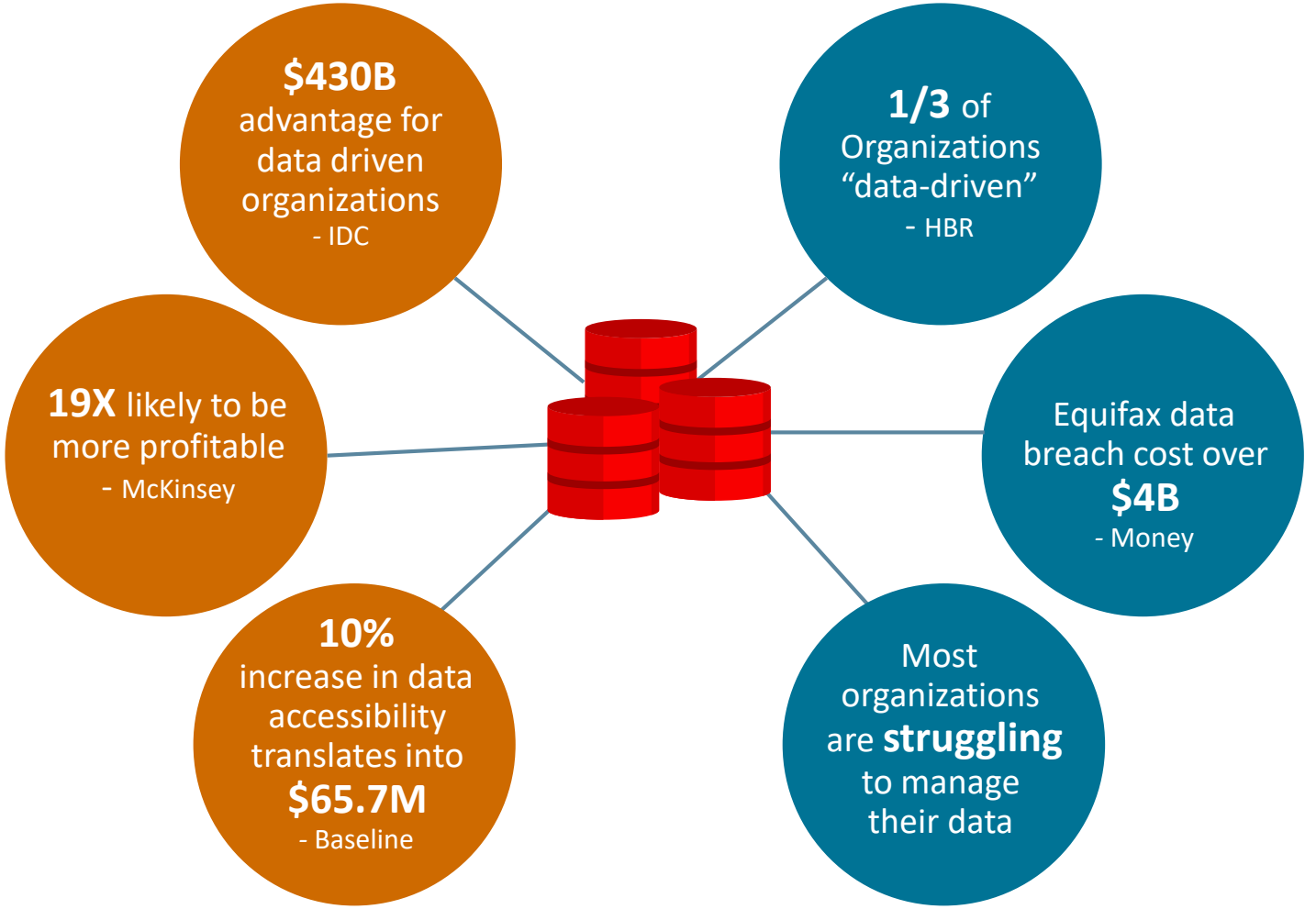
DATA – The World's Most Valuable Resource

THE OPPORTUNITY



THE CHALLENGES

Exponential Growth of Data

The Struggle to Manage the Data Deluge

Created By:
@LoriLewis
@OfficiallyChadd

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LOBs Are Seeking Business Insights to Drive Growth

75%
of time spent in analytics by 2020 vs 25% in 2015
– Accenture

FINANCE

Cut costs, improve security and better insights

375%
increase in analytics spending by marketers by 2020 vs 2017
– CMO survey

MARKETING

Improved customer acquisition, retention, and loyalty

4x
faster quota attainment by sales teams that use analytics
– Forbes

SALES

In-depth customer knowledge and personalization

70%
in the midst of major data projects for decision making
– Deloitte

HR

Improved recruiting, career development and success

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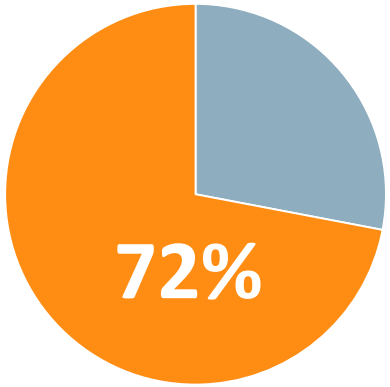
Additional Data Management Challenges

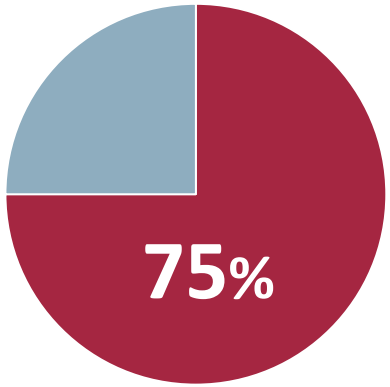
Maintenance



72% of IT Budget is spent on Generic Maintenance Tasks vs Innovation

- ComputerWorld

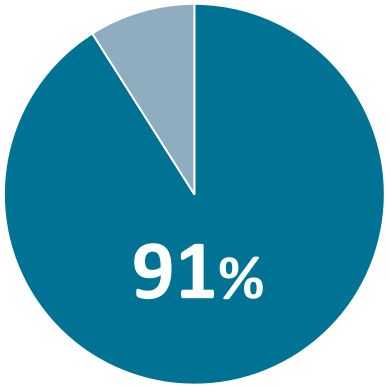
Cost and Complexity



¾ Cost of Database Management spent on labor

- IDC

Reliability



91% Experience Unplanned Data Center Outages

- Healthcare IT News

Database downtime costs **$7,900 / minute**

- DB Maestro

How to Solve the Equation? Enter AI & ML

61% of organizations most frequently picked Machine Learning / Artificial Intelligence as their company's **most significant data initiative**

IDC forecasts that spending on AI & ML will grow from $12B in 2017 to **$57.6B by 2021**

Data science and machine learning are the **fastest growing jobs** in the US

AI & ML lead to an autonomous future….

Sources: https://www.forbes.com/sites/louiscolumbus/2018/02/18/roundup-of-machine-learning-forecasts-and-market-estimates-2018/#60fd267a2225; https://www.infoworld.com/article/3259891/data-science/why-data-science-and-machine-learning-are-the-fastest-growing-jobs-in-the-us.html

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The Future Is Autonomous Database

> We are at the dawn of the intelligent, autonomous age and having a self-driving database is a natural progression... I feel that autonomous databases will become ubiquitous in the future."
>
> – Clark A. Kho , Senior Technology Architect, Accenture

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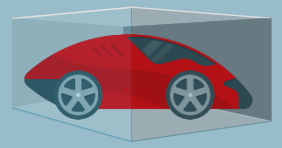
Oracle Autonomous Database

Self-Driving 

Reduces human labor

Self-Securing 

Protects itself from attacks

Self-Repairing 

Keeps business up and running

World's First Autonomous Database

A New Industry Category

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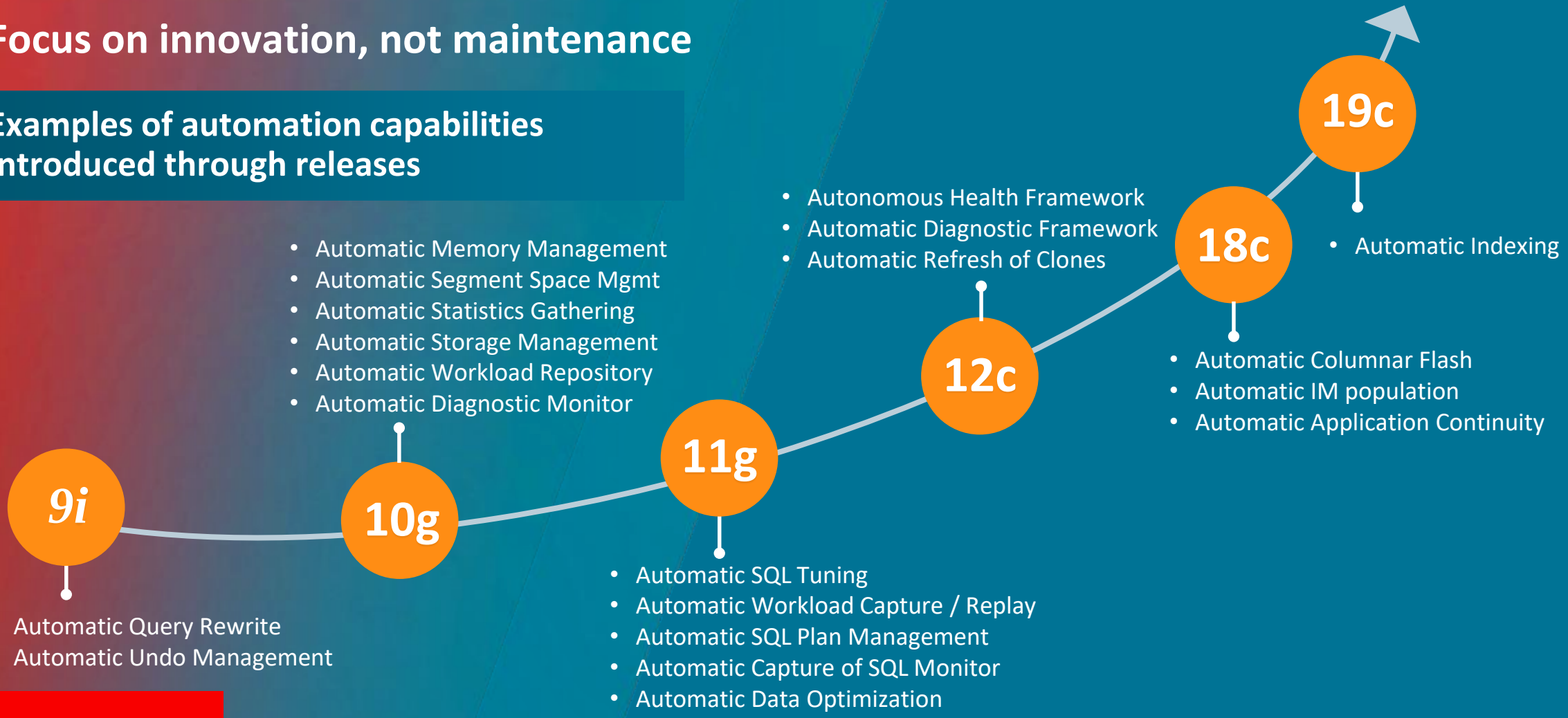
Journey to Autonomous Database

Focus on innovation, not maintenance

Examples of automation capabilities introduced through releases



Journey to Autonomous Database

Automating and optimizing database infrastructure

2008

- Smart Scan
- Infiniband Scale-Out

- Database Aware Flash Cache
- Storage Indexes
- Hybrid Columnar Data

- IO Priorities
- Data Mining Offload
- Offload Decryption

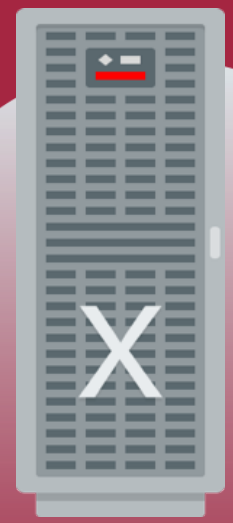
- Network Resource Mgmt
- Prioritized File Recovery

- Direct-to-wire Protocol
- JSON and XML Offload
- Instant Failure Detection

- In-Memory Columnar in Flash
- Smart Fusion Block Transfer

- Exadata Cloud Service

2019



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Oracle Autonomous Database | **Components**

Brings full automation to entire database lifecycle

Autonomous Database = **Complete Infrastructure Automation** + **Complete Database Automation** + **Automated Data Center Operations and Machine Learning**

World's First Fully Autonomous Database

Continuous Optimization – Enabled by Machine Learning

- **SQL Plans** are like driving directions
  - Should adapt as data volume (traffic) changes
- **Indexes** are like roads and bridges
  - Should adapt if nature of the workload evolves
- Changes in data volume and SQL workload are continuously captured
- Machine Learning algorithm processes changes to find new optimal plans and indexes*
  - Improved driving directions, roads, bridges

* Coming soon

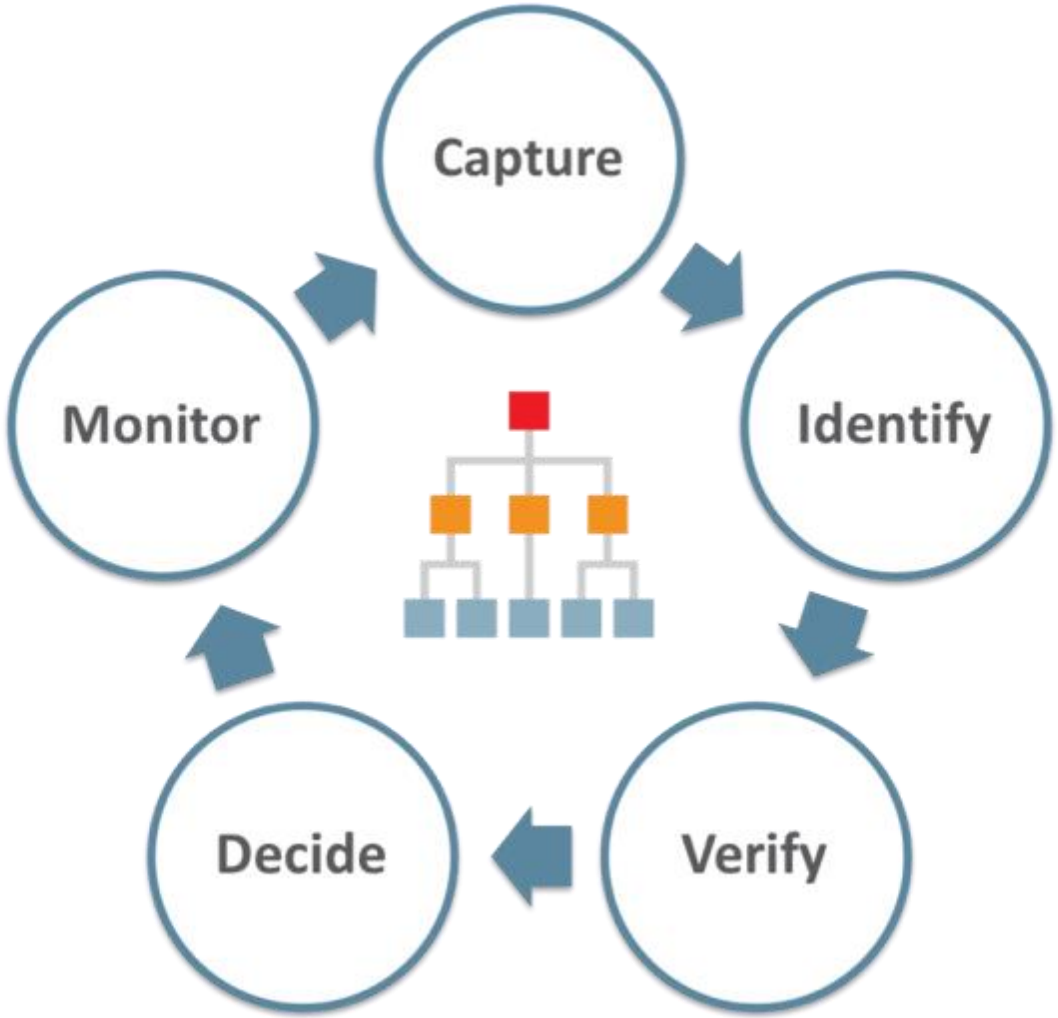
Machine Learning meets Mission Critical

- New approach **avoids performance regressions**
  - Even for difficult cases where new plan or index helps 99 SQL statements and hurts 1
- Changes are first tested in background
- Then the benefit is validated on first execute of every changed SQL
  - If performance regresses, then old SQL plan is used

More Details Tomorrow at 4:45pm in session TRN3980
Test Drive Automatic Index Creation in Oracle Autonomous Database Cloud

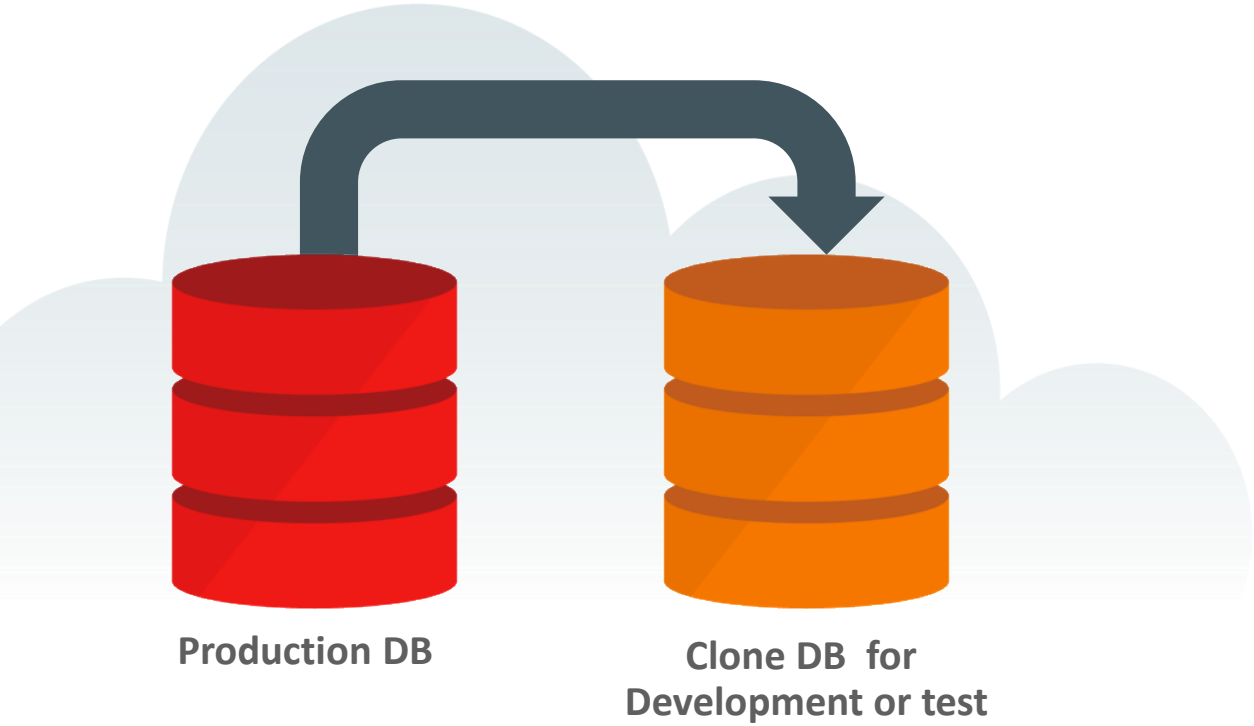
* Coming soon

Self-Driving | **Automatic Indexing**



- An expert system that implements indexes based on what a skilled performance engineer would do
- Reinforcement Learning allows it to learn from its own actions as all candidate indexes are validated before being implemented
- The entire process is fully automatic
- Transparency is equally important as sophisticated automation
- All tuning activities are auditable

Self-Driving | **Cloning**



Cloning creates a point-in-time copy of an ADB for testing, development, analytics, etc.

Two types of clone can be created:

- A full database clone
- A metadata clone (Schema but no data)

Easy and fast as user only has to decide:

1. Compartment for the clone
2. Name of the clone
3. CPU and storage
4. New ADMIN password

ML Worksheets and AWR data don't get cloned

Self-Securing | **Self Patching**

Automatic Patching of all components (on-demand for critical security issue)

- Firmware, OS, Hypervisor, Clusterware, Database

Patches applied in a rolling fashion across RAC nodes and Exadata storage servers

- Database is continuously available to application
- **Applications using Application Continuity best practices, run without interruption**

Patching is automatically scheduled

- Customer can adjust patching window within a time range on Dedicated deployments

Oracle Cloud patches thousands of systems in a day

- **Scale of patching has driven huge improvements in automation and reliability**

Self-Securing | **Separation of Duties**

- Security Managed by Oracle

- Network security and monitoring
- OS and platform security
- Database patches and upgrades
- Administrative separation of duties
- Data encryption by default

- Security Managed by the Customer

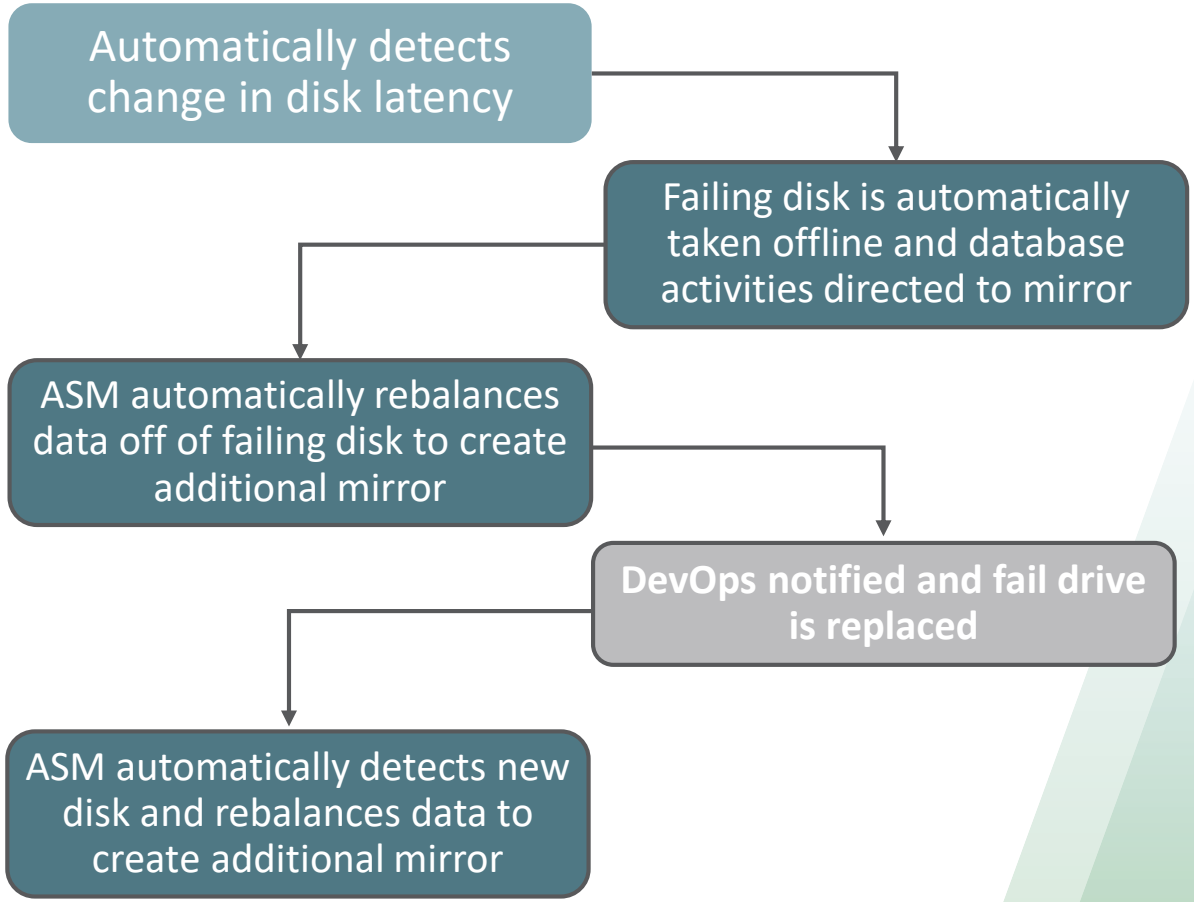
- Ongoing security assessments
- Users & Privileges
- Sensitive data discovery
- Data protection
- Activity auditing

But Remember, In the Cloud… Security Is a **Shared** Responsibility

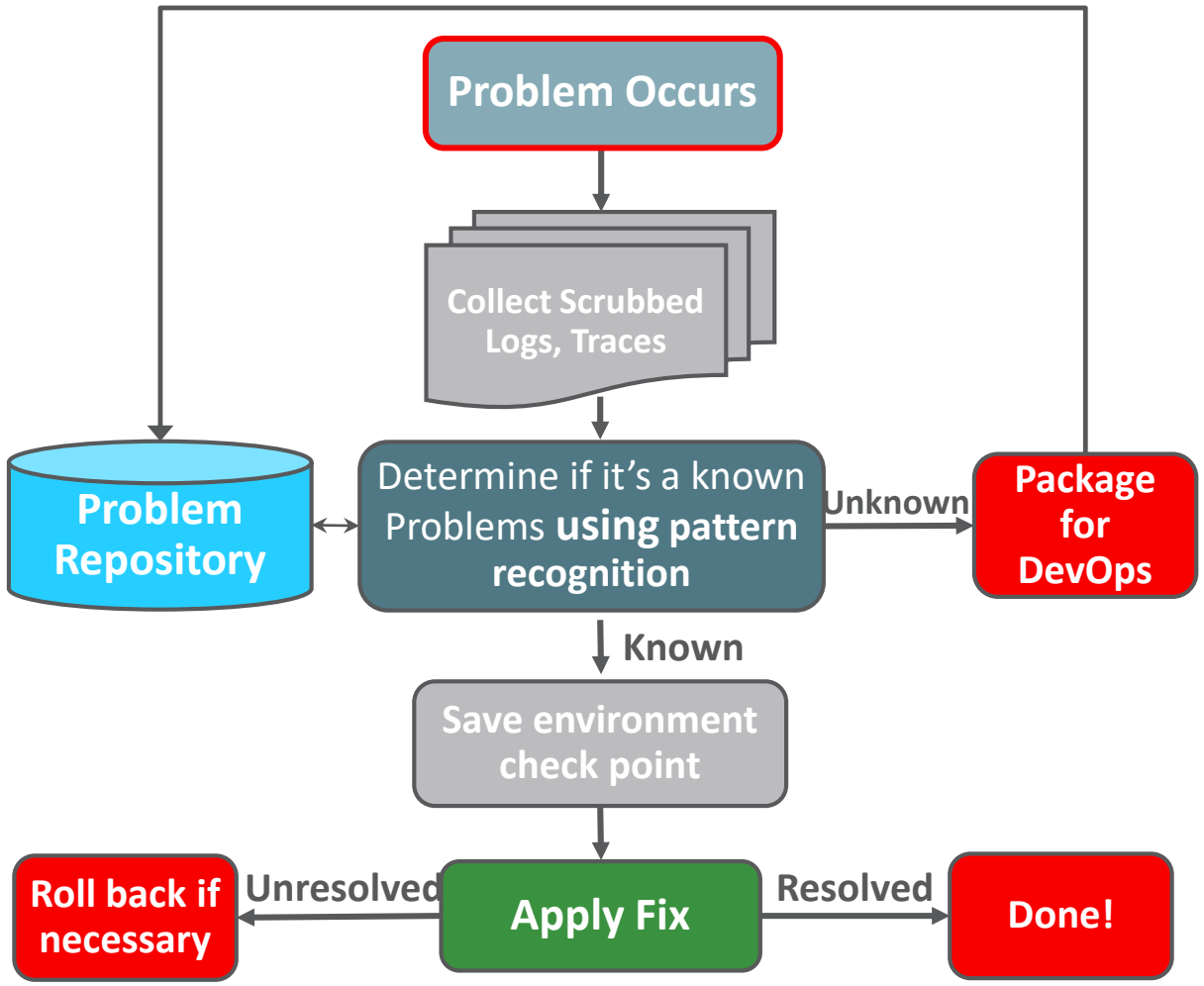
Self-Repairing | **Self-Healing Hardware**

- Database Infrastructure for Autonomous is provided by Exadata
- Exadata provides advanced predictive failure detection capabilities
  - Proactively detect hardware failure
  - Migrate customer off failing H/W
- Unique detection of server failures without a long timeout avoids system hangs
- Unique sub-second redirection of IOs around sick devices avoid database hangs

Example: Continuously monitors for sick devices



Self-Repairing | **Self-Healing Software**



- Automatically detect problems/issues:

1. Collect diagnostics info to establish an anomaly timeline or signature
2. Use Pattern Recognition to determine if it's a known problems

3. If known problem
   a. Explain what will be done to fix
   b. Save environment checkpoint
   c. Apply Fix and do root cause analysis
   d. Roll back fix if required
4. If a new problem
   a. Package up all diagnostic information
   b. Hand off to DevOps

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Using Machine Learning to Drive Autonomous

WORKLOAD OPTIMIZATIONS →	Automatically Adapts to Changing Workloads
SECURITY →	Protects Against External Malicious Attacks
MONITORING & DIAGNOSTICS →	Detects Anomalies and Fixes Known Issues

> “The big ticket item for 2018 & 2019 is the use of ML and AI in the DBMS allowing the DBMS to maintain itself – the DBMS becomes Self-Driving. The job of the DBA evolves to use their skills for tasks with greater business value.”
>
> – Donald Feinberg, Distinguished Analyst, Gartner

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Solutions for Varying Workload Needs

ORACLE AUTONOMOUS DATABASE

AUTONOMOUS DATA WAREHOUSE

All Analytic Workloads

Data Warehouse, Data Mart, Data Lakes

AUTONOMOUS TRANSACTION PROCESSING

Online TP & Mixed Workloads

Transactions, Mixed Workloads, Application Development

SELECT AN AUTONOMOUS DATABASE CLOUD SOLUTION THAT MEETS YOUR WORKLOAD NEEDS

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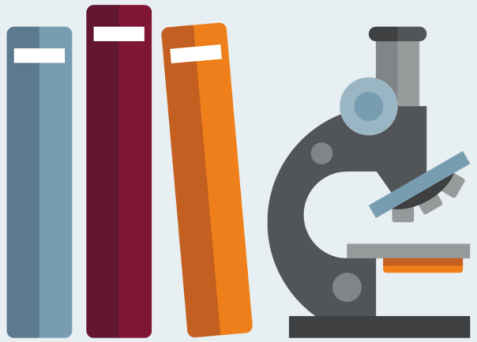
Autonomous Data Warehouse | **Key Use Cases**

Data Marts / Warehouses

Business Analytics

Sandboxes for Data Scientists



Machine Learning

Data Lakes

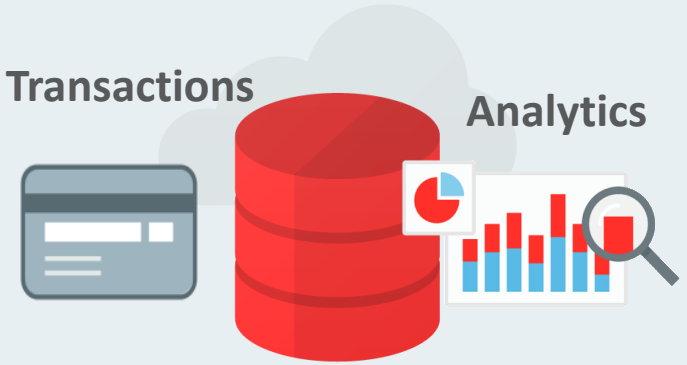
Query All Data

Autonomous Transaction Processing | **Key Use Cases**

Departmental or Mission Critical Applications[1]

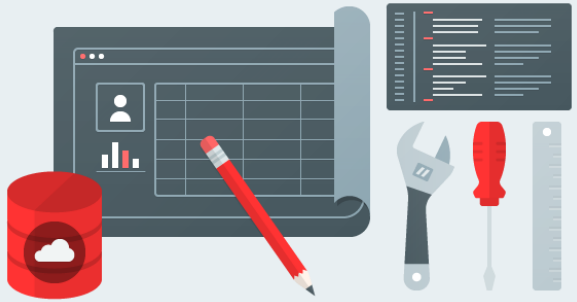
Support Business Operations

Mixed Workloads



Real-Time Analytics and Machine Learning

Application Development



Innovate Faster

[1] Coming in Calendar Year 2019

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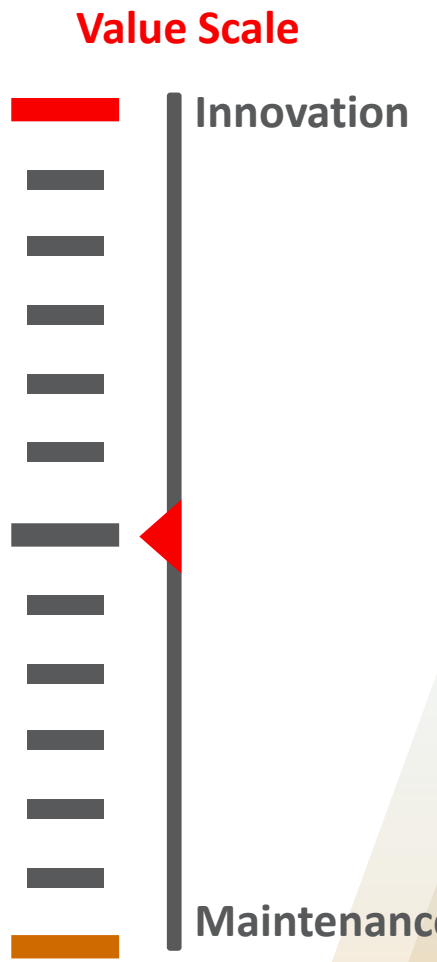
What Autonomous Database Means for **DBAs**

- Tasks Specific to the Business
  - Architecture, planning, data modeling
  - Data security and data lifecycle management
  - Application-related tuning
  - End-to-End service level management
- Tactical Operations
  - Configuration and tuning of systems, network, storage
  - Database provisioning, patching
  - Database backups, H/A, disaster recovery
  - Database optimization



What Autonomous Database Means for **DBAs**

Removes tactical drudgery, more time to innovate

- Tasks Specific to the Business
  - Architecture, planning, data modeling
  - Data security and data lifecycle management
  - Application-related tuning
  - End-to-End service level management

- ~~Tactical Operations~~
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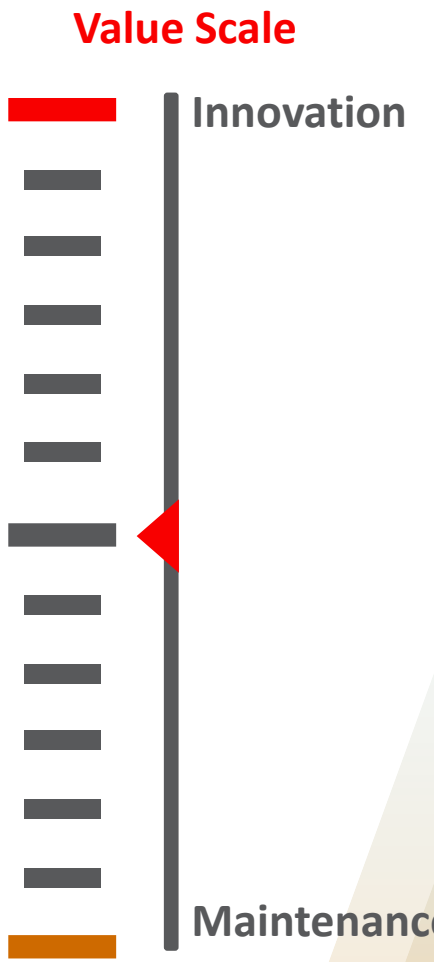

For more information:
oracle.com/autonomousdatabase

#thinkautonomous

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