SEMINARE

Oracle Database 12*c* Release 2

Überblick zu den hauptsächlichsten New Features

MD CONSULTING & INFORMATIONSDIENSTE GMBH

MD
CONSULTING & INFORMATIONSDIENSTE GMBH

Gründung:
1991

Büros:
Erfurt und München

35 Mitarbeiter

Vertriebsgebiet:
Deutschsprachiger Raum

MD
CONSULTING &
INFORMATIONSDIENSTE
GMBH

Datenbankprodukte
- MS SQL Server
- Gupta
- Oracle
- ...

MD
CONSULTING &
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GMBH

Datenbank-Technologien

Software-Entwicklung

Programmiersprachen

Entwicklungswerkzeuge

MD
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Auftragsentwicklung

Konzeptentwicklung

Nothelfer für IT-Projekte

Technologieberatung

Kunden / Anwendungsentwicklung

Düsseldorf	DOW Living. Improved daily.		Immenstaad
München	BMW / MINI	Boehringer Ingelheim	Ingelheim
München, Nürnberg, Erlangen	SIEMENS	OPEL	Eisenach
Ingolstadt	MediaMarkt	LIDL	Neckarsulm

Agenda

- Releaseplan
- Verfügbarkeit – alles ein bißchen besser
- Administration – die täglich Arbeit optimieren
- Database In-Memory – immer schneller
- Security – umfangreich und detaillierter
- Multitenant – die größten Neuerungen
- Sharding – höchste Performance für besondere Fälle
- Express Cloud Service – preiswerter geht es nicht

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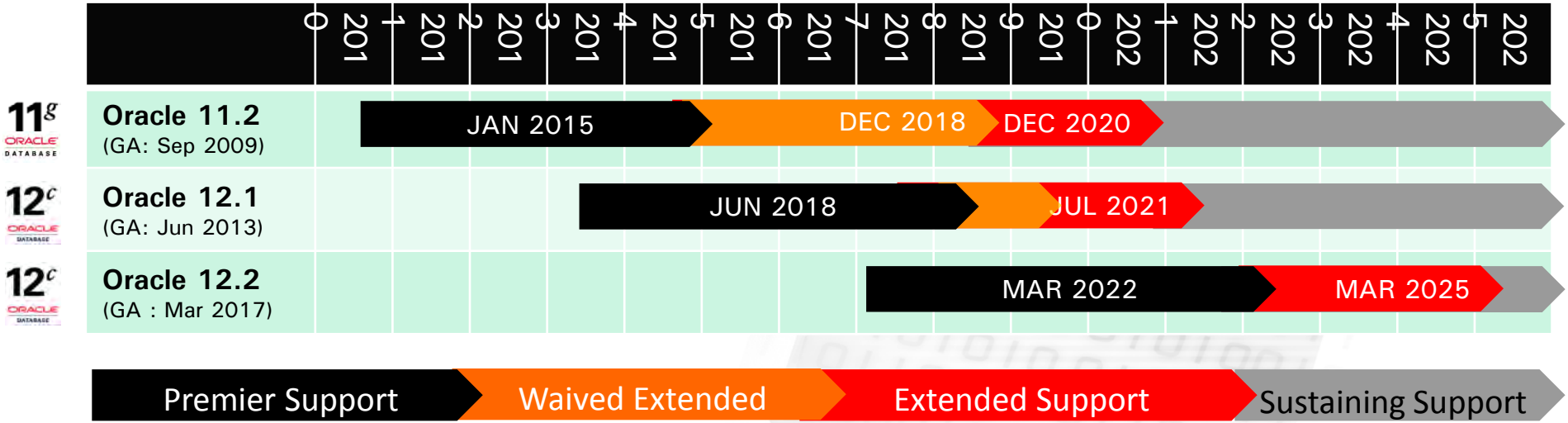
On-Premises Server Releases (includes client)

Linux x86	*Not planned*
Linux x86-64	1-Mar-2017
Oracle Solaris SPARC (64-bit)	1-Mar-2017
Oracle Solaris x86-64 (64-bit)	1-Mar-2017
Microsoft Windows x64 (64-bit)	16-Mar-2017
HP-UX Itanium[9]	Q2CY2017
HP-UX PA-RISC (64-bit) *See footnote 8 below*	*Platform desupported*[8]
IBM AIX on POWER Systems	Q2CY2017
IBM Linux on System z	Q2CY2017
Microsoft Windows (32-bit)	*Not planned*
Platform	**12.2.0.1**

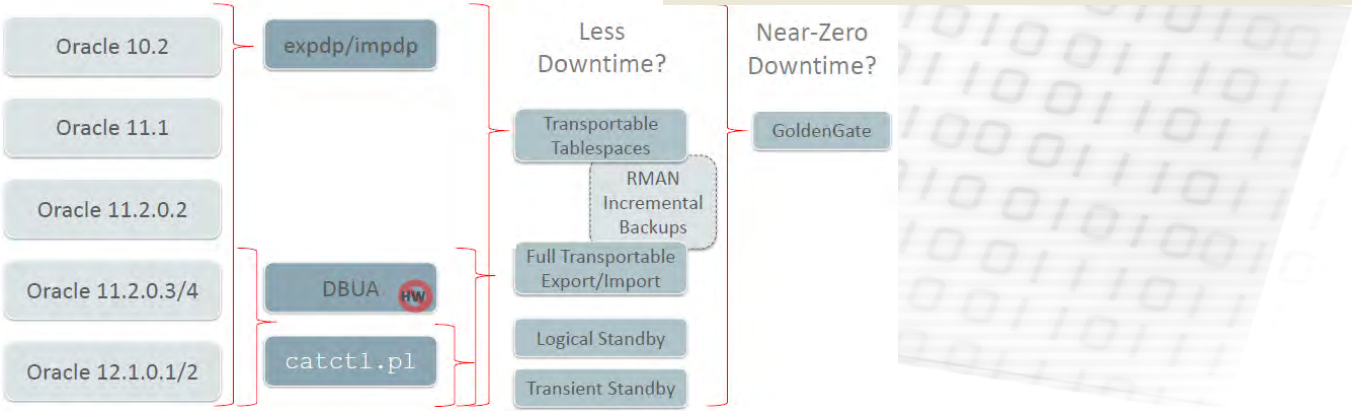
- Press Release am 6. März
  „Latest Release of Industry Leading Oracle Database Now Available in the Cloud, with Oracle Cloud at Customer, and On-Premises"
- Download für Linux x86-64, Solaris Sparc, Solaris x86-64 und Windows
- Offizielle Informationen
  Release Schedule (MOS Doc ID 742060.1)

Release Roadmap



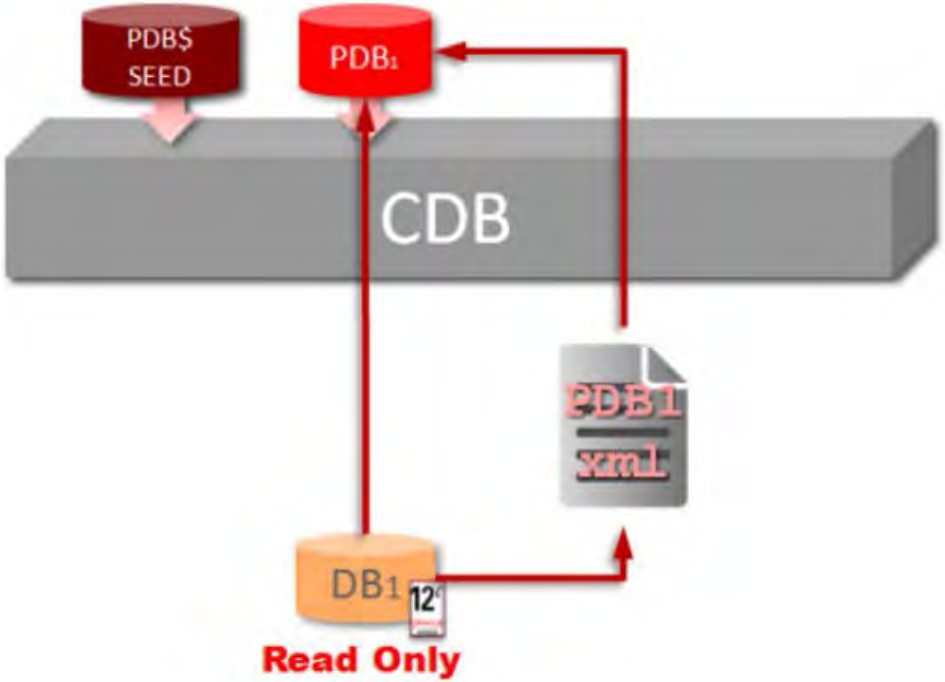
Fragen zum Upgrade

- Gibt es überhaupt noch die **Non CDB** Architecture?
  Non-CDB still exists in Oracle Database 12.2.
- Upgrade Pfade



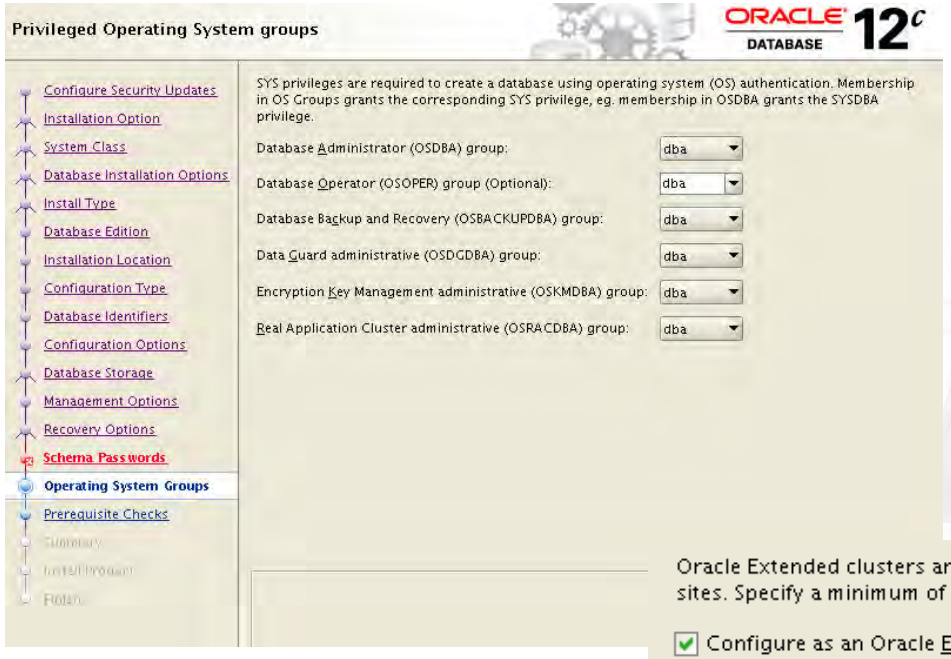
Upgrade to Oracle Database 12.2 - New MOS Notes:
nonCDB: 2173141.1, Multitenant: 2173144.1, DBUA: 2189854.1

Plugin Methode:
Migration von Non CDB in CDB

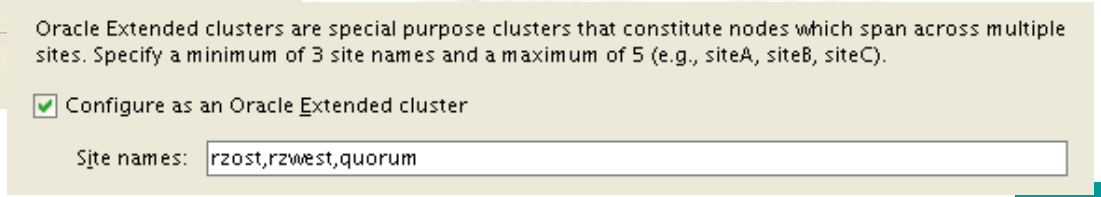


- **“You can't convert a stand-alone database to become a container database”**
- Converting an 12.1 non-CDB and plug it into an 12.2 CDB
- Übrigens ist auch eine Methode für Cloud Migration (Using Oracle Database Exadata Cloud Service)

Neues bei der Installation



- Kein C++ Kompiler mehr notwendig
- Separation of Duty: SYSRAC
- Dabei: TFA, SQLcl, SQL Developer
- Vereinfachte Cluster Installation
  - Unzip + **`./gridSetup.sh`**
  - ASM Filter Driver Integration, separate ASM Diskgroup für GI Management Repository
  - Stretch Cluster Setup und Definition



Lizenzierung

- http://docs.oracle.com/database/122/nav/portal_booklist.htm
- Licensing Information User Manual
  mit Permitted Features, Options und Management Packs
  - Sharding
  - Multitenant
  - Active Data Guard

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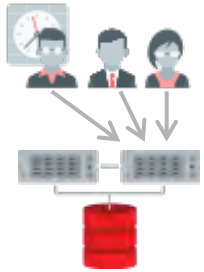
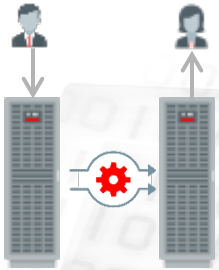
More 12.2 High Availability Innovations



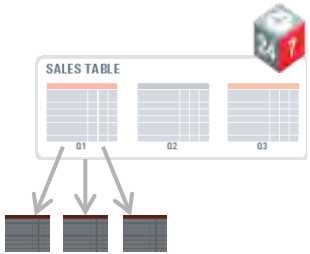
Application Continuity

- Planned maintenance enhancements



Active Data Guard

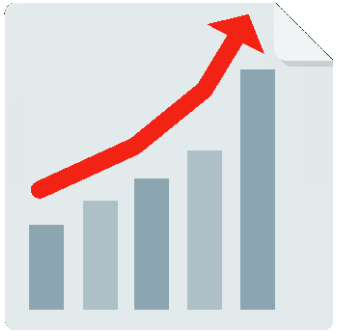
- Diagnostic, Tuning, and SQL Plan Analyzer on Standby
- No user disconnect on failover
- Multi-node parallel apply in RAC
- High-speed block comparison between primary and standby
- More secure (SSL-based redo transport, automatically maintain password files)

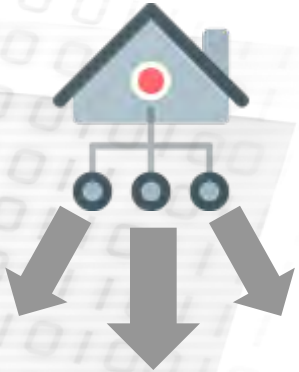


More partition maintenance operations now online

Online Table Move

Oracle Database 12cR2:
Real Application Clusters Scalability and Availability





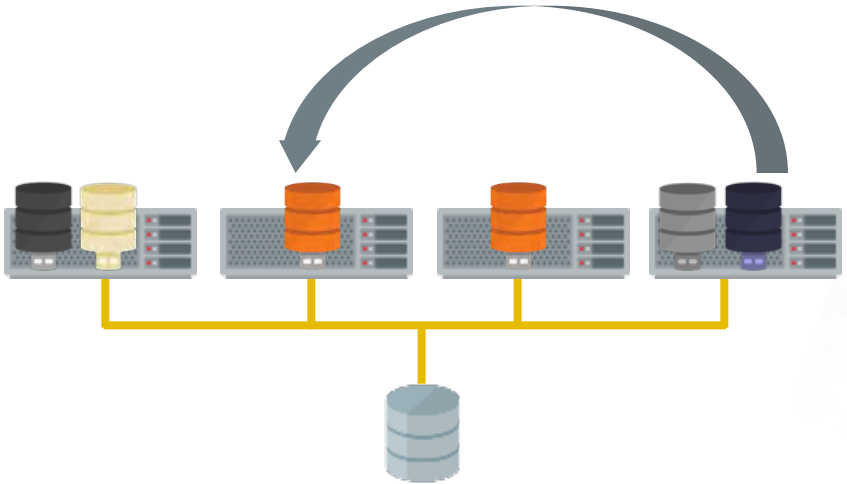
Better scalability
(for singleton services)
supporting cloud bursting

Better availability
due to reduced
reconfiguration times

Efficient management of
large scale deployments

Optimized Singleton Workload Scaling – 1

- Service-oriented Buffer Cache Access

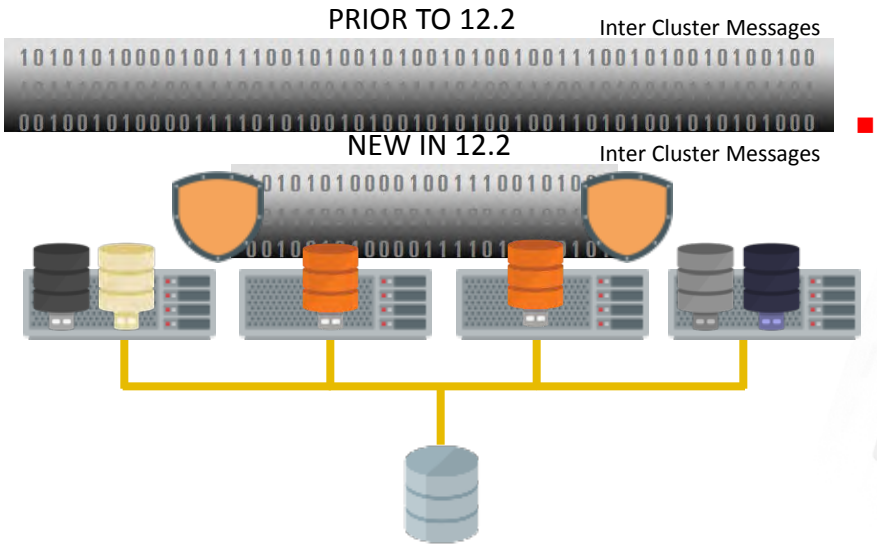


Service-oriented Buffer Cache Access over time determines the data (on database object level) accessed by the service. This information

- Is persisted in the database.
- Is used to improve data access performance
  (e.g. do not manage data of a service in an instance that does not host the service).
- Can be used to pre-warm an instance cache prior to a service startup (fresh start or relocation

Optimized Singleton Workload Scaling – 2

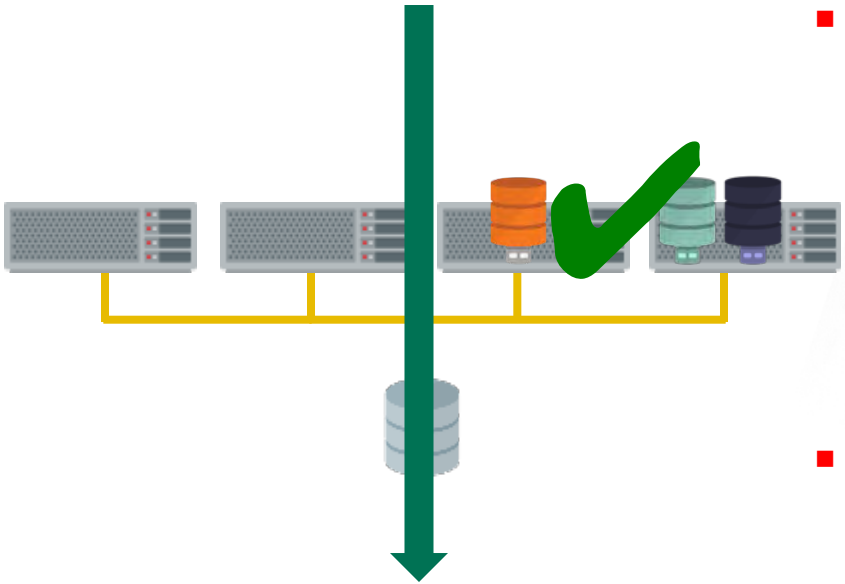
- Pluggable Database Isolation



- Using Oracle Multitenant, PDBs can be opened as singletons (in one data-base instance only), in a subset of instances or all in instances at once.
- If certain PDBs are only opened on some instances, Pluggable Database Isolation
  - **improves performance** by
    - Reducing DLM operations for PDBs not open in all instances.
    - Optimizing block operations based on in-memory block separation.
  - **improves availability** by
    - Ensuring that instance failures of instances only hosting singleton PDBs will not impact other instances of the same RAC-based CDB.

Node Weighting in RAC 12.2

Idea:
Everything equal,
let the majority of work survive



- is a new feature that considers the workload hosted in the cluster during fencing
- The idea is to let the majority of work survive, if everything else is equal
  - Example: In a 2-node cluster, the node hosting the majority of services (at fencing time) is meant to survive
  - Further aspects (e.g. ASM instance availability or public network availability) are taken into consideration
- DBAs can overrule and rate a service as a "critical" based on business needs

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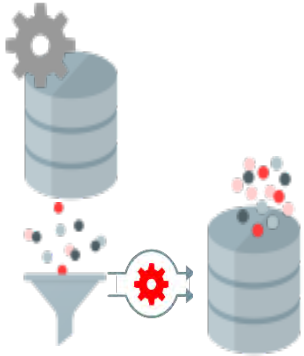
12.2 Manageability Improvements – 1

AWR Enhancements

- Per PDB AWR Support
- PDB Snapshots
- Support for ADG



Real Application Testing

- Improved scalability for large workloads
- Improved PL/SQL replay for long running calls

EM Cloud Control

- Support for Sharding
- Management of large volume PDB estates

EM Express

- Improved Multitenant support
- Simpler configuration
- SPA and Resource Manager support

12.2 Manageability Improvements – 2

Index Usage Statistics

- Track index usage with no overhead
- Views provide usage histograms and access

SQL Tuning Advisor

- Support for ADG

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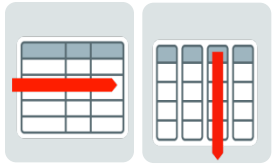
What's new in 12.2 for Database In-Memory

Real-Time Analytics

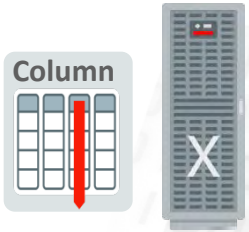
2X
Faster Joins
4X
Faster Expressions

On OLTP or DW



Active Data Guard Support

Massive Capacity



In-Memory on Exadata Flash

Multi-model

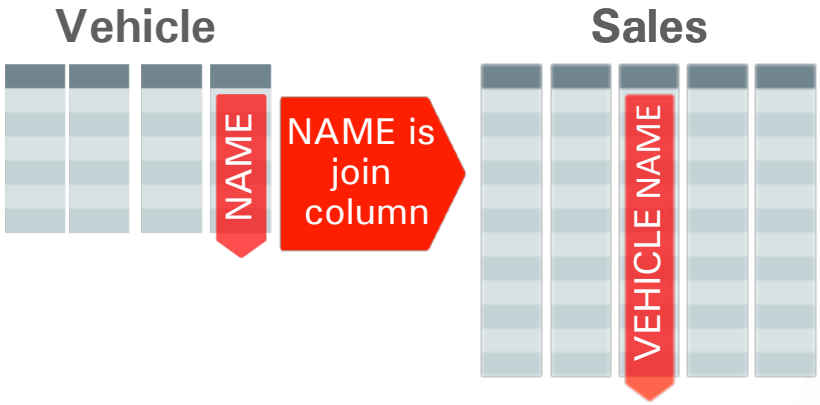
Native support for JSON Data type

Automation

Dynamic Data Movement Between Storage & Memory

Real-Time Analytics: Faster In-Memory Joins

Example: Find sales price of each Vehicle




```
CREATE INMEMORY JOIN GROUP
v_name_jg
(vehicles(name), sales(name));
```

- Analytic queries have complex joins with no filter predicates specified
- Join Group specifies columns used to join tables
  - Column share compression dictionary
  - Joins occur on dictionary values rather than data
- Enables **2-3x faster** join processing

Real-Time Analytics: Faster In-Memory Joins

- 12.1 Performance seriell

```
SQL> Select /*+ NO_VECTOR_TRANSFORM */
       sum(lo_extendedprice * lo_discount) revenue
From   LINEORDER l, DATE_DIM d
Where  l.lo_orderdate = d.d_datekey
And    l.lo_discount between 2 and 3
And    l.lo_quantity < 24
And    d.d_date='June 3, 1998';
  2    3    4    5    6    7

               REVENUE
--------------------
        884260172118

Elapsed: 00:00:11.40
```

- 12.2 Performance seriell

NEW IN 12.2

```
SQL> Select /*+ NO_VECTOR_TRANSFORM */
       sum(lo_extendedprice * lo_discount) revenue
From   LINEORDER l, DATE_DIM d
Where  l.lo_orderdate = d.d_datekey
And    l.lo_discount between 2 and 3
And    l.lo_quantity < 24
And    d.d_date='June 3, 1998';  2    3    4    5    6    7

               REVENUE
--------------------
        884260172118

Elapsed: 00:00:06.14
```

2 X Performance Improvement

Real-Time Analytics: In-Memory Expressions

NEW IN 12.2

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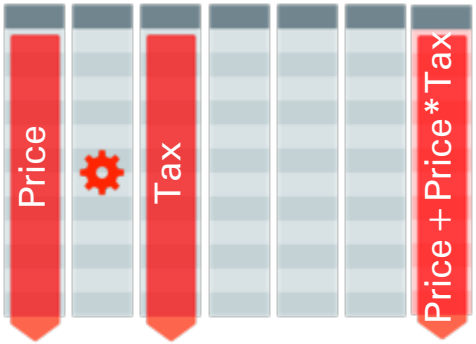
Example: Compute total sales price

Net = Price + Price * Tax

In-Memory Column Store

Sales



- Analytic queries contain complex expressions
  - Originally evaluated for every row
- Expressions pre-computed and cached in-memory
  - User defined via virtual columns
  - Or expressions automatic detected
- All In-Memory optimizations apply
- **5x** faster complex queries

Real-Time Analytics: In-Memory Expressions

- 12.1 performance number parallel 8

```
SQL> select  /*+ parallel(8) */
        lo_shipmode,
        sum(lo_quantity) as sum_qty,
        sum(lo_extendedprice) as sum_base_price,
        sum(lo_extendedprice * (1 - lo_discount)) as sum_disc_price,
        sum(lo_extendedprice * (1 - lo_discount) * (1 + lo_tax)) as sum_charge,
        avg(lo_quantity) as avg_qty,
        avg(lo_extendedprice) as avg_price,
        avg(lo_discount) as avg_disc,
        count(*) as count_order
from
        lineorder
group by
        lo_shipmode
order by
        lo_shipmode;
  2    3    4    5    6    7    8    9    10   11   12   13   14   15   16

7 rows selected.

Elapsed: 00:07:35.09
```

- 12.2 performance number parallel 8

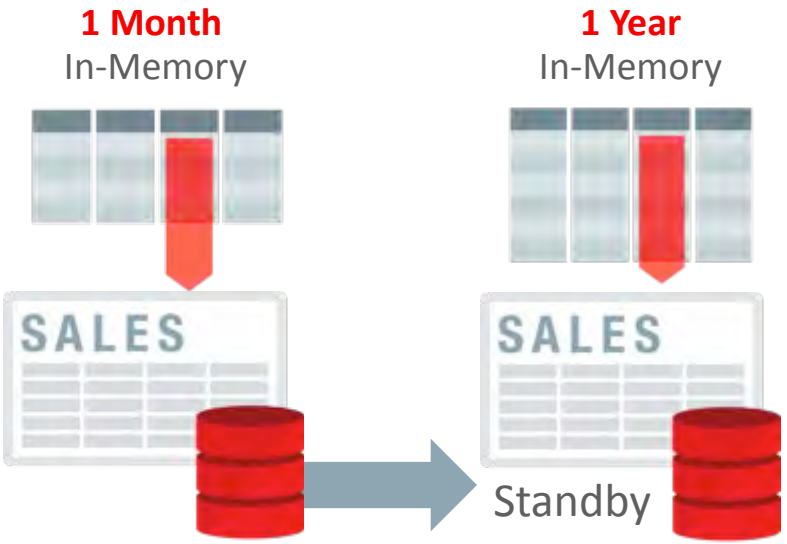
NEW IN 12.2

```
SQL> select  /*+ parallel(8) */
        lo_shipmode,
        sum(lo_quantity) as sum_qty,
        sum(lo_extendedprice) as sum_base_price,
        sum(lo_extendedprice * (1 - lo_discount)) as sum_disc_price,
        sum(lo_extendedprice * (1 - lo_discount) * (1 + lo_tax)) as sum_charge,
        avg(lo_quantity) as avg_qty,
        avg(lo_extendedprice) as avg_price,
        avg(lo_discount) as avg_disc,
        count(*) as count_order
from
        lineorder
group by
        lo_shipmode
order by
        lo_shipmode;
  2    3    4    5    6    7    8    9    10   11   12   13   14   15   16

7 rows selected.

Elapsed: 00:02:05.31
```

3,5 X Performance Improvement

OLTP: In-Memory on Active Data Guard

NEW IN 12.2

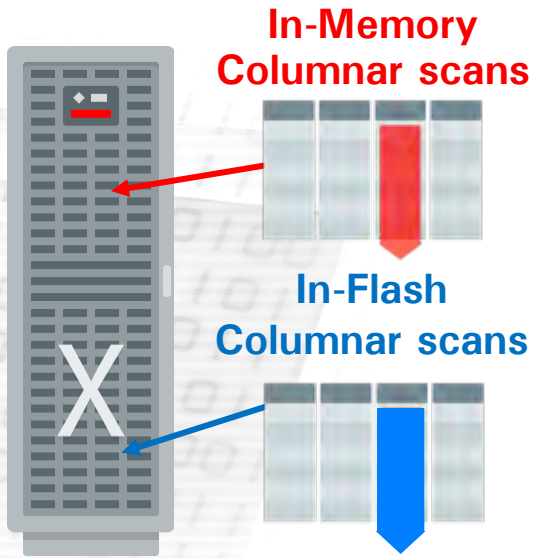


- Real-time analytics with no impact on production database
- Make productive use of standby database resources
- Can populate different data from production database
  - Use new DISTRIBUTE BY SERVICE to determine where to populate a table
  - Increase total columnar capacity

Massive Capacity:
IMC Format in Columnar Flash Cache

NEW IN 12.2

- In-Memory format now used in Smart Columnar Flash Cache
  - Enables in-memory optimizations on data in Exadata flash
  - E.g. multiple column values evaluated in single vector instruction
- In-memory performance seamlessly extended from DB node DRAM memory to 10x larger flash in storage
  - Huge advantage over all-flash arrays and other in-memory DBs



Only Hybrid columnar compressed objects are eligible

Automation:
In-Memory Data Auto Population Policies

NEW IN 12.2

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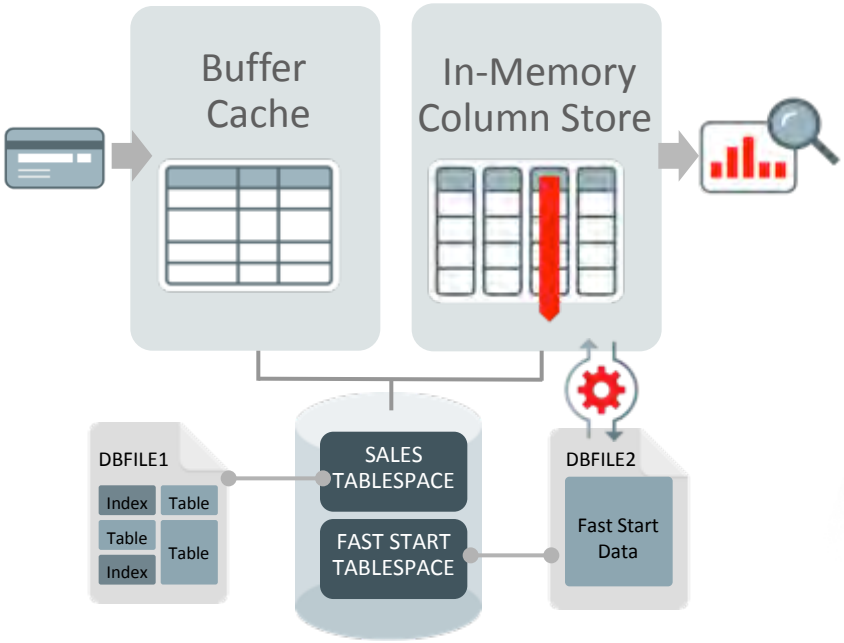
- Heat map tracks data access frequency
- Policies can be defined to
  - Bring data into the IM column store
  - Increase compression levels as data cools
  - Evict cold data from IM column store

Population Performance: In-Memory Fast-Start

NEW IN 12.2



- IM column format persisted to storage
  - In-Memory column store contents checkpointed to secure file lob on populate
  - When DB restarts population is faster as population process reads the column format directly from storage
  - Faster restore (2-5x) of column store since no need to reformat data

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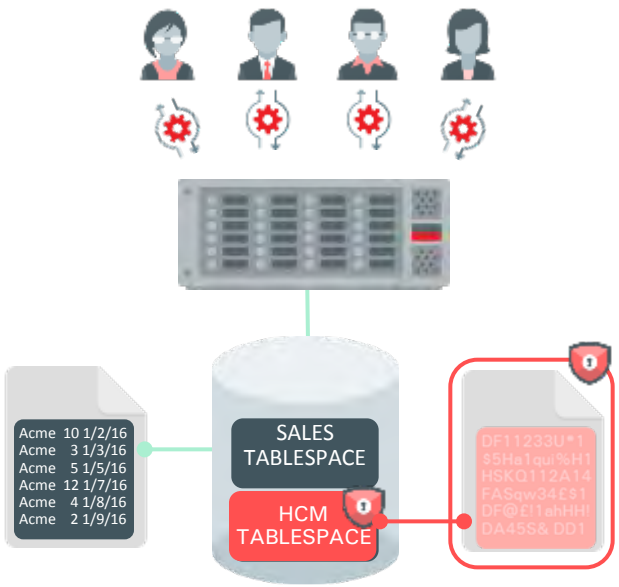
New in 12.2 Online Tablespace Encryption



- Online encryption of existing database tablespace files
- Full encryption of SYSTEM, SYSAUX, and UNDO tables (internal database structures)
- Offline tablespace encryption
  - 11.2.0.4 and 12.1.0.2 back port available

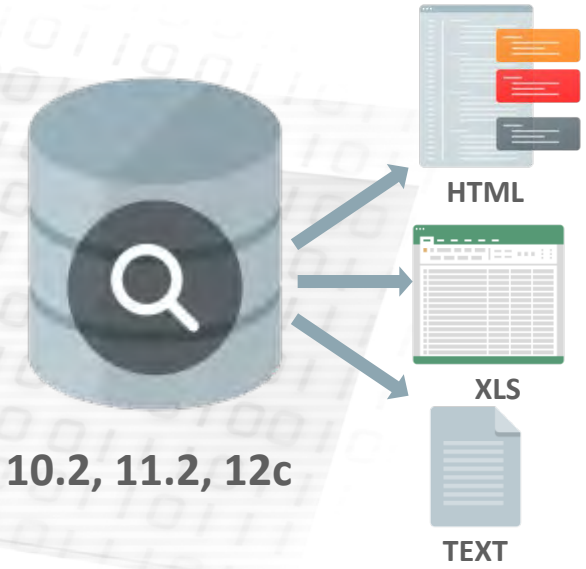
12.2 Security Innovations

- Advanced Security Option
  - Online and offline tablespace encryption
  - New algorithms (ARIA, SEED, GOST) for South Korean/Russian markets
  - Redaction of CLOB/NCLOB data identified using Regular Expressions
- Database Vault
  - Simulation mode for creating robust security rules for deployment
  - Security policy for grouping of realms, factors, and rules
  - Privilege Analysis uses full run-time and static usage for enforcing “Least Privilege”
- Real Application Security
  - RAS Administration Tool (RASADM) for authorization policies and management
  - Column-level Control for DMLs
  - Schema-wide RAS data policy management
- Auditing based upon Roles such as DBA

Database Security Assessment Tool (DBSAT)

Enables New Security Sales Opportunities

- Help SCs & partners quickly scan customer databases
  - Understand risk profile and provide recommendations
  - Help sales teams uncover new opportunities
- Report security risks and gaps
  - Configuration, privileges, encryption, auditing, …
- Recommend relevant products
  - TDE, Database Vault, AVDF, and more
- Downloadable free tool from MOS



Most Secure Database in the Cloud

	ORACLE CLOUD DB	AZURE SQL	AWS AURORA
Data Encrypted by Default	✓	✓	✗
Control Encryption Keys On-Premise	✓	✗	✗
Collect Audit Records On-Premise	✓	✗	✗
Mask Sensitive Data for Test/Dev	✓	✗	✗
Restrict Administrative Access	✓	✗	✗
Migrate Security Policies to the Cloud	✓	✗	✗

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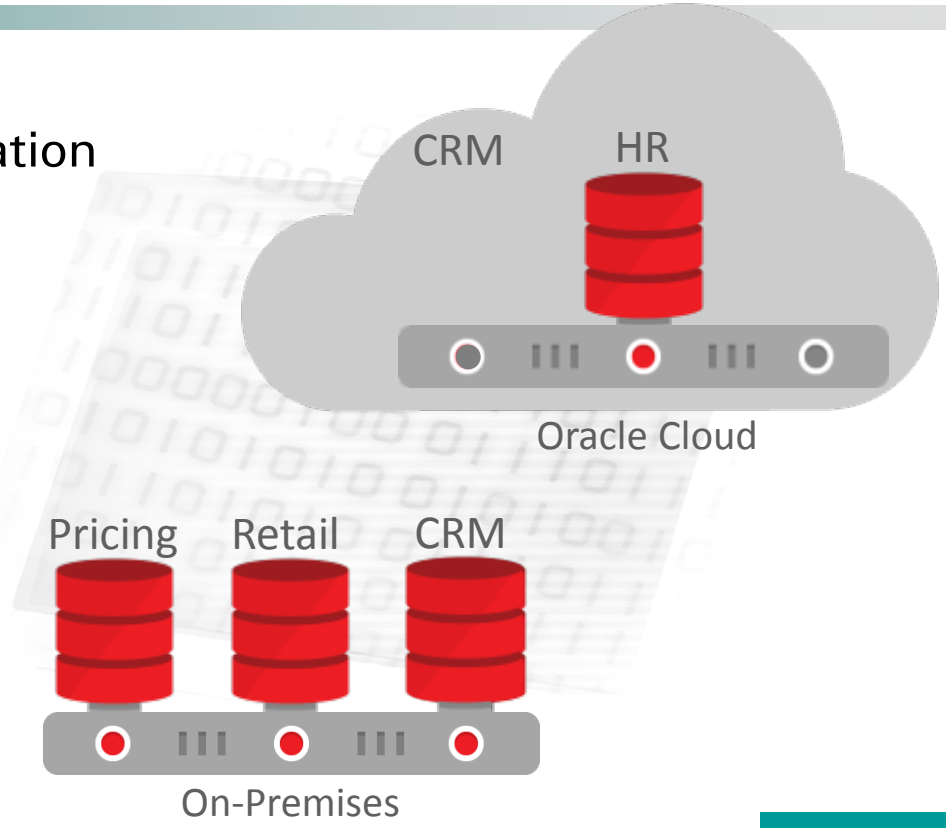
PDB Hot Clone

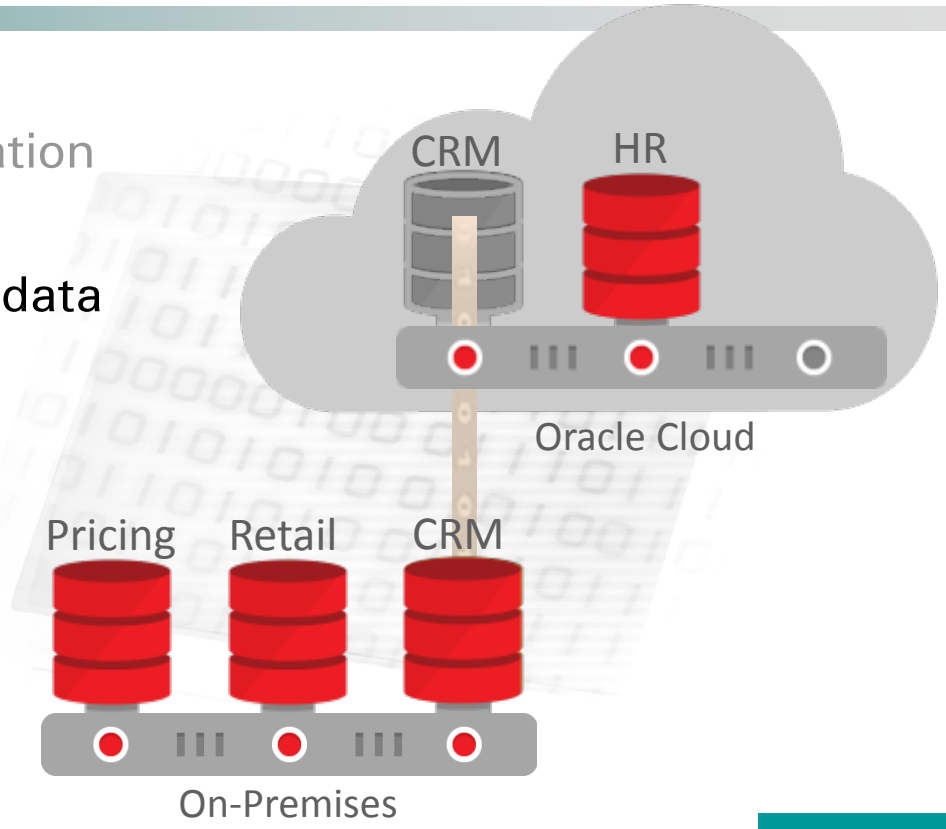
NEW IN 12.2

- PDB Hot Clone
  - Faster test master instantiation



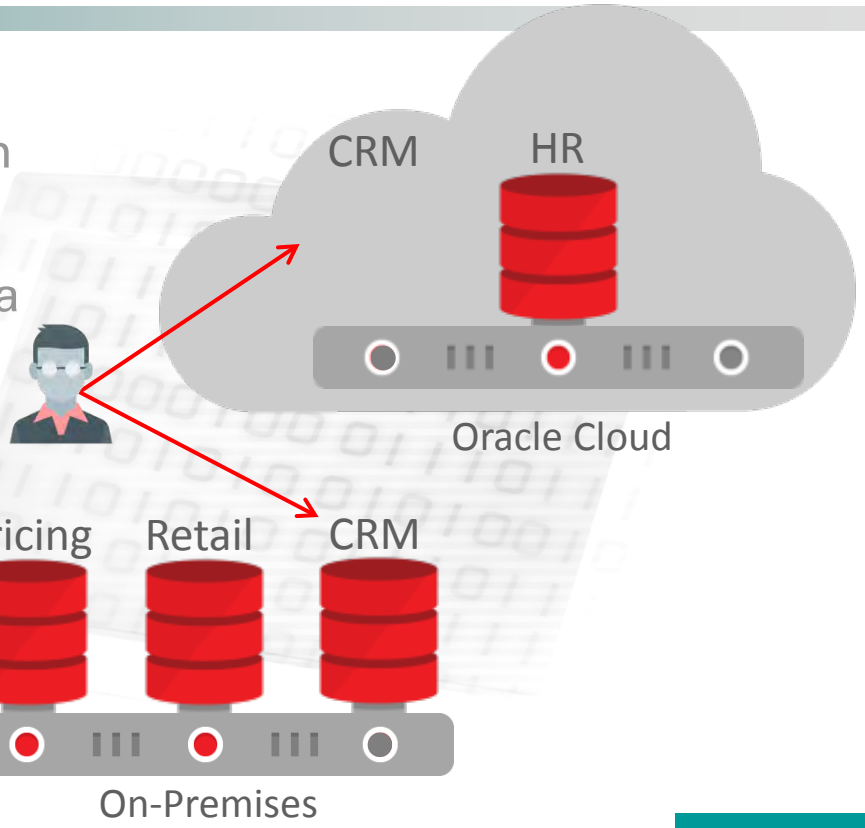
PDB Refresh

- PDB Hot Clone
  - Faster test master instantiation
- PDB Refresh
  - Simple operation for latest data



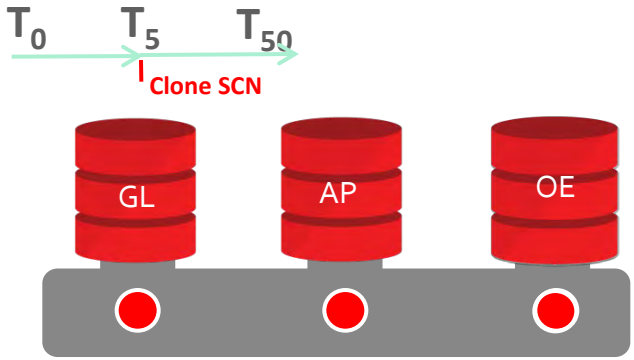
PDB Relocate

- PDB Hot Clone
  - Faster test master instantiation
- PDB Refresh
  - Simple operation for latest data
- PDB Relocate
  - Relocate with no downtime



12.1 PDB Static, Cold Cloning

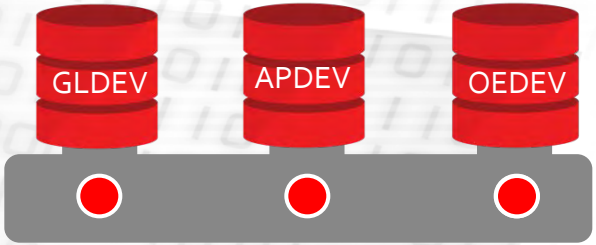
PRODUCTION



T5 1. *alter pluggable database oe close;*
2. *alter pluggable database oe open read only;*

T5 4. *alter pluggable database oe open read write force;*

DEVELOPMENT



3. *create pluggable database oedev from oe@dblink;*

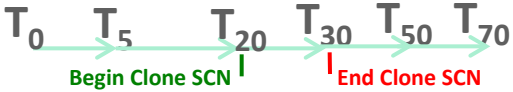
Datafile Copy

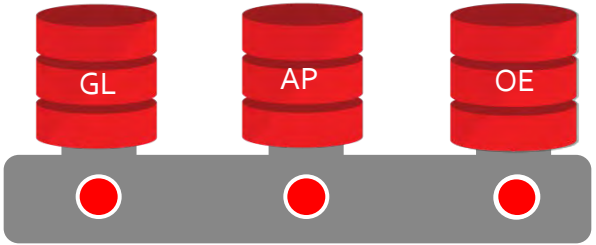
T5 4. *alter pluggable database oedev open;*

12.2 PDB Hot Cloning

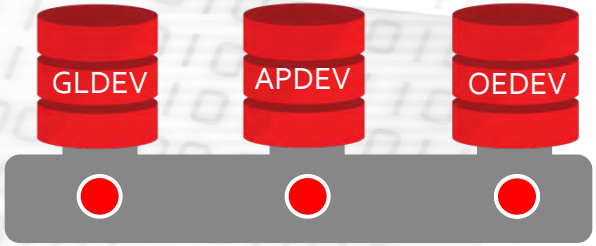
NEW IN 12.2

PRODUCTION





DEVELOPMENT



T_{20} 1. *create pluggable database oedev from oe@dblink;*

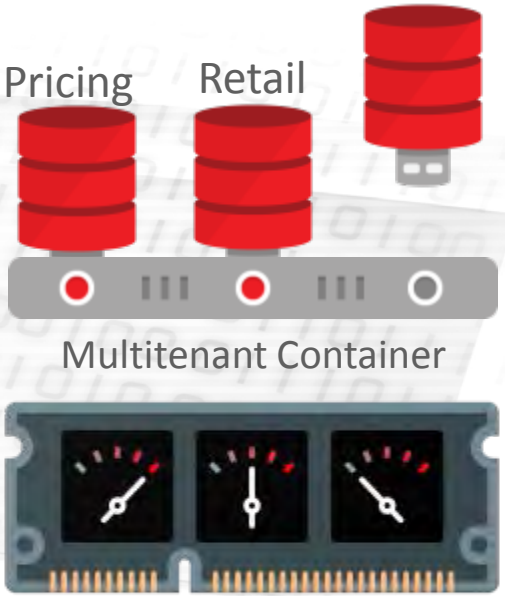
RED Final REDO Copy and ROLLBACK T_{30}

T_{30} 2. *alter pluggable database oedev open;*

Isolation with Economies of Scale

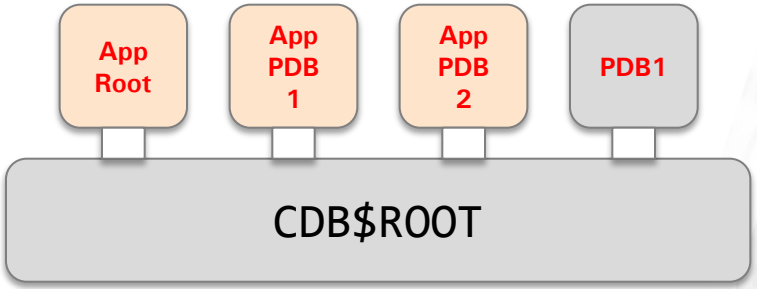
NEW IN 12.2

- Flashback PDB
- Per-PDB Character Set
- 4k PDBs per CDB
  (4,096 - increased from 252)
- Memory & I/O resource prioritization in addition to CPU
- Configurable isolation via Lockdown Profiles

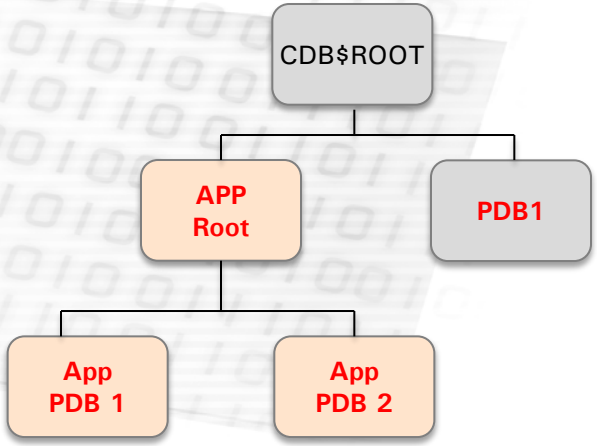


What is an Application Container ?

- An Application container is a collection of PDBs consisting of Application Root and all Application PDBs associated with it



Physical Representation



Logical Representation

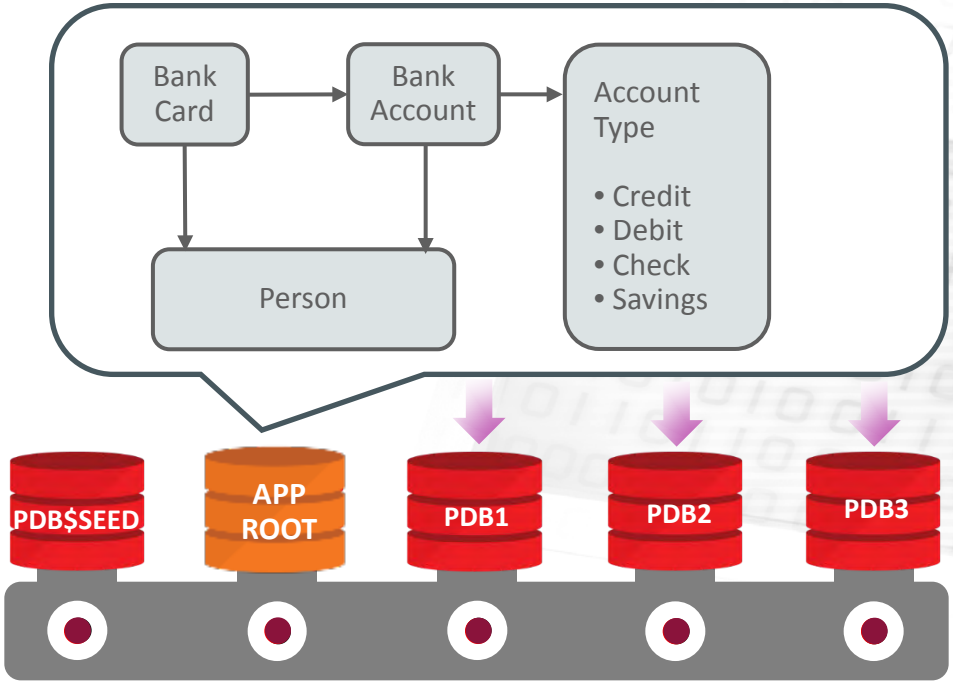
Application Container

NEW IN 12.2

- Application Container comprises
  - Application Root (Master)
  - Application PDBs (for each Tenant)
  - Application Seed (for provisioning)
- PDBs share application objects
  - Code, metadata and data
- Further simplifies management
  - Apply updates to application container
  - Sync tenant PDBs from central master
- Suitable for all applications
  - SaaS, franchise, divisional, etc.

Application Containers

Share & propagate across multiple PDBs



Application Containers: Features

NEW IN 12.2

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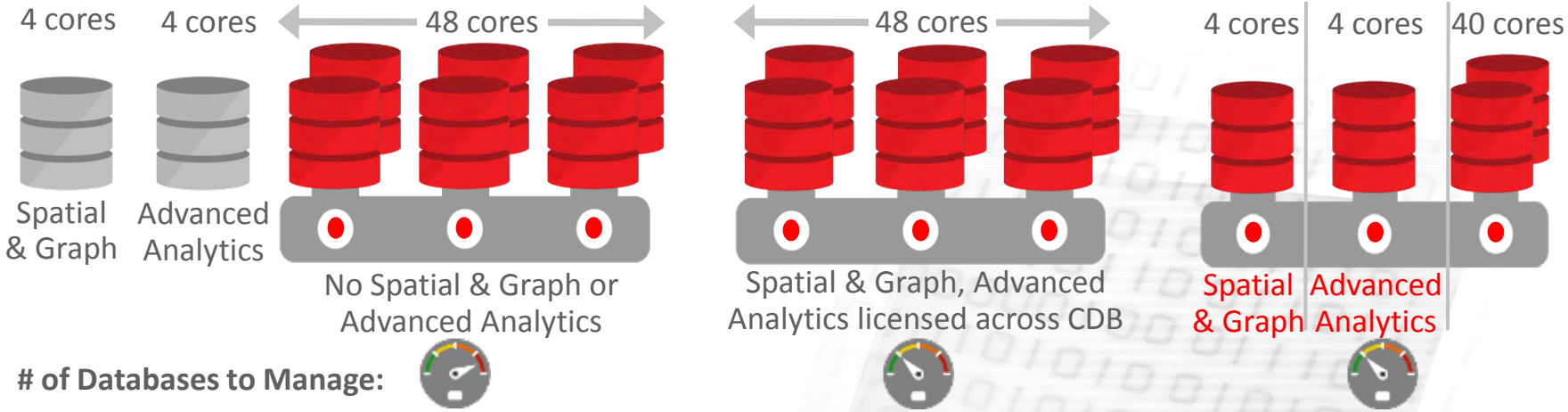
- Application Root PDB for defining application master
  - Metadata and common data shared across tenant PDBs
- Install one copy of your application
- Instant provisioning of a Application PDB/Tenant (with a seed PDB)
- Both local and remote PDBs can join the Application Containers
- Container Data views for reporting across PDBs (CONTAINERS clause based)
- Supports in-place simple patching
- Supports Unplug/Plug upgrade across Application Root

PDB as Trusted Partition

Consolidate diverse options with no license penalty

NEW IN 12.2

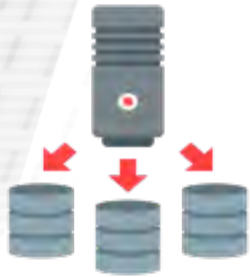
MD CONSULTING & INFORMATIONSDIENSTE GMBH



	Non-CDB with licensed options and Multitenant	Multitenant with options licensed across CDB	PDB as Trusted Partition
EE	$2,660K ($47.5K * 56 cores)	$2,280 ($47.5K * 48 cores)	$2,280K ($47.5K * 48 cores)
Multitenant	$840K ($17.5K * 48 cores)	$840K ($17.5K * 48 cores)	$840K ($17.5K * 48 cores)
Options	$162K (4 cores per option)	$1,944K (48 cores per option)	$162K (4 cores per option)
Total	$3,662K	$5,064K	$3,282K

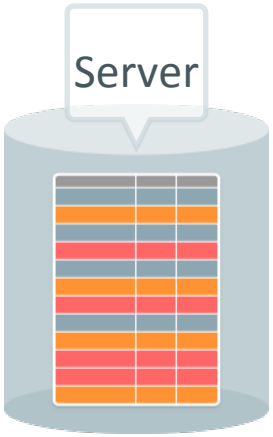
Agenda

- Releaseplan
- Verfügbarkeit – alles ein bißchen besser
- Administration – die täglich Arbeit optimieren
- Database In-Memory – immer schneller
- Security – umfangreich und detaillierter
- Multitenant – die größten Neuerungen
- Sharding – höchste Performance für besondere Fälle
- Express Cloud Service – preiswerter geht es nicht



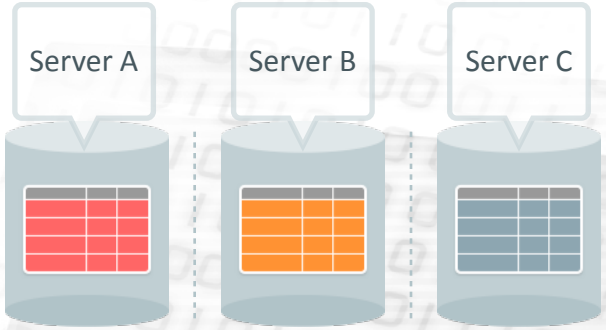
Oracle Sharding – A Database Architecture Pattern

Non-sharded Database



An unsharded table in a single physical database

Sharded Database

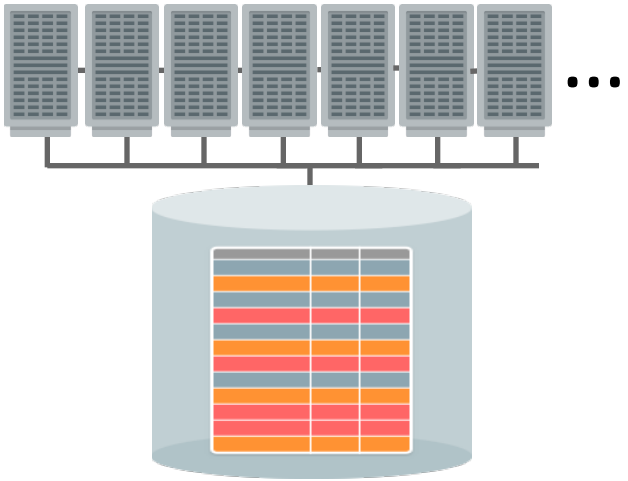


A sharded table horizontally partitioned in *N* independent databases (shards)

- Each shard has its own CPU, memory & disk
- Data is partitioned using a sharding key (i.e. account_id)
- Presented to the application as a single logical database

Oracle Database 12c Release 2 Offers Choice

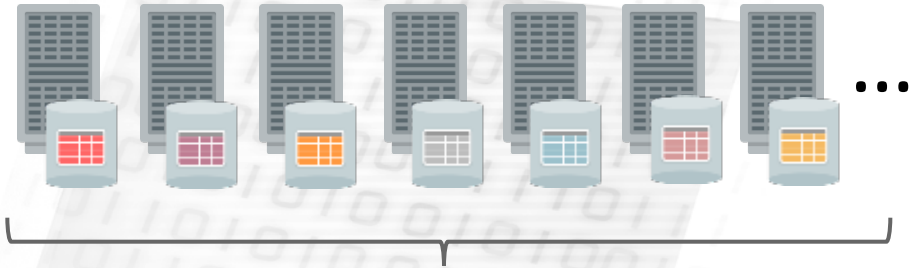
Oracle RAC



A single physical database

Oracle Sharding

N Physical Databases



A single logical database

Application Profile for Sharding

Custom OLTP Applications

Examples:

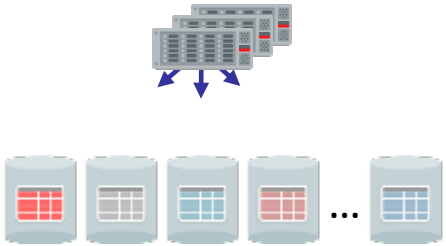
- Large billing systems
- Airline ticketing systems
- Online financial services
- Media companies
- Online information services
- Social media companies

Characteristics

- Application must specify a sharding key for optimal performance – sharding is not application transparent
  - e.g. customer_id, account_id etc
- Primary usage pattern
  - Direct routing to a shard based on sharding key
  - Single-shard operations for highest performance
- Ancillary usage pattern
  - Proxy routing for multi-shard queries (reporting)
  - Able to tolerate lesser performance than direct routing used for single-shard operations

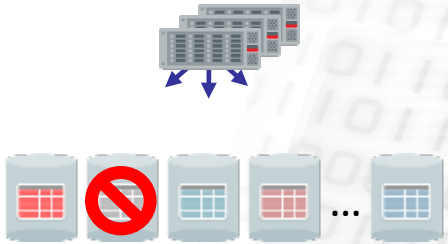
Oracle Database Sharding - Benefits

Linear Scalability



Add shards online to increase database throughput. Online split and rebalance.

Fault Tolerant

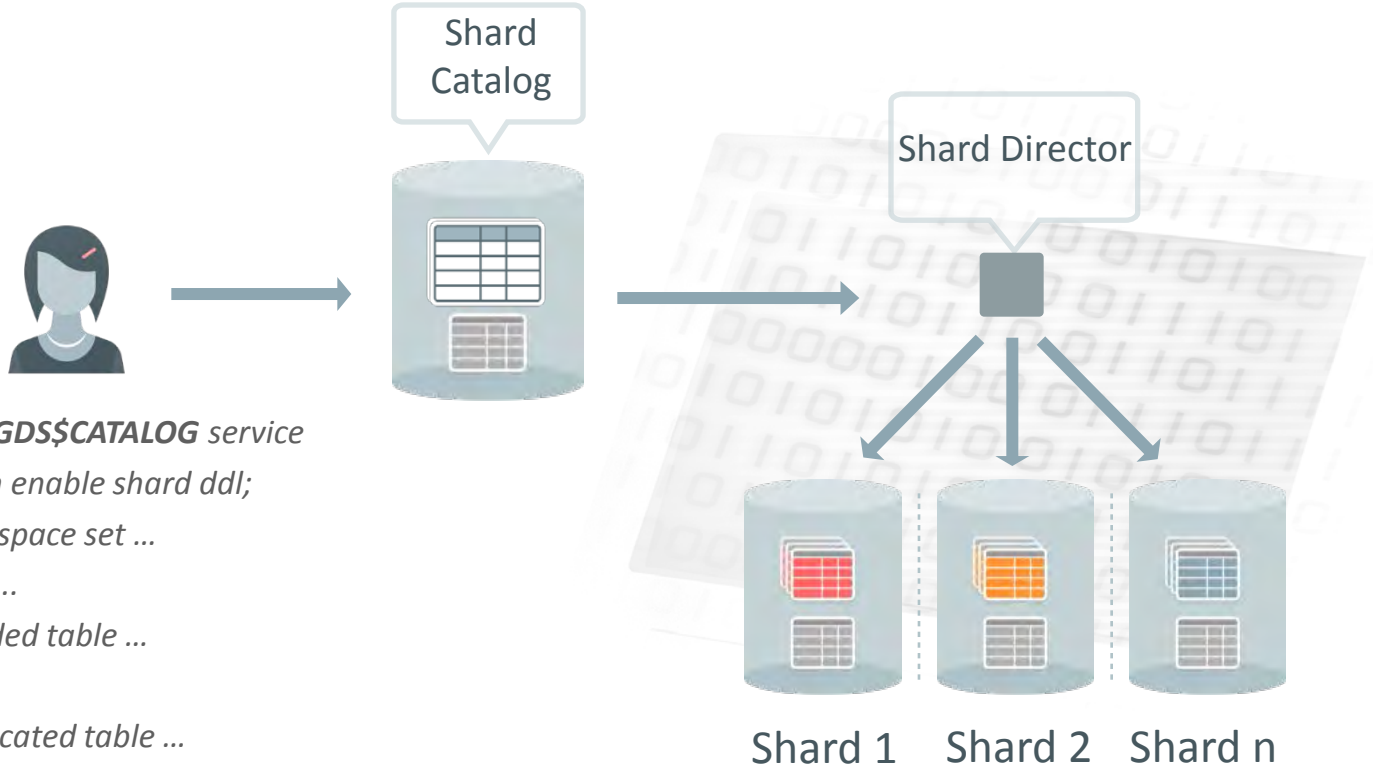


No shared hardware or software to isolate faults. Shards may run different Oracle releases.

Geographic Distribution

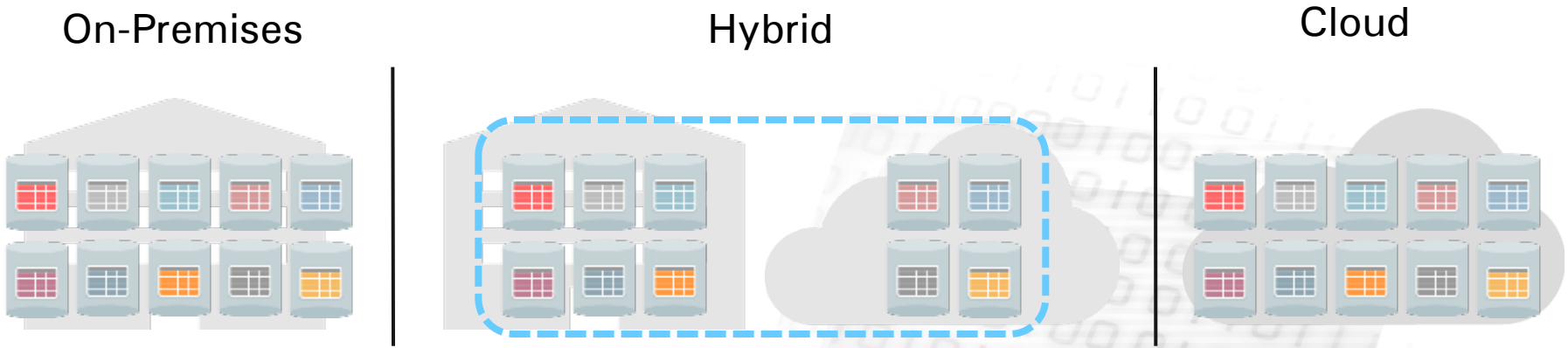
User defined data placement for performance, availability, DR or to meet regulatory requirements.

Centralized Schema Management



*connect to **GDS$CATALOG** service*
alter session enable shard ddl;
create tablespace set …
create user …
create sharded table …
..
Create duplicated table …

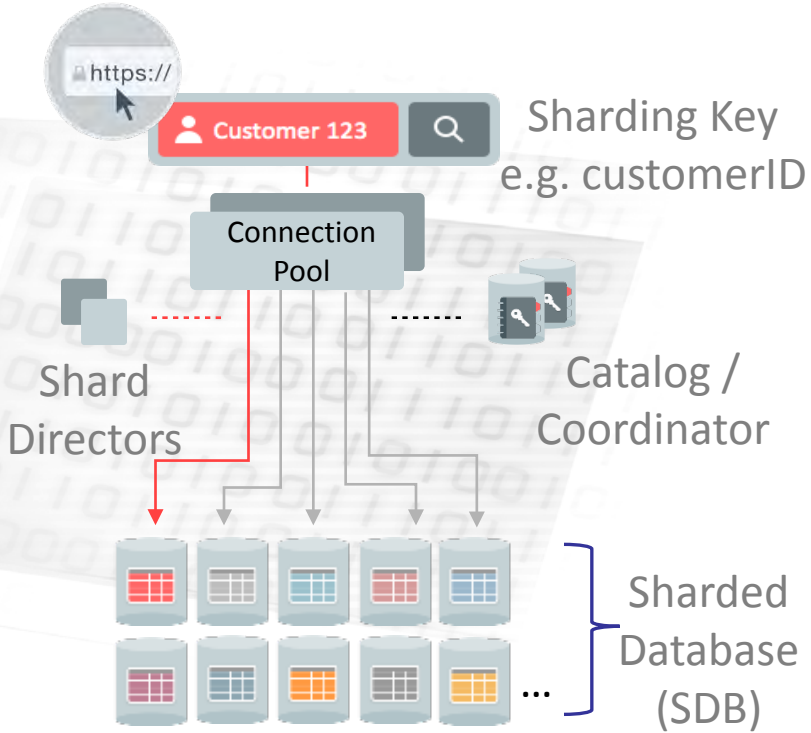
Flexible Deployment On-Premises or Cloud



- Validated on Oracle IaaS with Oracle MAA best practice blueprint at 12.2 launch
- Hybrid requires customers implement global routing to application tiers local to shards. Oracle sharding routes from an application tier to the appropriate shard
- Automated DBCS for sharding is on development roadmap

Oracle Sharding - Capabilities

- Auto deployment
- Multiple sharding methods
- Centralized schema maintenance (sharded and duplicated data)
- A single global service accesses any shard
- Direct and proxy routing
- Elastic scaling with automatic rebalance
- Replication used for shard-level HA
- Geo-distribution, on-premises, public or hybrid cloud



License Requirements for Oracle Sharding

- Oracle Enterprise Edition is a pre-requisite
  - Each shard is a standalone Oracle Database
- Each shard must be licensed for either Active Data Guard, GoldenGate or RAC
  - Includes right to deploy shard directors, the shard catalog and its Data Guard standby(s)
    - Additional Active Data Guard or RAC licenses are required for catalog DB if used for catalog HA
- No separate license for Oracle Partitioning is required for sharded or duplicated tables created using Oracle Sharding
- Enterprise Manager licensing to be determined

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- Sharding – höchste Performance für besondere Fälle
- Oracle Database Cloud Services

Oracle Cloud Editionen: Oracle Database Cloud Services

Spezifikationen

	Exadata Express	Database - *EC*	Database - *BM*	Exadata
Editions	EE with Lockdown	SE2, EE, HP, EP	SE2, EE, HP, EP	EP
Implementation	1 PDB in Shared CDB	1 Dedicated CDB	1 + Dedicated DBs	1 + Dedicated DBs
Management	Oracle	Customer	Customer	Customer
Max DB size	5G, 20G, 50GB	50GB – 11.2TB	4.2TB – 9.6TB	42TB – Petabytes
CPU range	~1	1 – 16	2 – 36	16 – 272
Storage	Exadata,Flash:Fixed	ZFS Block: $0.50 per GB	Local NVMe:Fixed	Exadata,Flash:Fixed

Oracle Database Cloud Service – Optionspakete

Standard Edition 2 | Enterprise Edition | EE High Performance | EE Extreme Performance

- Vollständige Datenbank
- Limitiert auf 16 OCPUs
- Enthält Transparent Data Encryption

- All Standard EE-Features (z.B. Parallel Queries)

Multitenant

Partitioning

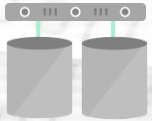
Advanced Compression

Advanced Security, Label Security, Database Vault

Real Application Testing

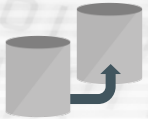
OLAP, Analytics, Spatial and Graph

Management Packs



RAC
RAC One Node

In Memory



Active Data Guard

Agenda

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Vielen Dank für Ihre Aufmerksamkeit!

Holger Bruchanski
Senior Business Consultant
holger.bruchanski@md-consulting.de
www.md-consulting.de
MD Consulting & Informationsdienste GmbH