

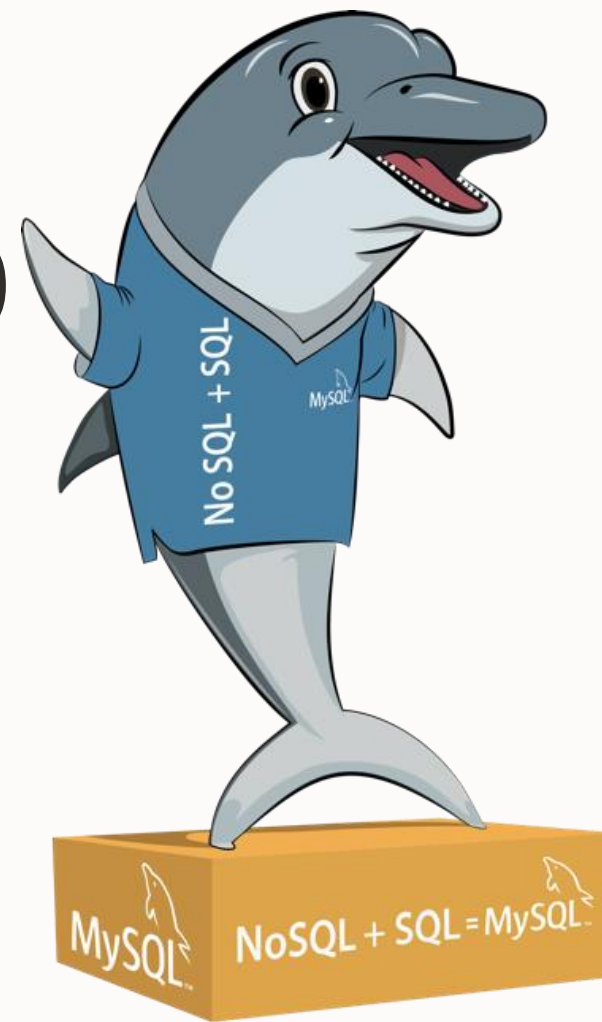
ORACLE

漫步云端 - MySQL Database Service (MDS) 和HeatWave极致加速引擎

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MySQL Solution Engineering Team

MySQL Global Business Unit





MySQL是什么？

全球最受欢迎的开源数据库

LAMP 技术堆叠中的“M”

- 网络应用实际上的标准数据库

由Oracle公司所发展和支持

- MySQL 是一个database management system.
- MySQL 是关系式,文件式,和地理数据库.
- MySQL 是开源软件.
- MySQL有很好的速度,可靠性,扩展性和易用性
- MySQL可用于client/server或嵌入式系统.
- 有大量贡献的MySQL软件可用

MySQL 8.0 Reference Manual 1.2.1 What is MySQL?

<https://dev.mysql.com/doc/refman/8.0/en/what-is-mysql.html>



MySQL Database Service – MDS是什么？

由甲骨文云所提供的全球第一的开源数据库服务

- 100%由Oracle MySQL团队所开发,管理和支持
- 100%和部署在本地的MySQL相容降低被锁定的风险
- 唯一整合高性能,数据都在内存的查询加速器-HeatWave的MySQL云服务
- 以MySQL企业版为基础,自动更新最新的安全修正
- 由技术专家提供 24/7支持服务,他们背后有OCI和MySQL开发团队的支持

架构和技术

MySQL Database Service with HeatWave



MySQL Database Service 加上 HeatWave

单一资料库,同时做OLTP 和 OLAP

MySQL Database Service (MDS)

- 100% 由Oracle的MySQL 团队, 所管理和支持
- Amazon RDS成本的1/3
- 在所有的OCI commercial regions都有MDS
- 很容易由本地的MySQL和 Amazon RDS迁移到MDS
- 10 E3 Shapes: 固定的OCPU和内存, 最大的shape 是 `MySQL.VM.Standard.E3.64.1024GB`

HeatWave

- 只在OC上提供的功能
- 独特的, 整合在MDS 之下的**查询加速器**
- 原由Oracle Labs 的RAPID专案, 现在整合到MDS
- HeatWave最快且最便宜的BI引擎服务
 - Amazon Aurora: 快1000倍, 只有1/3 的价钱
 - Amazon Redshift: 快2.7倍, 只有1/3 的成本
- 专用的配置:
`MySQL.HeatWave.VM.Standard.E3`

MDS Shapes

Browse All Shapes

☒	MySQL.VM.Standard.E3.1.8GB	No	1	8 GB
☐	MySQL.VM.Standard.E3.1.16GB	No	1	16 GB
☐	MySQL.VM.Standard.E3.2.32GB	No	2	32 GB
☐	MySQL.VM.Standard.E3.4.64GB	No	4	64 GB
☐	MySQL.VM.Standard.E3.8.128GB	No	8	128 GB
☐	MySQL.VM.Standard.E3.16.256GB	No	16	256 GB
☐	MySQL.VM.Standard.E3.24.384GB	No	24	384 GB
☐	MySQL.VM.Standard.E3.32.512GB	No	32	512 GB
☐	MySQL.VM.Standard.E3.48.768GB	No	48	768 GB
☐	MySQL.VM.Standard.E3.64.1024GB	No	64	1,010 GB
1 Selected				Showing 12 Items

Don't see the shape you want? [View your service limits and request an increase](#)

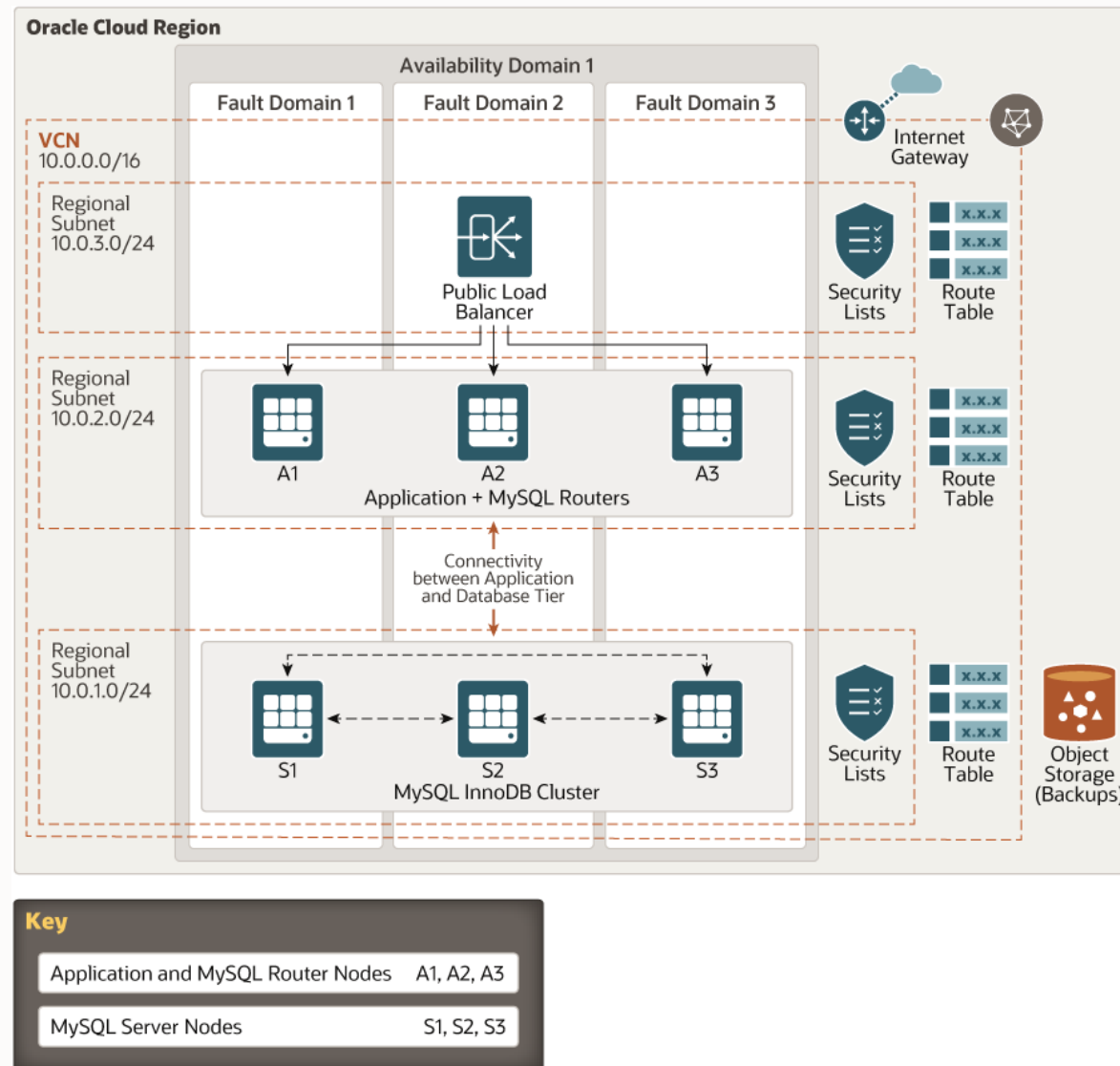
Select a Shape

[Cancel](#)

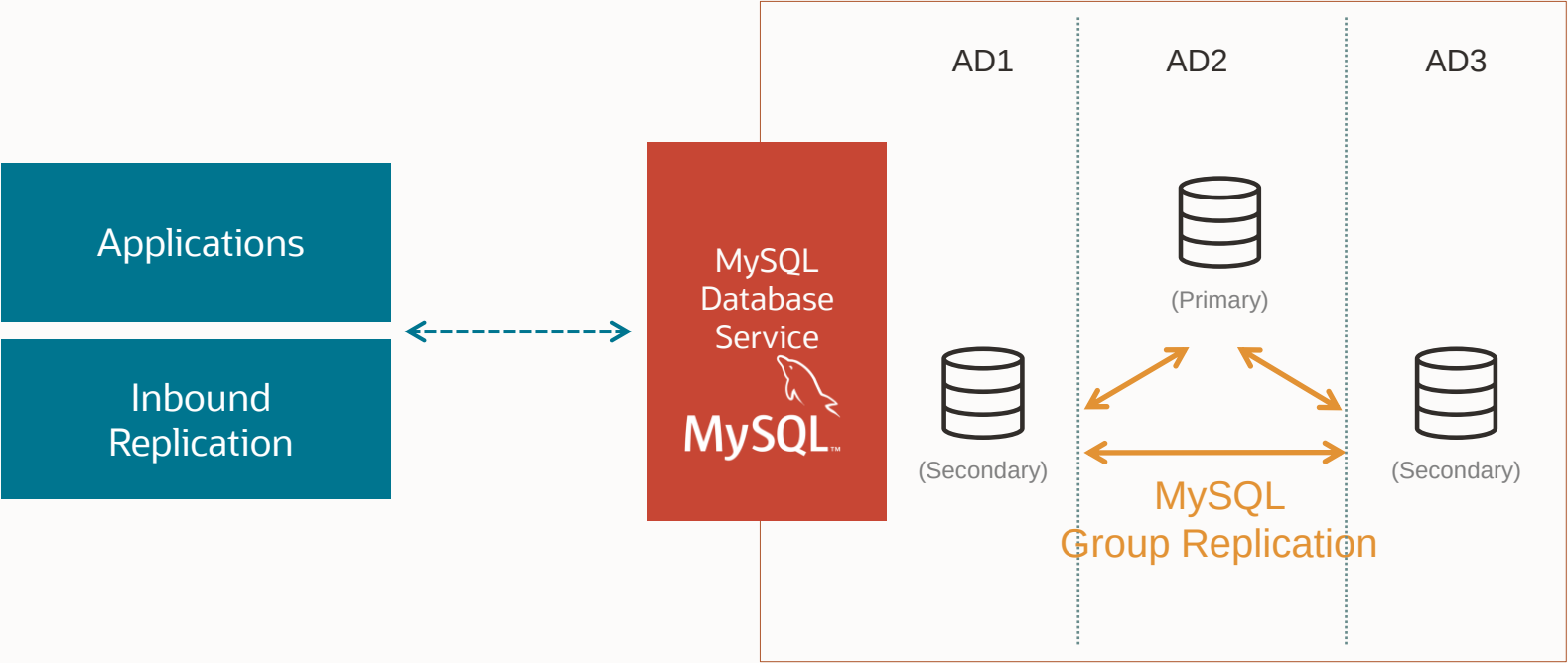
We are change pricing model to vCPU: <https://www.oracle.com/cloud/price-list.html#mysql>



范例架构: MySQL Database Service



MySQL Database Service:布署在多个可用域



跨故障和可用域部署
无缝集成复制到MySQL服务中
发生故障时不会丢失数据 (RPO=0)
在线和快速故障转移 (RTO=1分钟)



MySQL Database Service: 高可用

具有自动故障移转和零数据丢失的容错数据库

- 点一下就能创建一个高可用数据库
- 自动故障移转
- 增进服务水平
- 降低在故障移转时的下线时间 (RTO: Minutes)
- 故障移转时零数据丢失 (RPO: Zero)

Create MySQL DB System

Standalone

Single-instance MySQL DB System

High Availability

Run 3-node MySQL DB System providing automatic failover and zero data loss



高可用: Group Replication

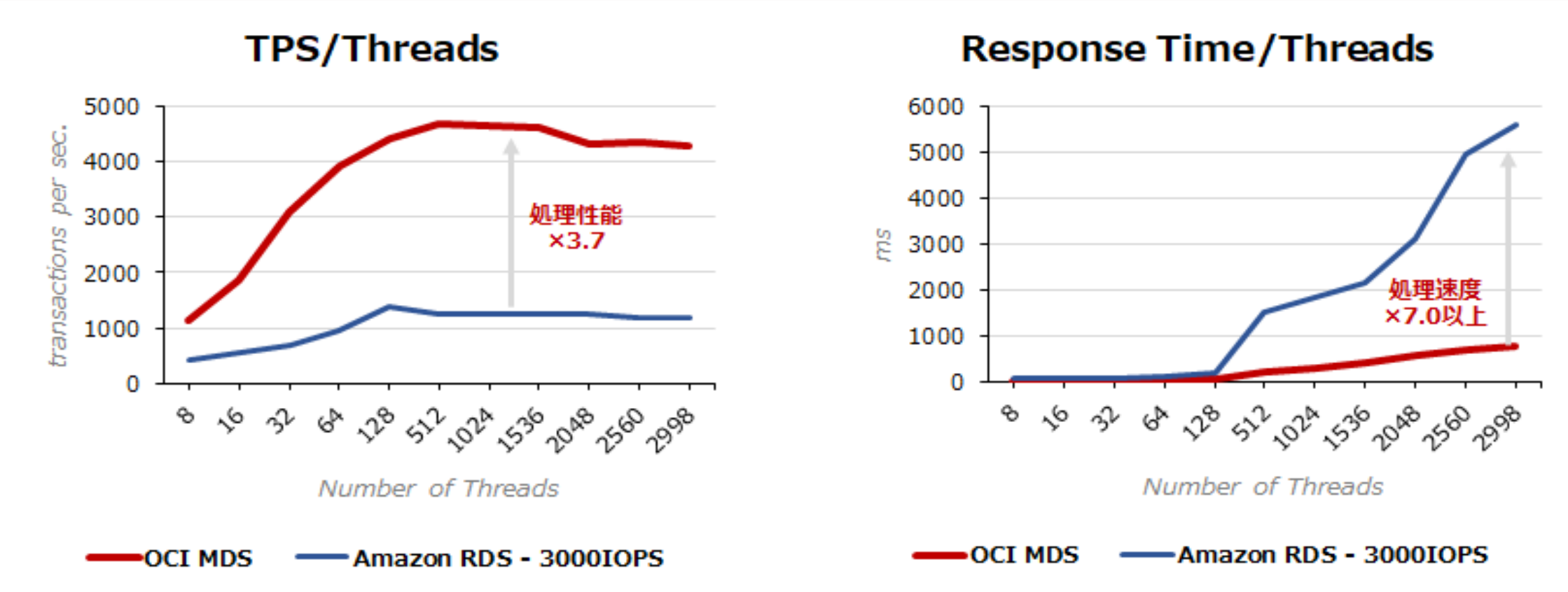
MySQL Database Service

- 建在MySQL Group Replication之上:
 - 提供分布式,在服务器之间强协作的状态复制.
 - 服务器间用以Paxos为基础自动协作
 - 逻辑复制
- MySQL原生的,久经考验的MySQL 技术 (binary log 和 replication)
- 由MySQL工程团队所开发
- 也是MySQL InnoDB Cluster的核心技术
- 目标RTO in minutes, RPO=0



单机MDS和AWS RDS的性能的对比

- <https://blog.s-style.co.jp/2021/02/7329/>

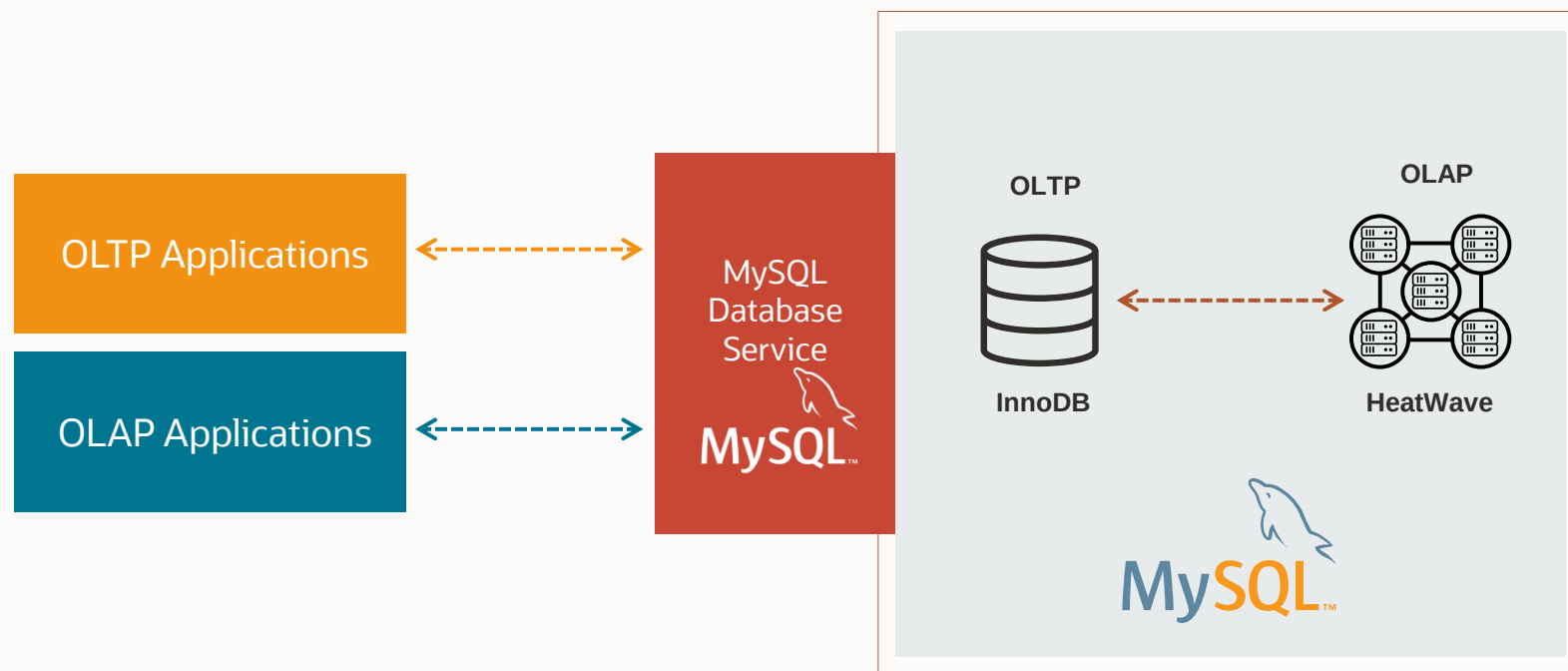


RDS	-Db.r6g.4xlarge (16个vCPU / 128GB) -MySQL 8.0.21 (最新可选版本) -存储：预置SSD 200GB (3000IOPS) / 300GB (15000IOPS) (* 2)
sysbench执行服务器 (EC2)	• T3a.xlarge (4个vCPU / 16GB RAM) • 存储：200GB (* 1) • NW带宽：最大5 Gbps

MDS	-MySQL.VM.Standard.E3.8.128 (8个OCPU / 128GB) -MySQL 8.0.22-存储空间：200GB
sysbench执行服务器 (Compute Instance)	• VM.Standard.E3.Flex (4个OCPU / 16GB RAM) • 存储：200GB (* 1) • NW带宽：4 Gbps

MySQL Database Service 加上 HeatWave

Easily run high performance analytics against your MySQL database, no ETL required



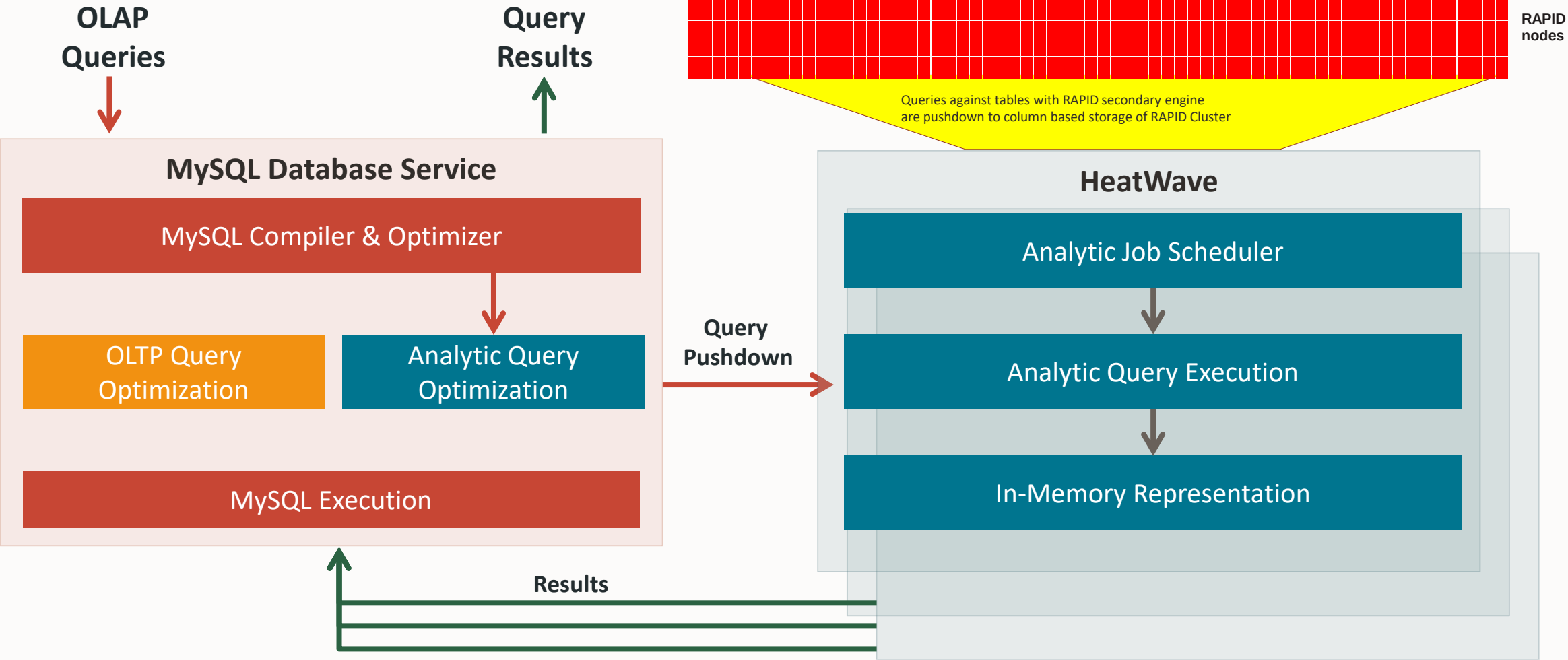
用于OLTP和分析应用程序的单一MySQL数据库

所有现有的应用程序无需任何更改即可工作

卓越的性能：比MySQL快400倍，可扩展到数千核

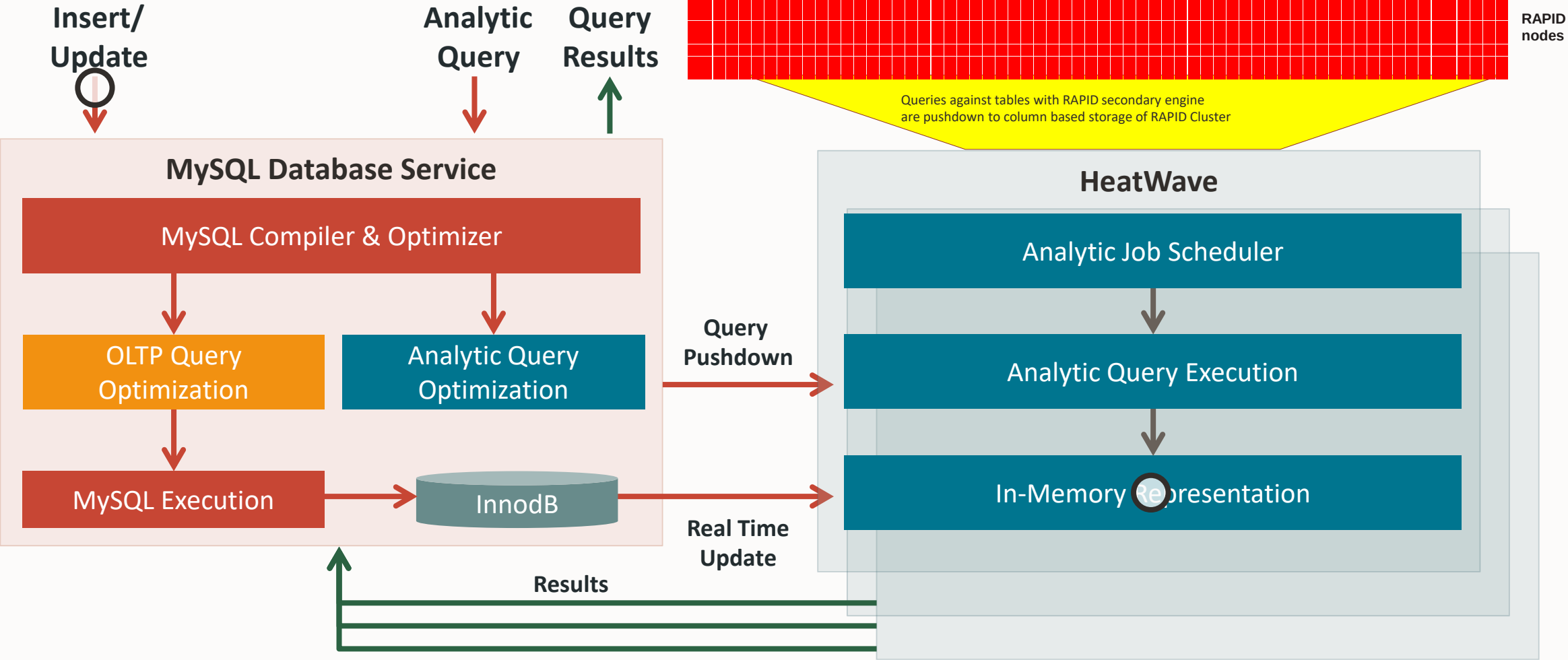


HeatWave:原生的高性能内存分析

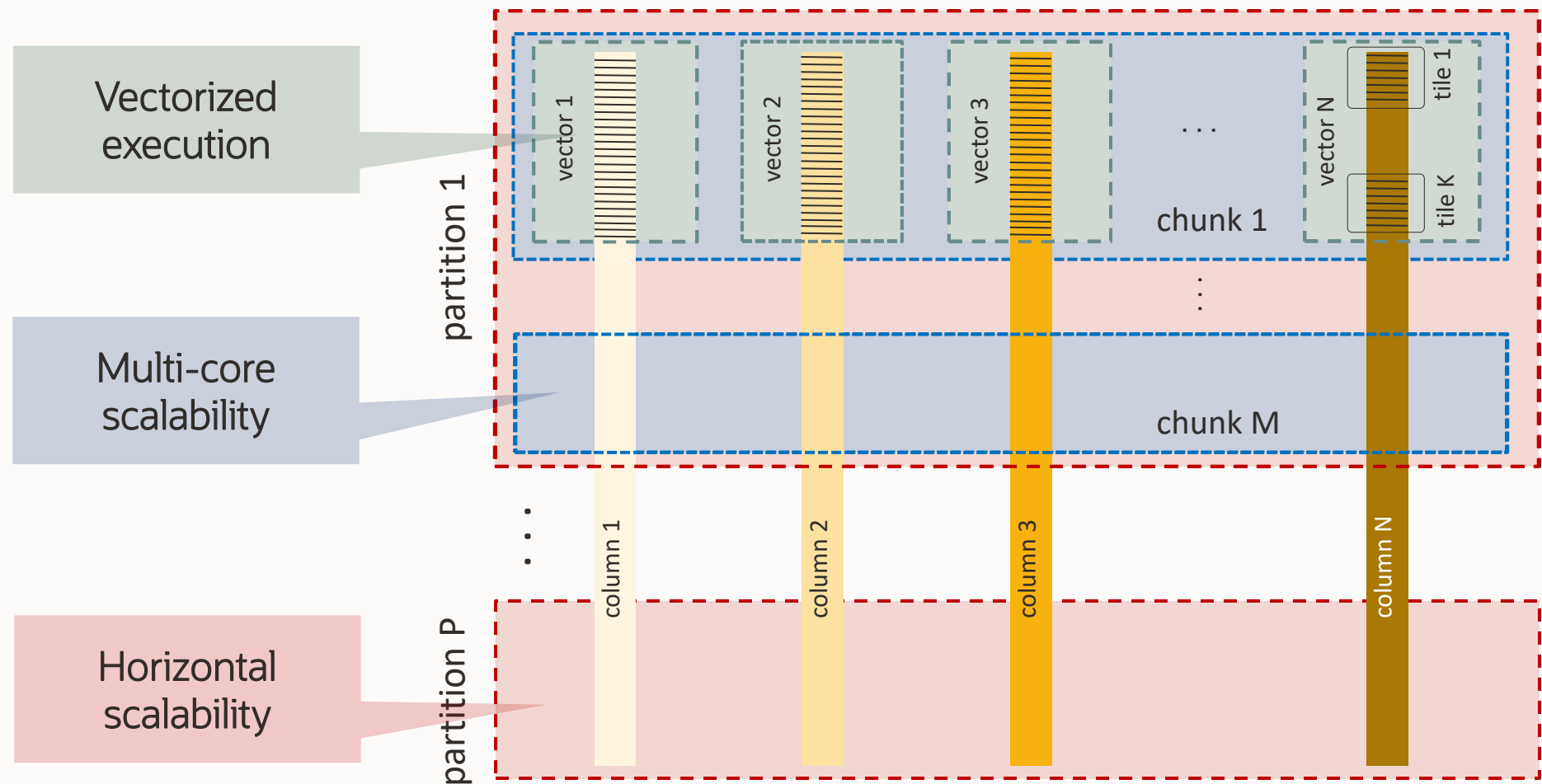


HeatWave:实时分析

插入MySQL的数据可以在一秒内进行分析查询

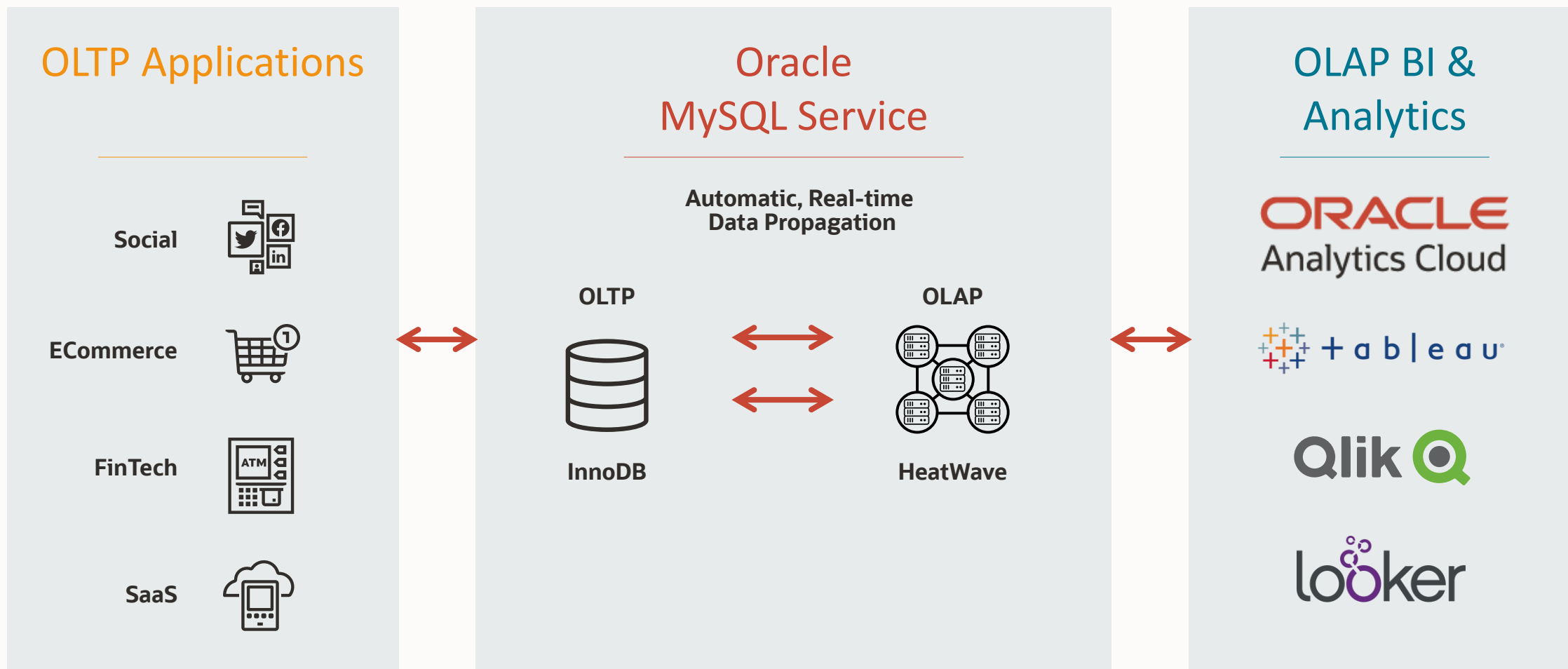


1. 内存中混合列式处理

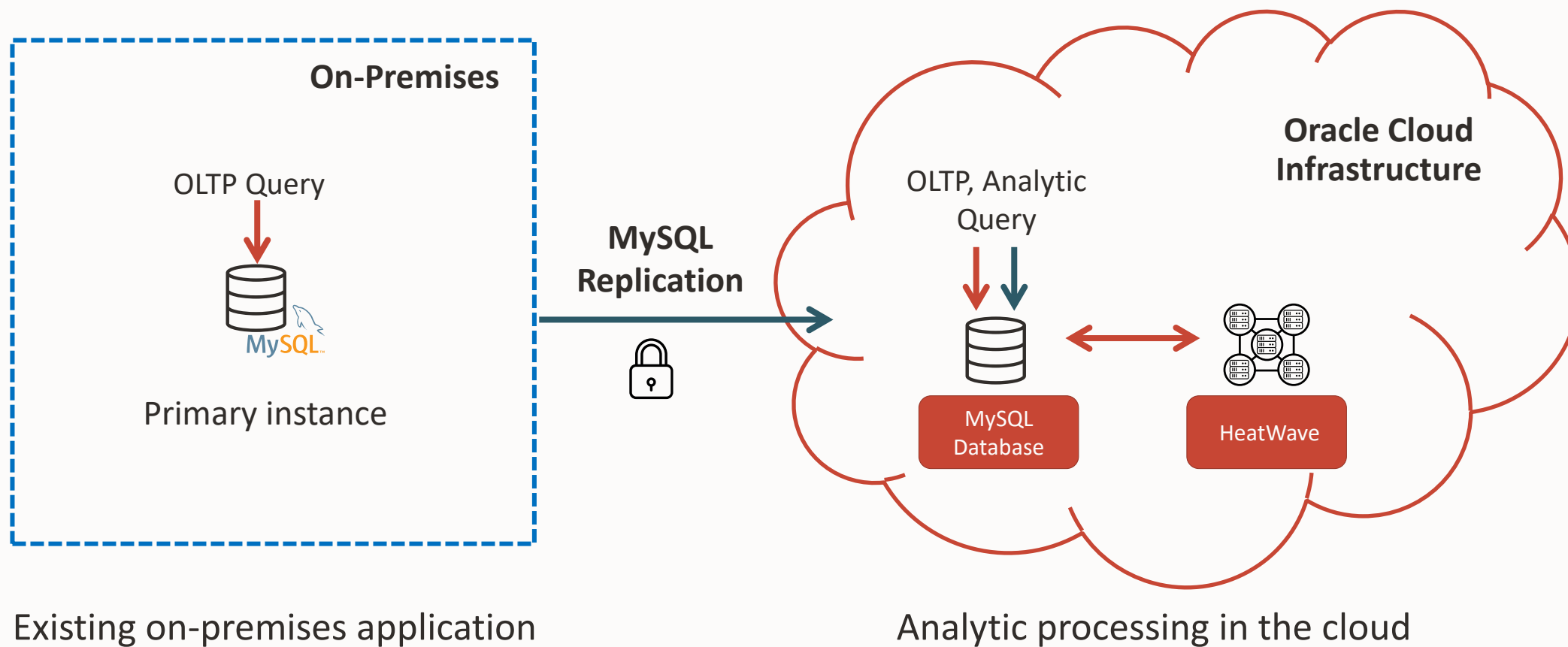


所有和MySQL相容的分析工具,都能不做修改就能用HeatWave

MySQL数据库无需ETL可以轻松运行高性能分析

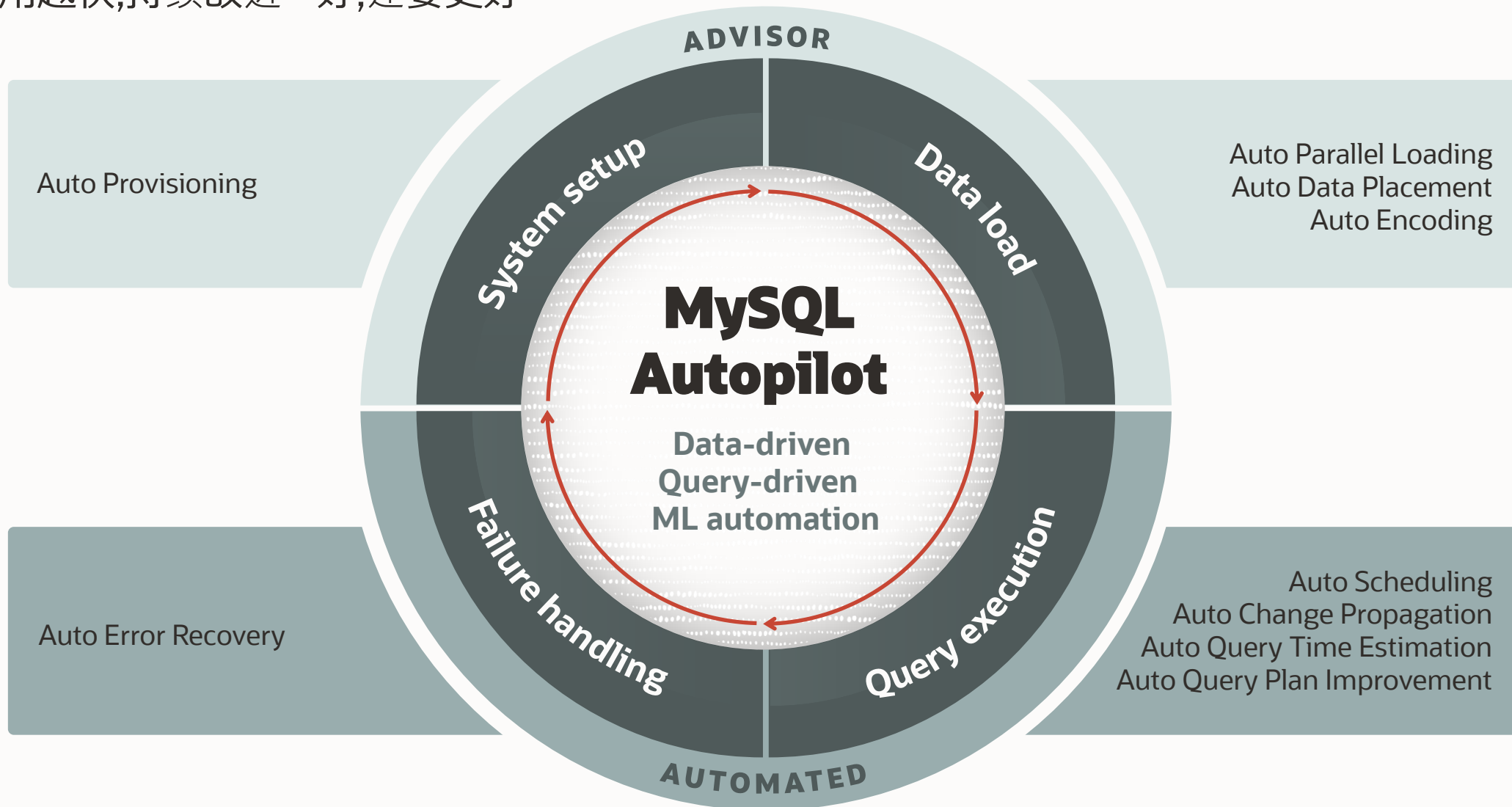


您的地端的MySQL以复制的方式就能使用HeatWave



MySQL HeatWave以machine-learning为基础的自动化

越用越快,持续改进 - 好,还要更好



MDS/HeatWave演示

演示

1. 试试看HeatWave能带来多大的性能提升?

- `select count(*) from patient;`
- `explain select count(*), continental from country c,patient pt, province p where p.countryid=c.id and pt.provinceid=p.id group by continental order by continental;`
- `select count(*), continental from country c,patient pt, province p where p.countryid=c.id and pt.provinceid=p.id group by continental order by continental;`
- `set @@use_secondary_engine=off;`

2. 由OAC仪表板看到是什么状况?

- <https://chuncheon3-idazzjlcjqzj-yn.analytics.ocp.oraclecloud.com/ui/>
- `alter table patient secondary_unload;`



竞争分析



MySQL Database Service的优势

100% 由OCI 和 MySQL 工程团队所支持,开发和维护

	Oracle MySQL Database Service	Amazon RDS / Aurora
支持服务	• 以MySQL engineering team为后盾 • 包括Consultative Support	• 不是由MySQL engineering 团队所支持 • 技术支持要额外的成本
版本和功能	• 100% 建于MySQL 企业版之上	• 是MySQL 社区版的分支 • 不是所有的功能都支持
Updates	• 自动上最新的由MySQL开发团队提供的安全修正版	• 不是最新的版本或无法即时的取得错误修正
Compatibility	• 100% 和地端的MySQL相容	• 不保证和MySQL的主流相容 • 有被锁定的风险
Analytics	• 完全和HeatWave整合	• 可能带外部的方案,例如 Redshift

1. 所有MySQL Server 的功能都具备,有部份企业版的功能,例如线程池等
 2. 无被锁定的风险, 享有开源系统的开放性
 3. 同一个库做OLTP 和 OLAP
- 成本只有Amazon RDS的三分之一



MySQL Database Service: 价格

Comparison US\$ per Month (PAYG)

	MySQL Database Service	AWS RDS MySQL	Azure MySQL	Google CloudSQL MySQL
Standard memory per Physical core/month	\$41.37 Standard.E3 AMD Rome (8GB/core)	+208% \$127.22 M5 Intel (8GB/core)	+217% \$ 130.94 General Purpose Intel (10GB/core)	+160% \$ 107.58 N1-standard Intel (7.5GB/core)
High memory per Physical core/month	\$54.46 Standard.E3 AMD Rome (16GB/core)	+228% \$ 178.56 R5 Intel (16GB/core)	+224% \$ 176.33 Memory Optimized Intel (20GB/core)	+157% \$ 140.17 N1-highmem Intel (13GB/core)
Storage (Data) per GB/month	0.040	+188% 0.115 General Purpose (SSD) Storage	+188% 0.115 General Purpose/Memory Optimized Storage	+325% 0.170 SSD provisioned
Backup per GB/month	0.040 (with free quota)	+138% 0.095 (with free quota)	+150% 0.100 (with free quota)	+100% 0.080 (no free quota)



MySQL Database Service 和 Ali RDS的成本比较

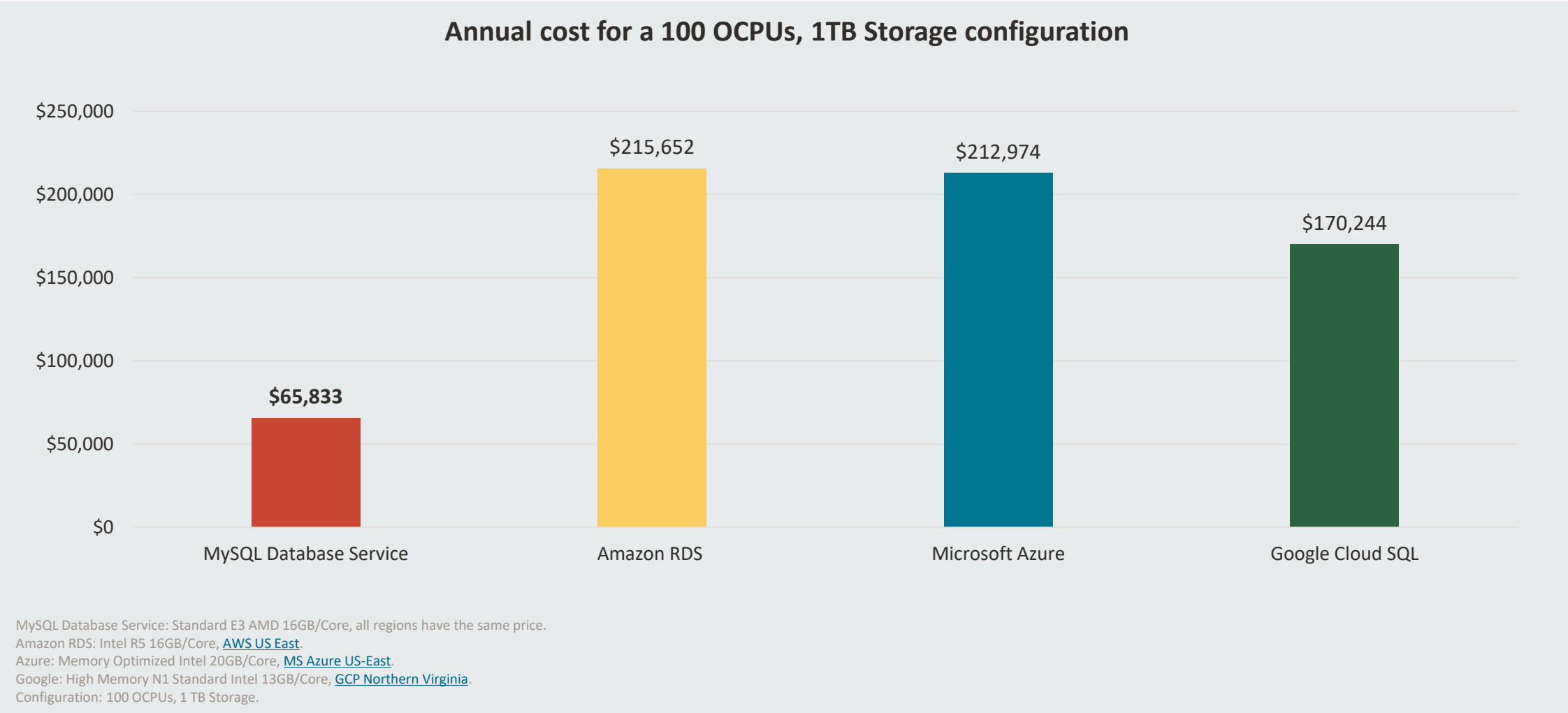
Comparison US\$ per Month (PAYG)

	MySQL Database Service 单机和高可用	阿里云 MySQL RDS 金融版
单机,低内存 per Physical core/month	\$45 Standard.E3 AMD, 1 OCPU (equivalent to 2vCPU) 8GB RAM, 100 GB Storage, 6,000 IOPS	+ 0 % \$45 (CNY 290) mysql.n4.medium.1, 2 vCPU, 8GB RAM
高可用低内存 per Physical core/month	\$135 (45 * 3) Standard.E3 AMD, 1 OCPU (equivalent to 2vCPU) HA 16GB RAM, 100 GB Storage, 6,000 IOPS	+38% \$186 (CNY 1200) Financial Edition mysql.n2.large.25, 2vCPU, 8GB RAM, 5,000 IOPS
高可用高内存 per Physical core/month	\$351 (117 * 3) Standard.E3 AMD, 2 OCPU (equivalent to 4vCPU) HA 32GB RAM, 200 GB Storage, 12,000 IOPS	+86% \$652 (CYN 4020) Financial Edition mysql.x8.large.3, 4vCPU, 32GB RAM, 9,000 IOPS
存储 (Data Storage) per GB/month	\$ 0.040 /1GB Month, NVMe Storage	+375% \$ 0.19 /GB Month General Purpose (SSD) Storage
附注	MDS HA是基于MySQL Group Replication	阿里金融版是基于MySQL Group Replication

Ali CPU and vCPU: <https://www.alibabacloud.com/help/tc/doc-detail/145895.htm>
 based on Ali N. China price scheme: <https://cn.aliyun.com/price/product#/rds/detail> , the price will be +50% if use data center outside of China
 Ali RDS is count with vCPU: <https://www.enterprisestorageforum.com/products/alibaba-apsaradb-product-overview-and-insight/>
 Currency rate is based on 16th Sept. exchange rate

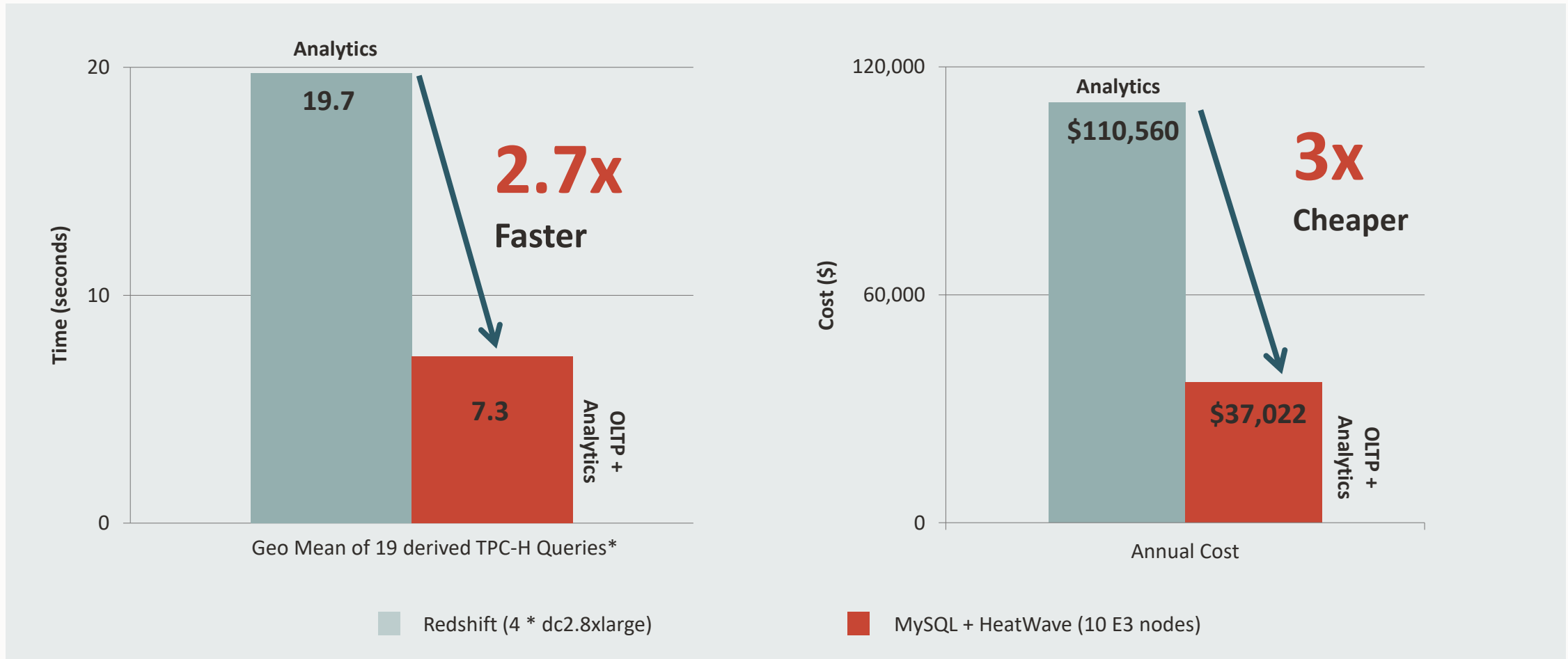


MySQL Database Service 更少的总成本



MySQL + HeatWave 和 Amazon Redshift最快的实例的比较

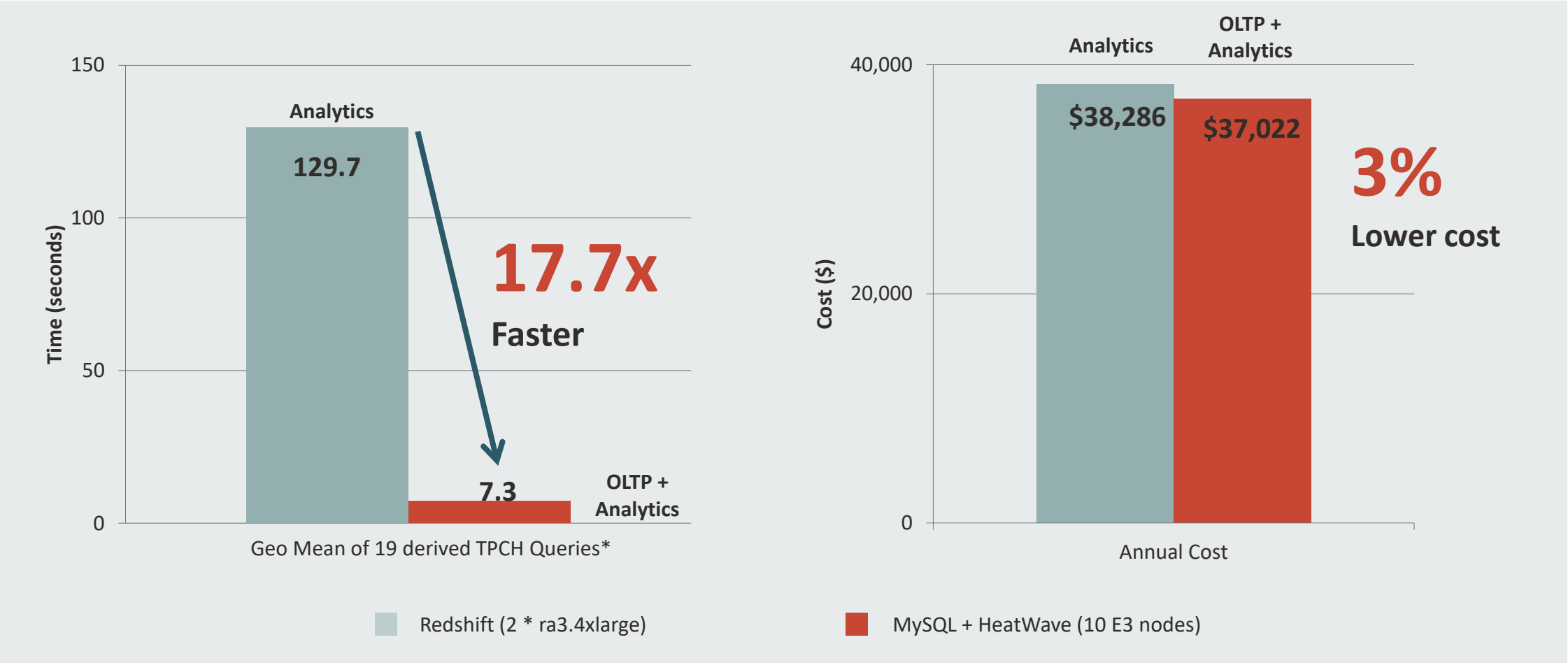
4TB



*Benchmark queries are derived from the TPC-H benchmark, but results are not comparable to published TPC-H benchmark results since they do not comply with the TPC-H specification

MySQL + HeatWave 和 Amazon Redshift的低成本实例的比较

4TB



*Benchmark queries are derived from the TPC-H benchmark, but results are not comparable to published TPC-H benchmark results since they do not comply with the TPC-H specification



Oracle Cloud Cost Estimator: MySQL Database Service

<https://www.oracle.com/cloud/cost-estimator.html>

▼ Oracle MySQL Database Service	\$37	
▼  MySQL Database	\$37	
Utilization		
▶ Number of Instances / 1 Instance(s)		
▶ Average Days Usage per Month / 31 day(s)		
▶ Average Hours Usage per Day / 24 hour(s)		
Configuration		
▶ MySQL Database - Standard - E2 - OCPU Per Hour (B92425) / 1 Ocpu Per Hour		\$35
▶ MySQL Database - Storage - Gigabyte Storage Capacity per Month (B92426) / 50 Gigabyte Storage Capacity Per Month		\$2
▶ MySQL Database - Backup Storage - Gigabyte Storage Capacity per Month (B92483)		\$0

注意:记忆体的配置必需和OCPU数配套(参考 [MDS Shapes](#)),不能随意给一数值



The background features a stylized illustration of a fish swimming in water. The fish is depicted with a red body and a blue outline, positioned in the upper right quadrant. The water is represented by horizontal wavy lines in shades of blue and green. The sky is a light blue gradient. The overall design is clean and modern.

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迁移过程

AWS RDS MySQL -> MySQL Database Service

MySQL Database Service

Migration tools

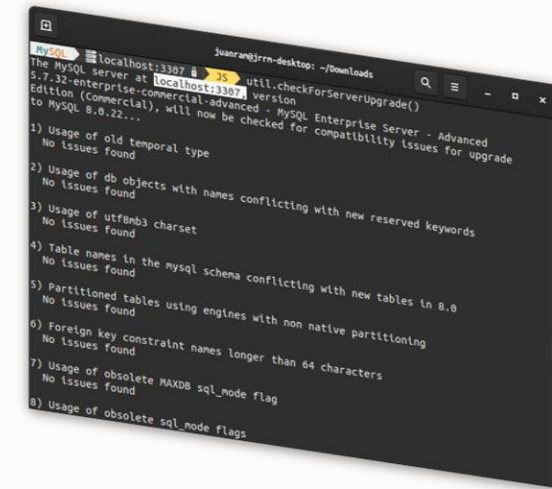
异质数据源:

- Oracle Golden Gate



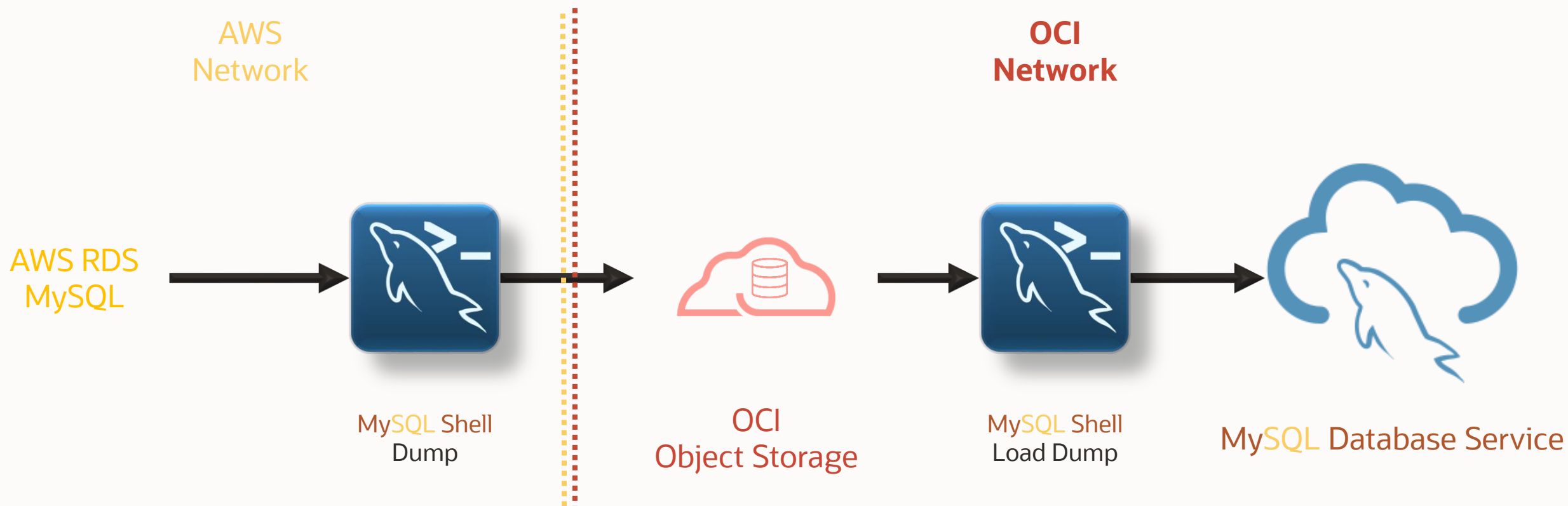
MySQL 和 以MySQL为基础的数据源

- MySQL Shell做初步的数据传输
 - MySQL 5.6, 5.7, 8.0
 - AWS RDS 和 Aurora-MySQL
- 事后的数据同步
 - MySQL 主从复制及MDS Channel (inbound replication)
 - Oracle Golden Gate



MySQL Shell 做数据初步迁移

Process overview



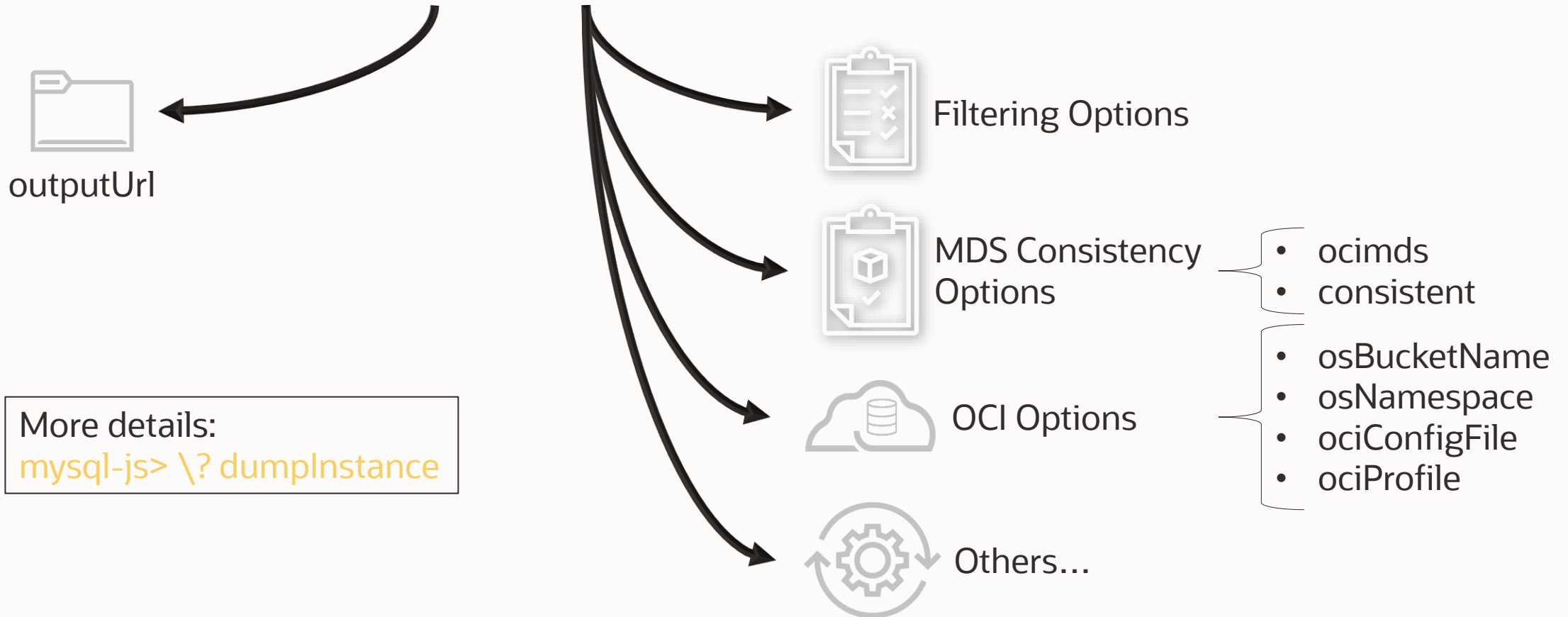
Download MySQL Shell: <https://dev.mysql.com/downloads/shell/>



以MySQL Shell 自AWS导出数据

Dump syntax overview

SYNTAX: `util.dumpInstance( outputUrl ,options )/util.dumpSchema()/util.dumpTable()`



RDS > Object Storage



```
util.dumpSchemas(["world_x"], "world_x", {  
  dryRun: false,  
  showProgress: true,  
  threads: 4,  
  ocimds: true,  
  "osBucketName": "bucket-xxxxxx",  
  "osNamespace": "xxxxxx",  
  ociConfigFile: "D:\\oci.config",  
  "compatibility": ["strip_definers"],  
  "ociParManifest": true,  
  "consistent" : false})
```

Object Storage » Bucket Details



bucket-2021-01-20-covid19

Edit Visibility Move Resource Re-encrypt Add Tags Delete

Bucket Information Tags

Visibility: Private

Namespace: idazzjlcqzj

Default Storage Tier: Standard

Auto-Tiering: Disabled Edit

Approximate Count: 616 objects

E Tag: d77ec5e3-06ba-406b-bf78-ba6475a1ebff

Encryption Key: Oracle managed key [Assign](#)

Created: Wed, Jan 20, 2021, 09:33:48 UTC

Compartment: [IvanTu-Sandbox](#)

Approximate Size: 701.03 MiB

Emit Object Events: Disabled Edit

Object Versioning: Disabled Edit

} Object Storage
Bucket Info.

—————→ To import data when creating MDS instance

由key file产生fingerprint





第一种导入方式:以MySQL Shell载入到开好的MDS

Dump Load syntax overview

SYNTAX: `util.loadDump( inputUrl, options )`



inputUrl



Filtering Options



OCI Options



Others...

- osBucketName
- osNamespace
- ociConfig
- ociProfile

More details:

```
mysql-js> \? loadDump
```

第二种导入方式-在建新MDS时自Object Storage Import



Create MySQL DB System

Configure Backup Plan

Enable Automatic Backups ☒

Enables automatic backups. You must also specify a retention period, and select a backup window.

Backup retention period *Optional*

The Retention Period defines how long to store the backups, in days. ⓘ

7

Select Backup Window ☐

The backup window start time defines the start of the time period during which your DB System is backed up.

[Hide Advanced Options](#)

Configuration Management Networking **Data Import** Tables

PAR Source URL *Optional* ⓘ

Define the PAR source URL of the file to be imported from Object Storage.

[Click here to create a PAR URL for an existing MySQL Shell dump file \(@.manifest.js\)](#)

Create Cancel

Create PAR for existing MySQL Shell dump manifest

ⓘ This feature works with MySQL Shell dump files exported to Object Storage. [Learn more](#)

Select a bucket in **IvanTu-Sandbox** ⓘ [\(Change Compartment\)](#)

bucket-20210819-aws-migrate

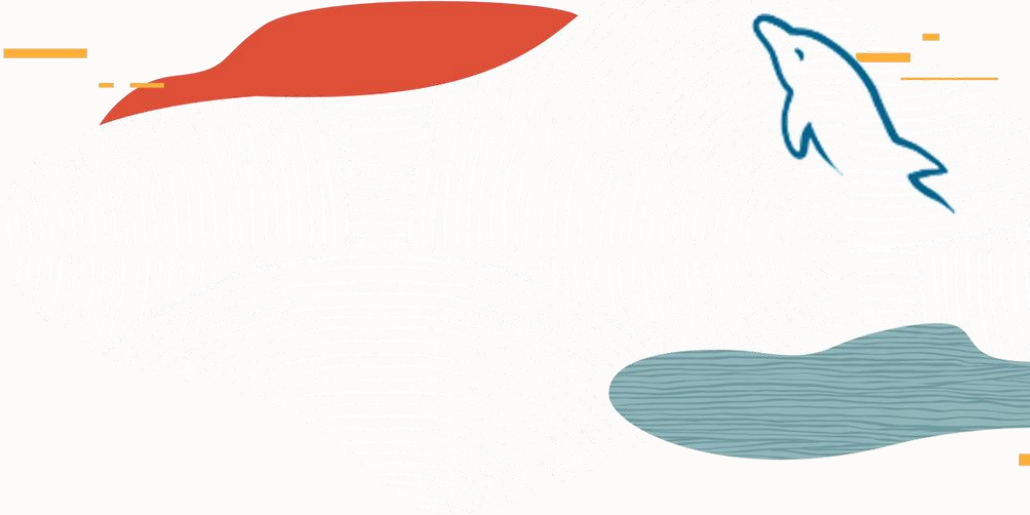
Select a MySQL Shell dump manifest file ⓘ

world_x/@@.manifest.json *util.dumpSchema时所产生的manifest档*

Specify an expiration time for the PAR ⓘ

1 Week

Create and set PAR URL Cancel



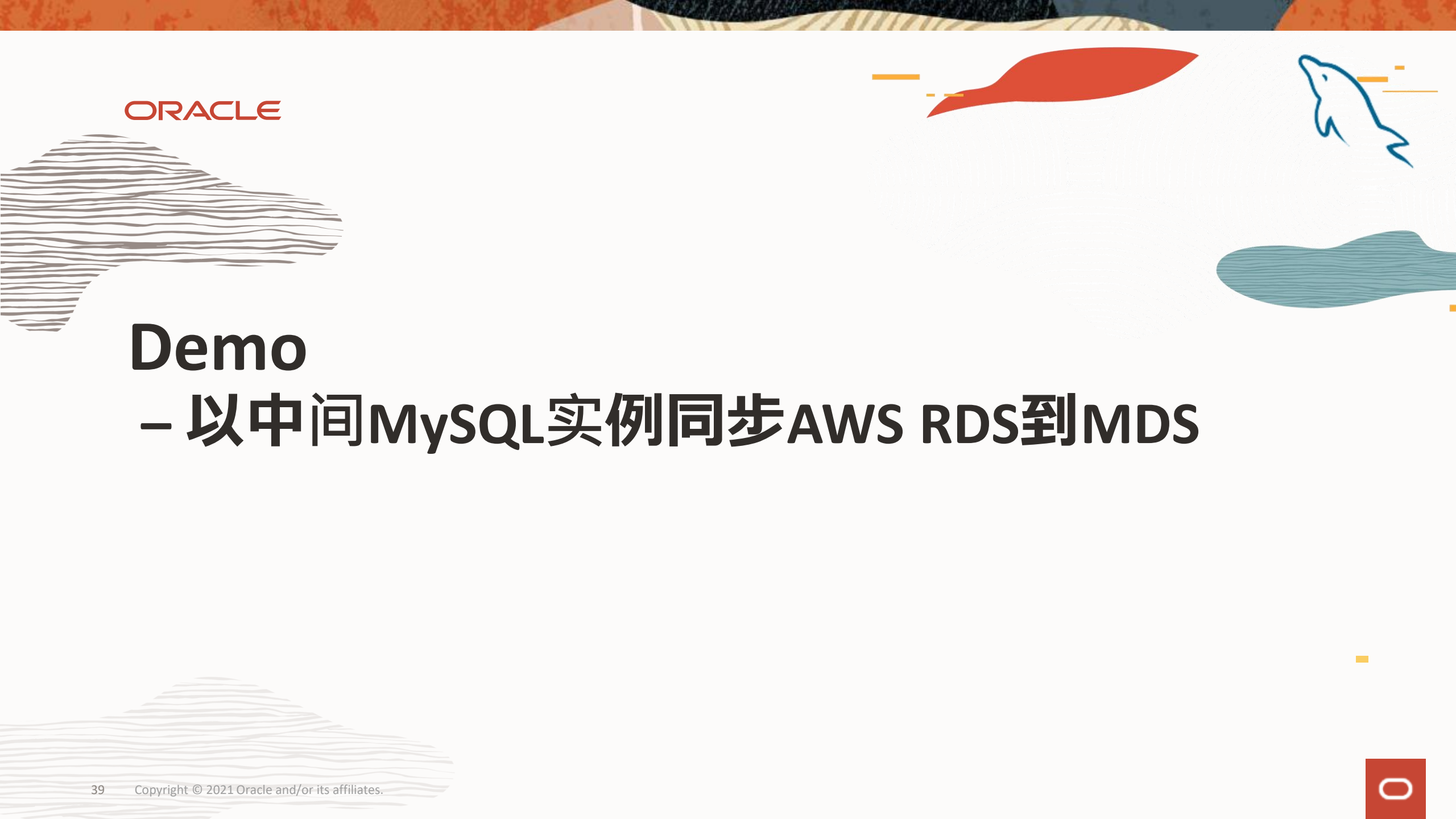
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演示 – 第一次将AWS RDS数据导入MDS

事后的同步



1. 用MySQL Replication到中间MySQL(以筛掉mysql schema的数据),再以MDSChannel同步到MDS
2. 用Oracle GoldenGate同步



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Demo

– 以中间MySQL实例同步AWS RDS到MDS

感谢您!
请您指教



有兴趣进一步了解MDS/HeatWave请洽甲骨文销售,或到以下网址要求MySQL Performance Health Check
<https://www.mysql.com/news-and-events/health-check/>

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