



ORACLE



# Autonomous Database

## Level 100

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Oracle Cloud Infrastructure  
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## Safe harbor statement

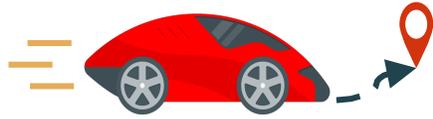
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# Objectives

After completing this lesson, you should be able to:

- Compare Autonomous Database (ADB) with DB System Cloud offerings in OCI
- Describe the features of Autonomous Data Warehouse Cloud - Serverless and Autonomous Data Warehouse Cloud - Dedicated, Autonomous Transaction Processing - Serverless and Autonomous Transaction Processing – Dedicated
- Describe how to deploy, use and manage ADB



## Autonomous Database

- All database operations fully automated
- User runs SQL, no access to OS or CDB
- Exadata Performance and Availability
- Customizable for DW or TP Workload

## Automated DB Services

- Database lifecycle automation provided
- User operates, has DBA and OS root access
- Runs older database versions
- ALL database features ( e.g. Java, etc )

### Serverless

Ultra-Simple &  
Elastic

### Dedicated

Customizable  
Private Cloud

### ExaCS

Scale, Performance,  
Availability

### DBCS

VM or bare metal,  
single server or RAC



## Autonomous Database

World's Best Fully Self-Driving Database

Oracle Builds and Operates Exadata Infrastructure and Databases  
User runs SQL, no Access to OS or Container DB



## Oracle Database Cloud Services

World's Best Automated Database Cloud

Oracle Builds and Operates Infrastructure

User Operates Databases Using Provided Lifecycle Automation  
User Has Full Control, including DBA and Root Access

## Exadata

World's Best Database Platform

Oracle Builds, Optimizes, and Automates Infrastructure  
All In-Database Automation Features Included



## Oracle Database

World's Best Database

Runs Anywhere

User Builds and Operates Databases and Infrastructure

## Use Cases

Cloud elasticity, Machine Learning, Self driving  
Instant Provisioning, Always online operation  
All workloads, JSON Documents,  
Graphs, and more

## Use cases

Availability, Flexible Version and Features,  
Small to Large DB deployment,  
Single Instance or RAC, Automated Backup,  
Patching, Customer controls

## Use Cases

Private/Public Cloud on-premise, Consolidation,  
Highest Performance, Scalability for Mission  
Critical Workload

## Use Cases

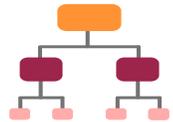
Small to Big Database transactional need  
as well DWH needs, Customer Data Center,  
DIY model

# Autonomous Optimizations - Specialized by Workload

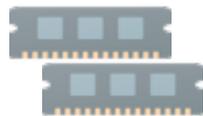
## Autonomous Data Warehouse



Columnar Format



Creates Data Summaries



Memory Speeds Joins, Aggs



Statistics updated in real-time while preventing plan regressions

## Autonomous Transaction Processing

Row Format

Creates Indexes

Memory for Caching to Avoid IO

# Autonomous Database - Choice of Cloud Deployment



## DBaaS VM or Bare Metal

## Exadata Cloud Service or Cloud @ Customer

## Autonomous Serverless

## Autonomous Dedicated

	DBaaS VM or Bare Metal	Exadata Cloud Service or Cloud @ Customer	Autonomous Serverless	Autonomous Dedicated
<b>Management</b>	Customer	Customer	Oracle	Oracle
<b>Private Network</b>	Yes	Yes	No	Yes
<b>Single/Multi Tenant</b>	Single/Multi	Single/Multi	Single	Single/Multi
<b>Software Updates</b>	Customer Initiated	Customer Initiated	Automatic	Customer Policy Control
<b>Private Cloud</b>	No	Yes	No	Yes
<b>Offers Availability SLA</b>	No	99.95%	SLO	SLO
<b>Database Versions</b>	11g,12c,18c,19c	11g,12c,18c,19c	18c	19c
<b>Disaster Recovery</b>	Yes Across ADs & Regions	Yes Across ADs & Regions	No	No
<b>Hybrid DR</b>	Yes	Yes	No	No
<b>Consolidation</b>	Yes	Yes	No	Yes

# Autonomous Database Cloud Service – Deployment Options

Oracle Autonomous Database can be deployed in 2 ways – dedicated and serverless.

Dedicated deployment is a deployment choice that enables you to provision autonomous databases into their own dedicated Exadata cloud infrastructure, instead of a shared infrastructure with other tenants.

With serverless deployment, the simplest configuration, you share the resources of an Exadata cloud infrastructure. You can quickly get started with no minimum commitment, enjoying quick database provisioning and independent scalability of compute and storage.

Both deployment options are available for Autonomous Transaction Processing and Autonomous Data Warehouse.

# Autonomous Database - Serverless

Autonomous Data Warehouse & Autonomous Transaction Processing

# Autonomous Database - Fully-managed

Oracle automates end-to-end management of the autonomous database

- Provisioning new databases
- Growing/shrinking storage and/or compute
- Patching and upgrades
- Backup and recovery

Full lifecycle managed using the service console

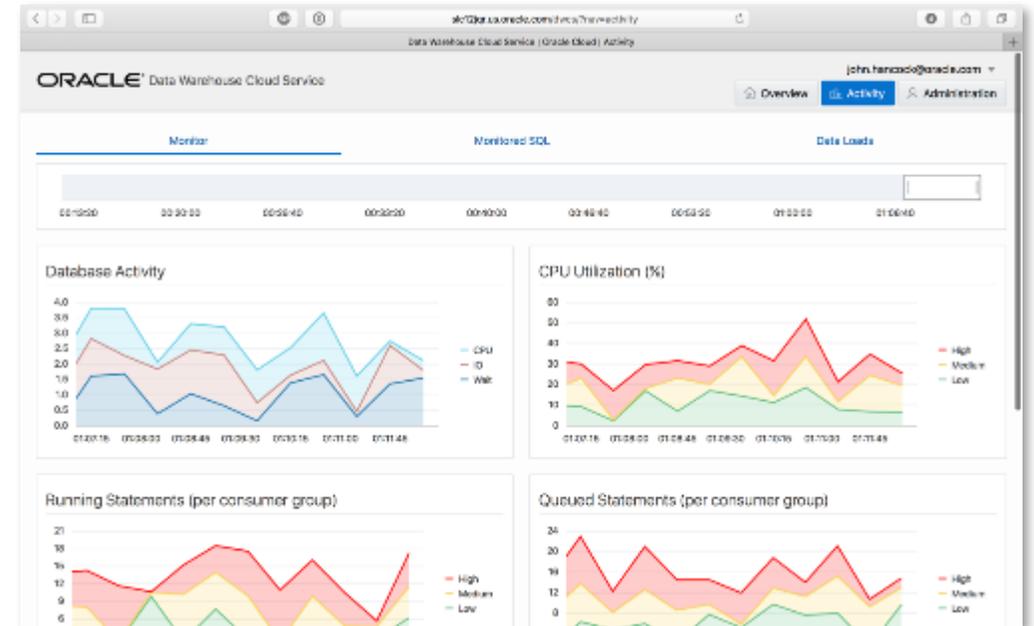
- Alternatively, can be managed via command-line interface or REST API

The screenshot displays the Oracle Cloud console for Autonomous Databases. The top navigation bar shows 'ORACLE Cloud' and a search bar. The main content area is titled 'Autonomous Databases in Sandbox1 Compartment'. On the left, there is a sidebar with navigation options: 'Autonomous Database', 'Autonomous Container Database', and 'Autonomous Exadata Infrastructure'. Below this, there are filters for 'List Scope', 'COMMITMENT' (set to 'Sandbox1'), 'Hiters', 'WORKLOAD TYPE' (set to 'Data Warehouse'), and 'STATE' (set to 'Any state'). The main area features a 'Create Autonomous Database' button and a table with columns: 'Name', 'Database Name', 'State', 'Dedicated Infrastructure', 'CPU Core Count', 'Storage (TB)', 'Workload Type', and 'Created'. The table currently shows 'No items'. At the bottom right of the table area, it says 'Displaying 0 Autonomous Databases < Page 1 >'.

# Automated Tuning in Autonomous Database

“Load and go”

- Define tables, load data, run queries
  - No tuning required
  - No special database expertise required
  - No need to worry about tablespaces, partitioning, compression, in-memory, indexes, parallel execution
- Fast performance out of the box with zero tuning
- Simple web-based monitoring console
- Built-in resource-management plans



# Autonomous Database – Fully-elastic

Size the database to the exact compute and storage required

- Not constrained by fixed building blocks, no predefined shapes

Scale the database on demand

- Independently scale compute or storage
- Resizing occurs instantly, fully online

Shut off idle compute to save money

- Restart instantly

Auto scaling:

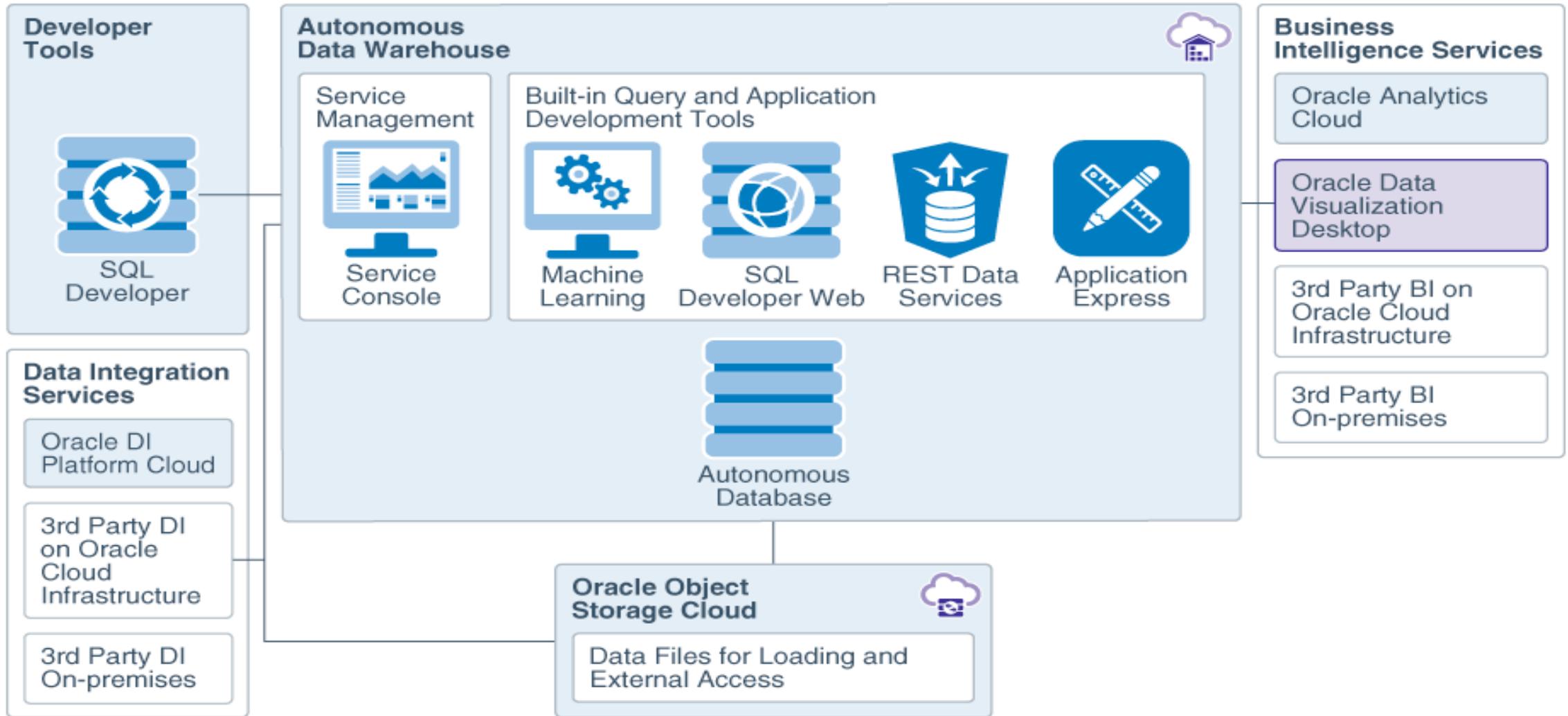
- Enable auto scaling to allow Autonomous Database to use more CPU and IO resources automatically when the workload requires it.

# Full Support of Database Ecosystem

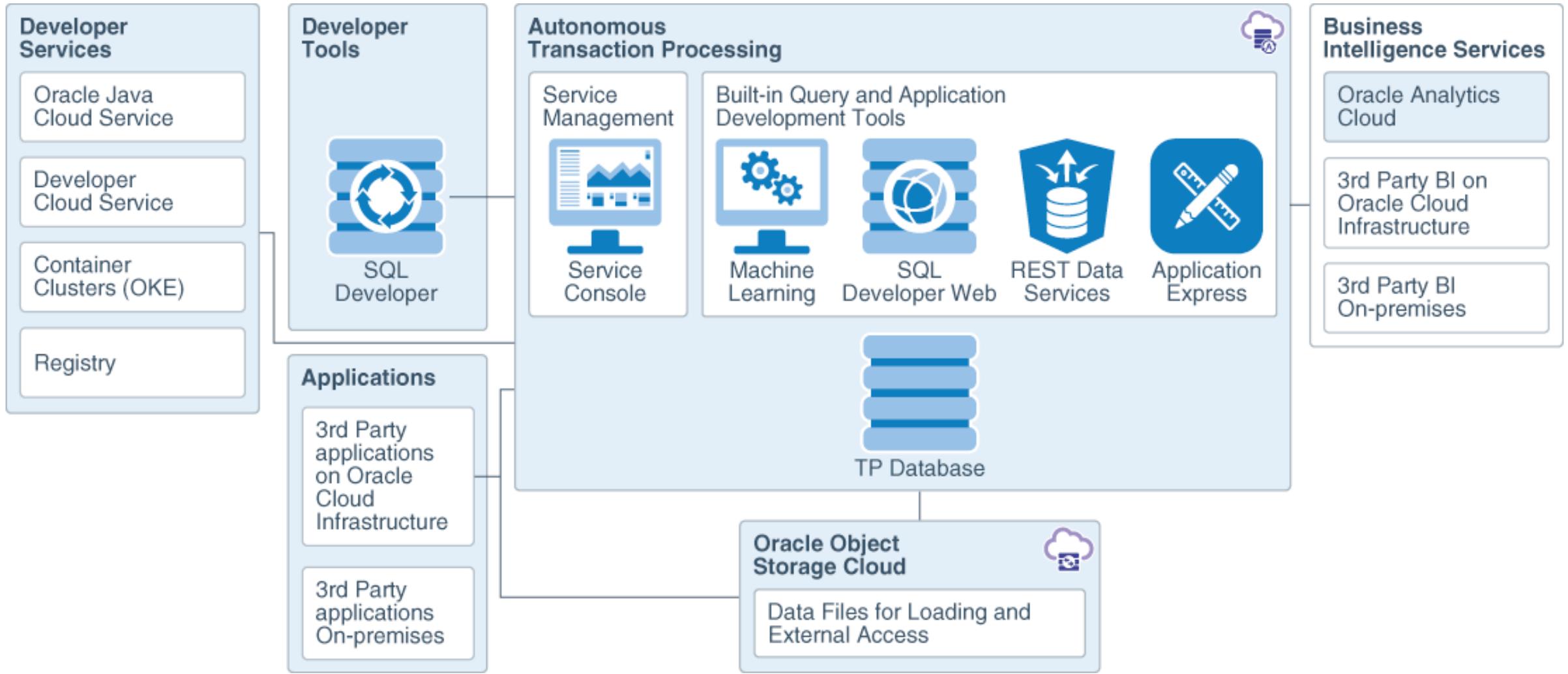
Autonomous Database service supports :

- Existing tools, running on-premises or in the cloud
  - Third-party BI tools
  - Third-party data-integration tools
  - Oracle BI and data-integration tools: BIEE, ODI, etc.
- Oracle cloud services: Analytics Cloud Service, GoldenGate Cloud Service, Integration Cloud Service, and others
- Connectivity via SQL\*Net, JDBC, ODBC

# Autonomous Data Warehouse: Architecture



# Autonomous Transaction Processing: Architecture



# Getting Started with Autonomous Database

Provisioning an ADB database requires only answers to 7 simple questions:

Database name?

Which data center (region)?

How many CPU cores?

How much storage capacity (in TBs)?

Admin password?

License Type?

Enable Auto scaling?

New service created in a few minutes (regardless of size)

Database is open and ready for connections

Create Autonomous Database

Provide basic information for the Autonomous Database

Choose a compartment  
Sandbook1

Display name  
DB 201607031051

Database name  
DB201607031051

Choose a workload type

Data Warehouse  
Configures the database for a decision support or data warehouse workload, with a bias towards large data scanning operations.

Transaction Processing  
Configures the database for a transactional workload, with a bias towards high volumes of random data access.

Configure the database

CPU core count  
1

Storage (TB)  
1

Auto scaling

Create administrator credentials

Username: ADMIN

Password

Confirm password

Choose a license type

Bring Your Own License  
My organization already owns Oracle database software licenses. Bring my existing database software licenses to the database cloud service.

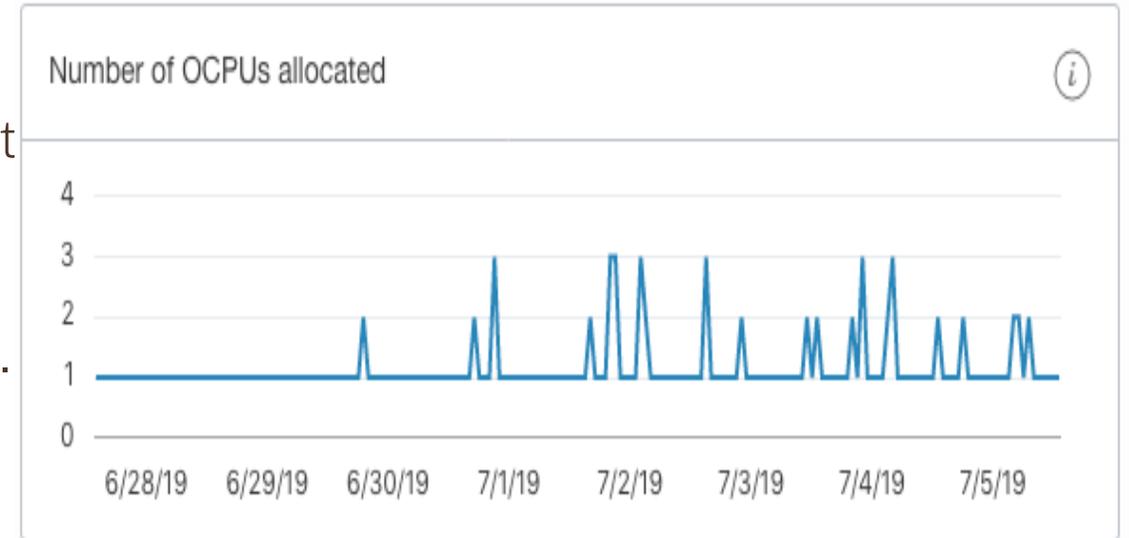
License Included  
Subscribe to new database software licenses and the Database Cloud Service.

Show Advanced Options

Create Autonomous Database

# Auto Scaling Autonomous Database

- Auto scaling allows Autonomous Database to automatically increase the number of CPU cores by up to three times the assigned CPU core count value, depending on demand for processing.
- The auto scaling feature reduces the number of CPU cores when additional cores are not needed.
- You can enable or disable auto scaling at any time.
- For billing purposes, the database service determines the average number of CPUs used per hour.

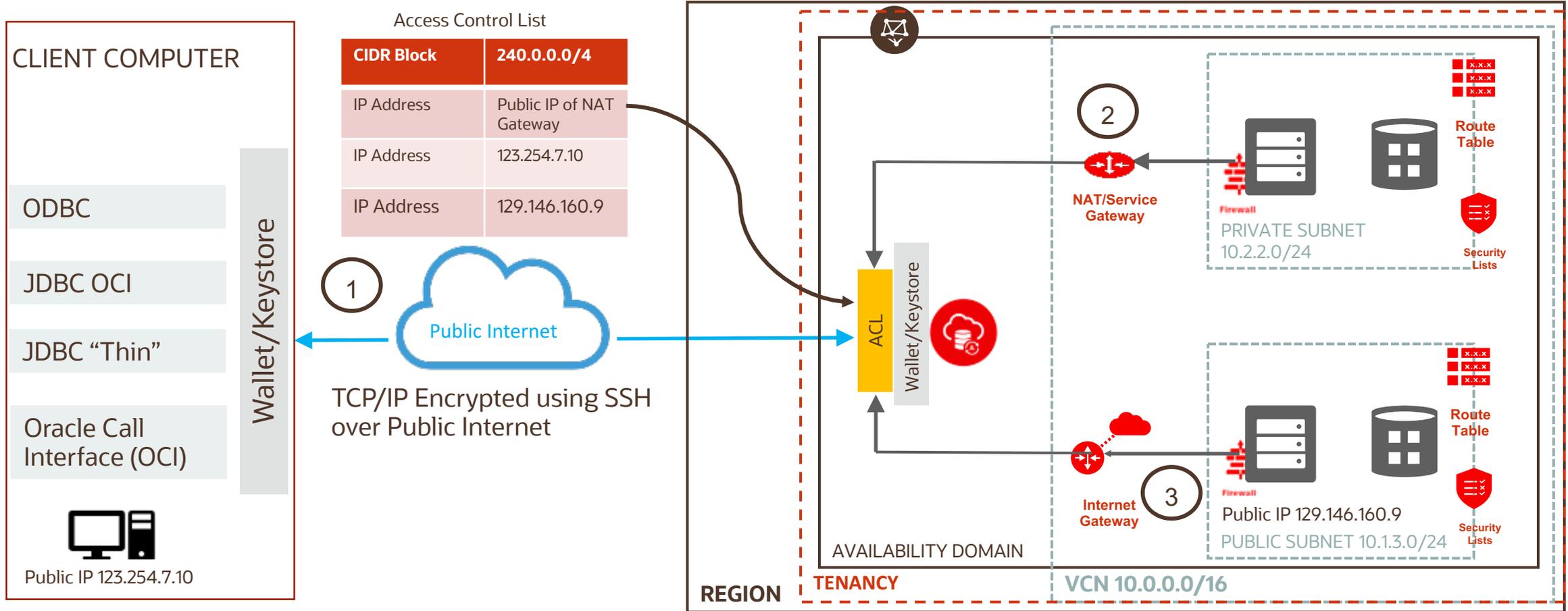


This picture shows how ADW service automatically scales OCPUs up when there is a demand for more computing power and then scales it down once the demand goes down.

# Securing Autonomous Database (ADB)

- Stores all data in encrypted format in the Oracle Database. Only authenticated users and applications can access the data when they connect to the database.
- Database clients use SSL/TLS 1.2 encrypted and mutually authenticated connections. This ensures that there is no unauthorized access to the ADB Cloud and that communications between the client and server are fully encrypted and cannot be intercepted or altered.
- Certificate based authentication uses an encrypted key stored in a wallet on both the client (where the application is running) and the server (where your database service on the ADB Cloud is running). The key on the client must match the key on the server to make a connection. A wallet contains a collection of files, including the key and other information needed to connect to your database service in the ADB Cloud.
- You can specify IP addresses (or CIDR block) allowed to access the ADB using the access control list. This access control list will block all IP addresses that are not in the list from accessing the database.

# Connecting to the Autonomous Database



- 1 Connecting to Autonomous Database Warehouse (ADW) or Autonomous Transaction Processing (ATP) from Public Internet
- 2 Connecting to ADW or ATP (via NAT or Service Gateway) from a server running on a private subnet in OCI (in the same tenancy)
- 3 Connecting to ADW or ATP from a server running on a public subnet in OCI (in the same tenancy)

# Troubleshooting connectivity issues

- Ensure that the Access Control List for the Autonomous Database (ADB) has the necessary entries for CIDR Block ranges and IP addresses, as your use case dictates.
- When connecting to ADB from a client computer behind a firewall, the firewall must permit the use of the port specified in the database connection when connecting to the servers in the connection. The default port number for Autonomous Data Warehouse is 1522 (find the port number in the connection string from the tnsnames.ora file in your credentials ZIP file). Your firewall must allow access to servers within the .oraclecloud.com domain using (TCP) port 1522.
- When connecting to ADB from a server running on a private subnet (on the same OCI tenancy as the ADB), ensure that you have a service gateway or NAT gateway attached to the VCN. The route table for the subnet needs to have the appropriate routing rules for the service gateway or NAT gateway. The security lists for the subnet will need to have the right egress rules.
- For connections originating from a server running on a public subnet (on the same OCI tenancy as the ADB), ensure that route table and security lists are appropriately configured.

# Scaling Your Database

Scale your database on demand without tedious manual steps

- Independently scale compute or storage
- Resizing occurs instantly, fully online
- Memory, IO bandwidth, concurrency scales linearly with CPU
- Close your database to save money when not used
- Restart instantly

# Monitoring

- **Service Console based monitoring**
  - Simplified monitoring using the web-based service console.
  - Historical and real-time database and CPU utilization monitoring.
  - Real Time SQL Monitoring to monitor running and past SQL statements.
  - CPU allocation chart to view number of CPUs utilized by the service.
- **Performance Hub based monitoring**
  - Natively integrated in the OCI console and available via a single click from the ADB detail page
  - Active Session History (ASH) analytics
  - Real Time SQL monitoring

# Autonomous Database (ADB) Cloud – Backup and recovery

- Autonomous Database Cloud automatically backs up your database for you. The retention period for backups is 60 days. You can restore and recover your database to any point-in-time in this retention period.
- Autonomous Database Cloud automatic backups provide weekly full backups and daily incremental backups.
- Manual backups for your ADB database is not needed.
- But, you can do manual backups using the cloud console if you want to take backups before any major changes, for example before ETL processing, to make restore and recovery faster. The manual backups are put in your Cloud Object Storage bucket. When you initiate a point-in-time recovery Autonomous Database Cloud decides which backup to use for faster recovery.
- You can initiate recovery for your Autonomous Database using the cloud console. Autonomous Database Cloud automatically restores and recovers your database to the point-in-time you specify.
- Network Access Control Lists (ACL)s are stored in the database with other database metadata. If the database is restored to a point in time the network ACLs are reverted back to the list as of that point in time.

# Autonomous Database Cloud – Cloning

- Autonomous Database provides cloning where you can choose to clone either the full database or only the database metadata.
- **Full Clone:** creates a new database with the source database's data and metadata.
- **Metadata Clone:** creates a new database with the source database's metadata without the data.
- When creating a **Full Clone** database, the minimum storage that you can specify is the source database's actual used space rounded to the next TB.
- You can only clone an Autonomous Database instance to the same tenancy and the same region as the source database.
- During the provisioning for either a Full Clone or a Metadata Clone, the optimizer statistics are copied from the source database to the cloned database.
- The following applies for optimizer statistics for tables in a cloned database:
  - Full Clone: loads into tables behave the same as loading into a table with statistics already in place.
  - Metadata Clone: the first load into a table after the clone clears the statistics for that table and updates the statistics with the new load.

# Autonomous Data Warehouse Cloud – Cloning screenshots

## Create Autonomous Database Clone

### Choose Clone Type

#### Full clone

Creates a new database with source database's data and metadata.

#### Metadata clone

Creates a new database that includes all source database schema metadata, but not the source database data.

### Provide basic information for the Autonomous Database

#### Create In Compartment

Sandbox1

ocw.ahw.ahw.com/ocw/Sandbox1

#### Origin Database Name PSID ONLY

ADW Test DB

#### Display Name

Clone of ADW Test DB

#### Database Name

DB201907081421

The name must contain only letters and numbers, starting with a letter. 14 characters max.

### Configure the database

#### CPU core count

1

The number of CPU cores to enable. Available cores are subject to your tenancy's service limits.

#### Storage (TB)

1

The amount of storage to allocate.

#### Auto scaling

Allows system to run up to three times the provisioned number of cores as the workload increases. [Learn more](#)

### Create administrator credentials (?)

#### Username READ-ONLY

ADMIN

#### Password

#### Confirm password

### Choose a license type

#### Bring Your Own Licence

My organization already owns Oracle database software licenses. Bring my existing database software licenses to the database cloud service [details](#).

#### License Included

Subscribe to new database software licenses and the Database cloud service.

[Show Advanced Options](#)

Create Autonomous Database Clone

# Pre-defined Services for Autonomous Data Warehouse

3 pre-defined database services identifiable as high, medium and low

- Choice of performance and concurrency for ADW

## HIGH

- Highest resources, lowest concurrency
- Queries run in parallel

## MEDIUM

- Less resources, higher concurrency
- Queries run in parallel

## LOW

- Least resources, highest concurrency
- Queries run serially

Example for a database with 16 OCPUs

	<b>No of concurrent queries</b>	<b>Max idle time</b>	<b>CPU shares</b>
HIGH	3	5 mins	4
MEDIUM	20	5 mins	2
LOW	32	1 hour	1

\*When connecting for replication purposes, use the LOW database service name. For example, use this service with Oracle GoldenGate connections.

# Pre-defined Services for Autonomous Transaction Processing

- Five pre-defined database services controlling priority and parallelism
- Different services defined for Transactions and Reporting/Batch

SERVICES NAME	RESOURCE MANAGEMENT PLAN SHARES	PARALELLISM
<b>HIGH</b>	4	Operations run in parallel and are subject to queuing
<b>MEDIUM</b>	2	Operations run in parallel and are subject to queuing
<b>LOW</b>	1	None
<b>TPURGENT</b>	12	Manual
<b>TP</b>	8	None

■ For Transaction Processing ■ For Reporting or batch processing

# Autonomous Database Demo

# Autonomous Database - Dedicated

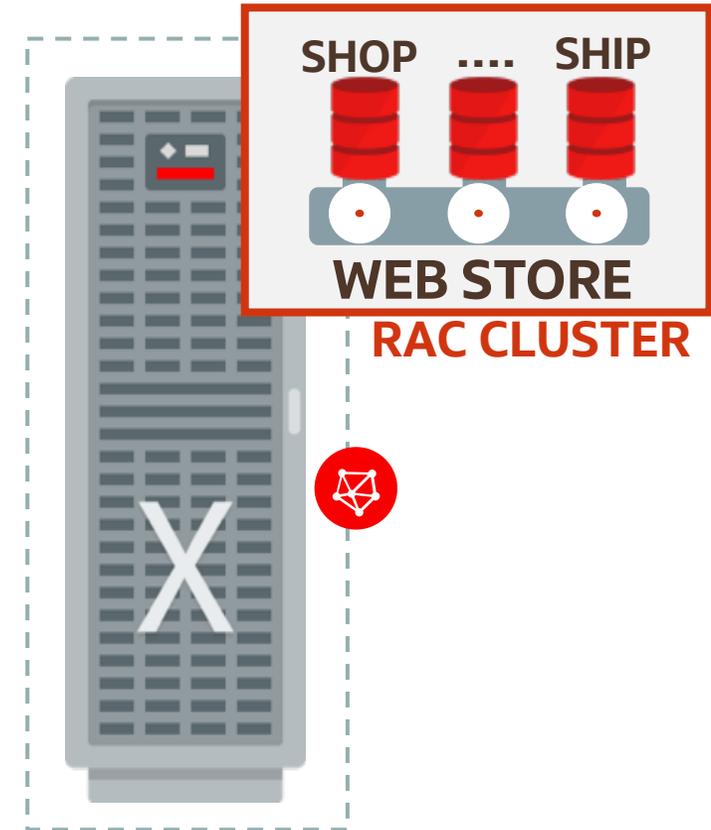
Autonomous Data Warehouse & Autonomous Transaction Processing

# Autonomous Database - Dedicated

- The Autonomous Dedicated database service provides a private database cloud running on dedicated Exadata Infrastructure in the Public Cloud.
- It has multiple levels of isolation protects you from noisy or hostile neighbors.
- Customizable operational policies give you control of provisioning, software updates, availability and density.

# Autonomous Database- Dedicated Physical Characteristics and constraints

- Quarter rack X7 Exadata Infrastructure
  - 2 servers( 92 OCPU, 1.44TB RAM)
  - 3 Storage Servers ( 76.8TB Flash, 107TB Disk)
- Cluster / Virtual Cloud Network
  - 1 Cluster per quarter rack
- Autonomous Container Database
  - Maximum of 4 per Cluster
- Autonomous Database
  - High Availability SLA – Maximum 100 DBs
  - Extreme Availability SLA – Maximum 25 DBs



# Autonomous Database- Dedicated

## High Level Deployment Flow



# Autonomous Database - Dedicated Security

- Databases always encrypted
- Reduced attack surface
- Automatic protection of customer data from Oracle operations staff
- Database Vault's new Operations Control feature
- Oracle automatically applies security updates for the entire stack
- Quarterly, or off-cycle for high-impact security vulnerability
- Customer can separately use Database Vault for their own user data isolation

# Summary

You should now be able to

- Compare Autonomous Database (ADB) with DB System Cloud offerings in OCI
- Describe the features of Autonomous Data Warehouse Cloud - Serverless and Autonomous Data Warehouse Cloud - Dedicated, Autonomous Transaction Processing - Serverless and Autonomous Transaction Processing – Dedicated
- Describe how to deploy, use and manage ADB

# Additional resources

- Autonomous Data Warehouse Service Documentation  
<https://docs.oracle.com/en/cloud/paas/autonomous-data-warehouse-cloud/>
- Autonomous Transaction Processing Documentation  
<https://docs.oracle.com/en/cloud/paas/atp-cloud/index.html>
- Autonomous Data Warehouse Cloud for Experienced Oracle Database Users  
<https://docs.oracle.com/en/cloud/paas/autonomous-data-warehouse-cloud/user/experienced-database-users.html> - GUID-58EE6599-6DB4-4F8E-816D-0422377857E5
- Migrating Amazon Redshift to Autonomous Data Warehouse Cloud  
<https://docs.oracle.com/en/cloud/paas/autonomous-data-warehouse-cloud/user/migrating.html> - GUID-A00E1C78-BCB1-46E9-97FA-DD1B377DF1F2

**Oracle Cloud always free tier:**

[oracle.com/cloud/free/](https://oracle.com/cloud/free/)

**OCI training and certification:**

<https://www.oracle.com/cloud/iaas/training/>

<https://www.oracle.com/cloud/iaas/training/certification.html>

**OCI hands-on labs:**

[ocitraining.qcloudable.com/provider/oracle](https://ocitraining.qcloudable.com/provider/oracle)

**Oracle learning library videos on YouTube:**

[youtube.com/user/OracleLearning](https://youtube.com/user/OracleLearning)

