

Internal Cloud vs. External Cloud: A Database Perspective

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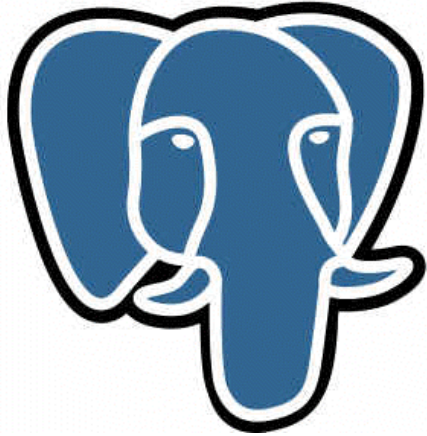
UC BERKELEY INTERNAL CLOUD

Kellie Hobbs, UCCSC 2016

A photograph of the Campanile tower at UC Berkeley during sunset. The tower is illuminated from within, and the sky is a mix of orange, pink, and blue. The city lights are visible in the background.

UC Berkeley IST Database Services

PostgreSQL



Microsoft®
SQL Server®



ORACLE®

176 Database VMs Supported

Hosts (VMs) Supported

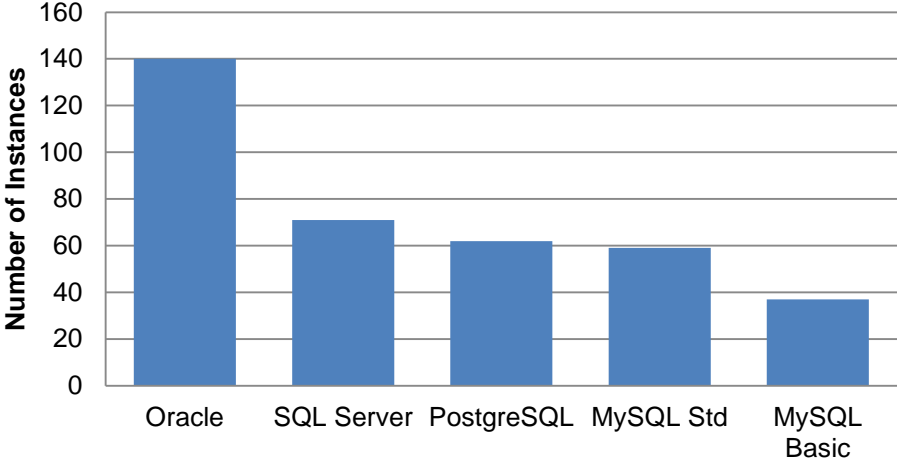


Each of these “servers” is a VM hosted on our internal cloud.

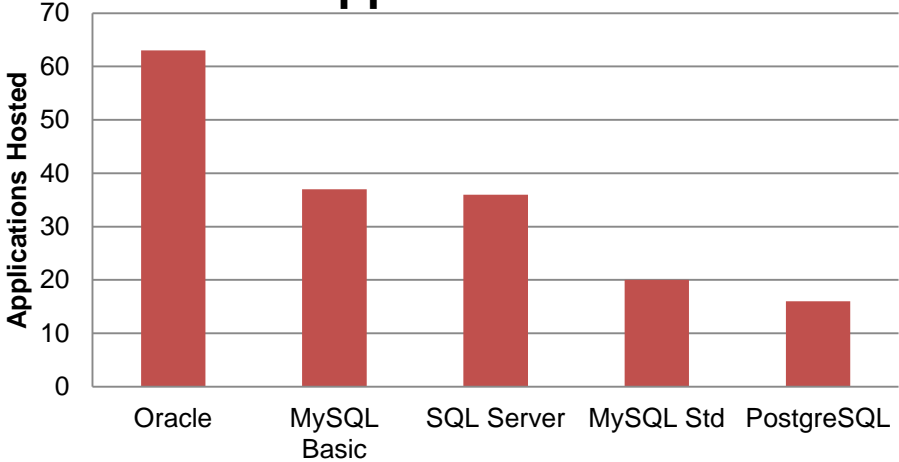
Over 40 TB of Managed Database space

300 managed database instances, running over 200 different applications.

Database Instances Supported



Applications




ServiceNow: Support

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Berkeley Campus Shared Services and IST
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Cal Time

AMAZON RDS AT CDL

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Amazon RDS Supported Databases

 <p>Amazon Aurora</p>	<h2>MySQL</h2> <p>MySQL Community Edition</p> <p>Select</p>
 <p>MySQL</p>	<p>MySQL is the most popular open source database in the world. MySQL on RDS offers the rich features of the MySQL community edition with the flexibility to easily scale compute resources or storage capacity for your database.</p>
 <p>MariaDB</p>	<ul style="list-style-type: none">• Supports database size up to 6 TB.• Instances offer up to 32 vCPUs and 244 GiB Memory.• Supports automated backup and point-in-time recovery.• Supports cross-region read replicas.
 <p>PostgreSQL</p>	
 <p>ORACLE</p>	
 <p>Microsoft SQL Server</p>	

Standard CDL Configuration

- Every service has its own database instances
 - Development
 - Stage
 - Production
- Multi-AZ configuration for stage and production
- Standard instance types
- Naming conventions (rds-ias-demo-stg)
- Tags: Program, Service, Environment
- Snapshot retention (7-14-35 days)
- Standard/custom VPC security groups
- SNS event notifications

RDS Instance Configuration - 1

Instance Specifications

DB Engine mysql

License Model

DB Engine Version



Review the [Known Issues/Limitations](#) to learn about potential compatibility issues with specific database versions.

DB Instance Class

Multi-AZ Deployment

Storage Type

Allocated Storage* GB

Provisioned IOPS

Settings

DB Instance Identifier*

Master Username*

Master Password*

Confirm Password*

Example RDS Instance Types

Class	vCPU	Memory	EBS Optimized	Network
db.t2.small	1	2	-	Low
db.t2.medium	2	4	-	Moderate
db.m4.large	2	8	Yes	Moderate
db.m4.xlarge	4	16	Yes	High
db.m4.2xlarge	8	32	Yes	High
db.m4.10xlarge	40	160	Yes	10 Gigabit
db.r3.large	2	15	-	Moderate
db.r3.xlarge	4	30.5	Yes	Moderate
db.r3.2xlarge	8	61	Yes	High
db.r3.8xlarge	32	244	-	10 Gigabit

RDS Instance Configuration - 2

Network & Security



VPC*	Default VPC (vpc-eaf21f8f) ▼
Subnet Group	cdl-stg-database-subnets ▼
Publicly Accessible	Yes ▼
Availability Zone	No Preference ▼
VPC Security Group(s)	MySQL custom (web-cdlib-stg) - CDL- ▲ MySQL from Dev/Stg/UCB/UCOP (VP SMTP from UCOP (VPC) VSFTP from UCOP - Dev-Stg-VPC (VI ▼

Database Options

Database Name	<input type="text"/>
---------------	----------------------

Note: if no database name is specified then no initial MySQL database will be created on the DB Instance.

Database Port	3306
DB Parameter Group	ias-default-mysql56 ▼
Option Group	default:mysql-5-6 ▼
Copy Tags To Snapshots	<input checked="" type="checkbox"/>
Enable Encryption	No ▼

RDS Instance Configuration - 3

Backup

Please note that automated backups are currently supported for InnoDB storage engine only. If you are using MyISAM, refer to detail [here](#).

Backup Retention Period days

Backup Window

Start Time : UTC

Duration hours

Monitoring

Enable Enhanced Monitoring

Monitoring Role

Granularity second(s)

I authorize RDS to create the IAM role rds-monitoring-role.

Maintenance

Auto Minor Version Upgrade

Maintenance Window

Start Day

Start Time : UTC

Duration hours

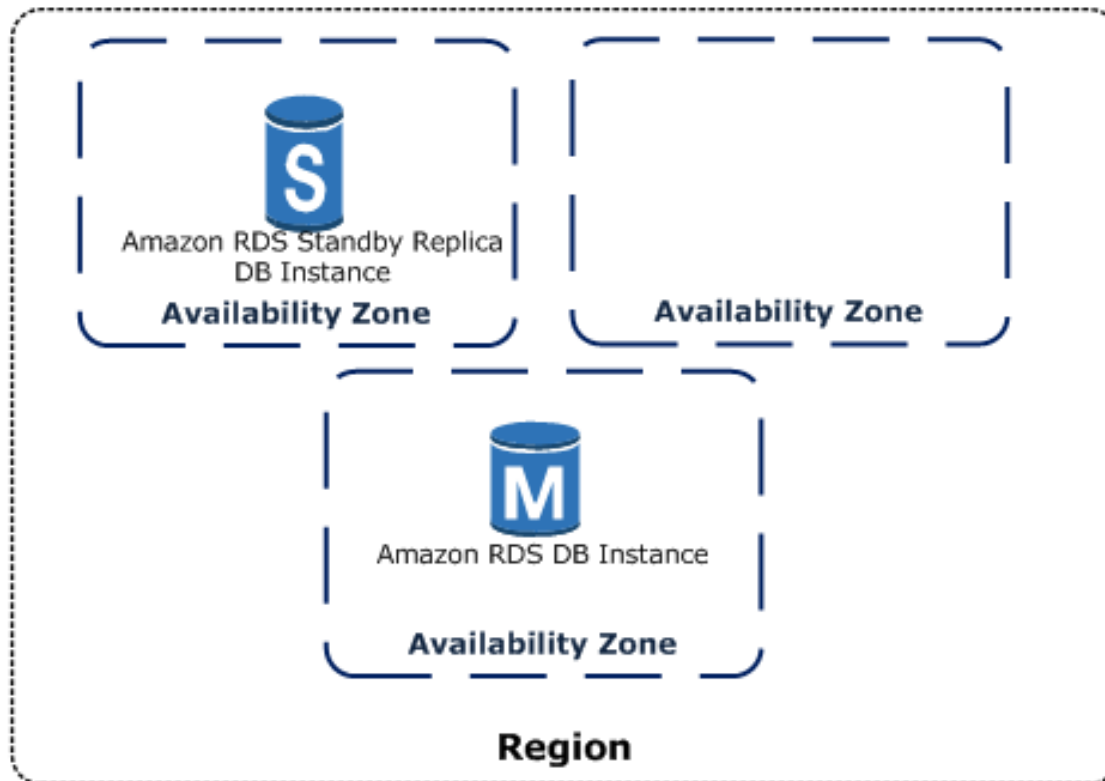
Tips

- Backup/Restore
 - Snapshot: Restore takes about 20 minutes (regardless of size)
 - Point-in-Time Restore: Takes longer, less data loss
- Performance monitoring/tuning
 - Database parameters based on instance type
 - SSD storage/provisioned IOPS
- Failover testing
- No SUPER privilege
- Timezone (UTC)

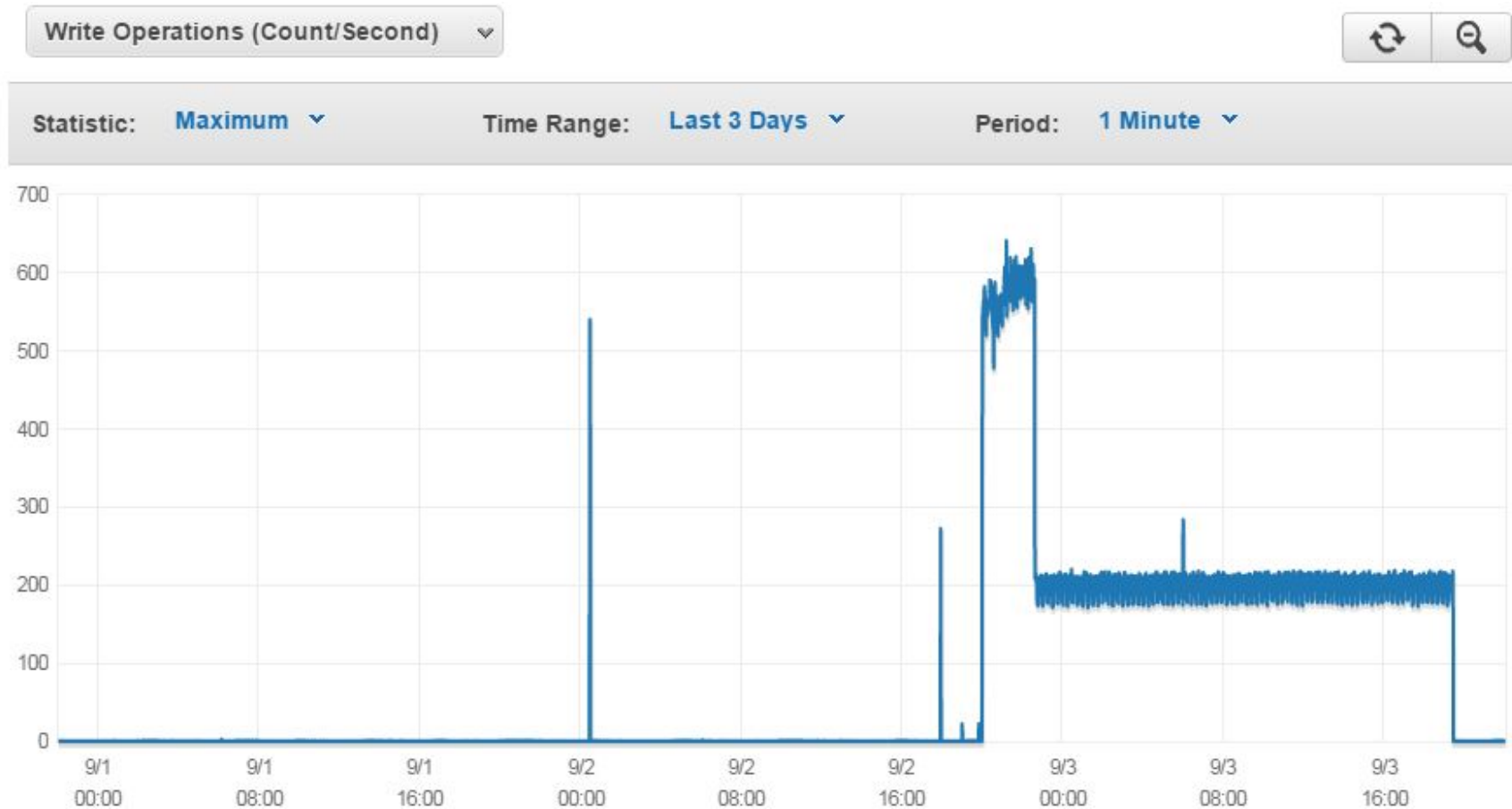
Considerations

- Availability
- Monitoring
- Latency
- Backup and Data Retention
- Security
- Flexibility
- Migration Strategy
- Staffing
- Existing Data Center Investment
- Integration
- Cost

Availability



Monitoring

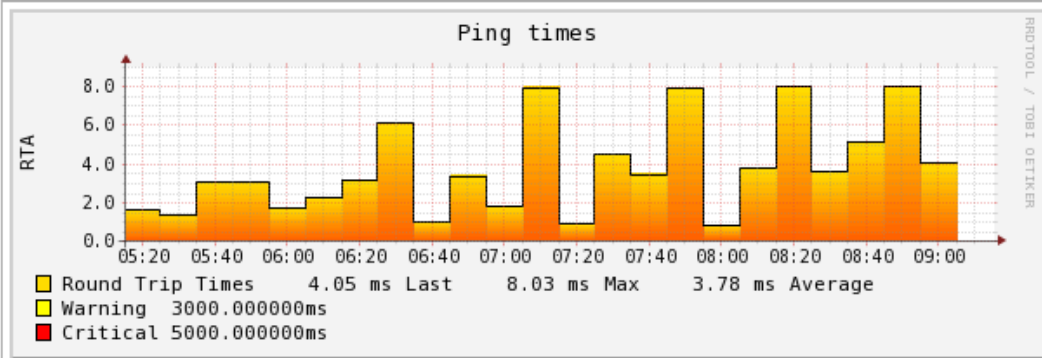


Latency

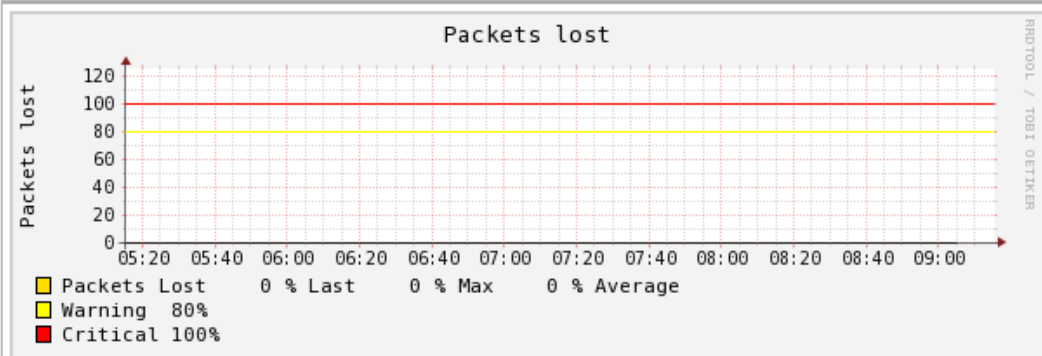
Host: dba-opsc-qa-01.ist Service: net: ping

4 Hours 27.06.16 5:14 - 27.06.16 9:14

Datasource: Round Trip Times



Datasource: Packets Lost



Backup and Data Retention

Buttons: [Create Snapshot](#) [Restore Snapshot](#) [Migrate Snapshot](#) [Copy Snapshot](#) [Share Snapshot](#) [Delete Snapshot](#)

Filter: [Owned by Me](#)

<input type="checkbox"/>	Snapshot	DB Instance or Cluster	Snapshot Creation Time	Status	Prog
<input checked="" type="checkbox"/>	rds:rds-d2d-htmm-stg-2016-06-14-04-02	rds-d2d-htmm-stg	Jun 13, 2016, 9:02:26 PM	available	Com

DB Snapshot Name: rds:rds-d2d-htmm-stg-2016-06-14-04-02

VPC: CDL-Dev-Stg-VPC

DB Engine: mysql

License Model: general-public-license

Status: available

DB Storage: 800GB

Port: 3306

Snapshot Creation Time: June 13, 2016 at 9:02:26 PM UTC-7

Instance/Cluster Creation: January 20, 2016 at 8:04:43 AM UTC-8

Security

UC Berkeley



Information Security and Policy

Home » [Minimum Security Standards for Electronic Information \(MSSEI\)](#)

Minimum Security Standards for Electronic Information (MSSEI)

The following [Minimum Security Standards for Electronic Information \(MSSEI\)](#) are issued under the authority vested in the UC Berkeley Chief Information Officer by the [UC Business Finance Bulletin IS-3 Electronic Information Security](#)®: "All campuses shall establish an Information Security Program (Program) in conformance with the provisions in this bulletin. In order to achieve a secure information technology environment, the campus Program shall comprise a comprehensive set of strategies that include a range of related technical and non-technical measures." (Section III)

Issue Date: April 23, 2013

Effective Date: July 1, 2014

Responsible Executive: Associate Vice Chancellor for Information Technology and Chief Information Officer

Responsible Office: IT Policy Office

Contact: IT Policy Manager, itpolicy@berkeley.edu✉

<https://security.berkeley.edu/minimum-security-standards-electronic-information>

Flexibility

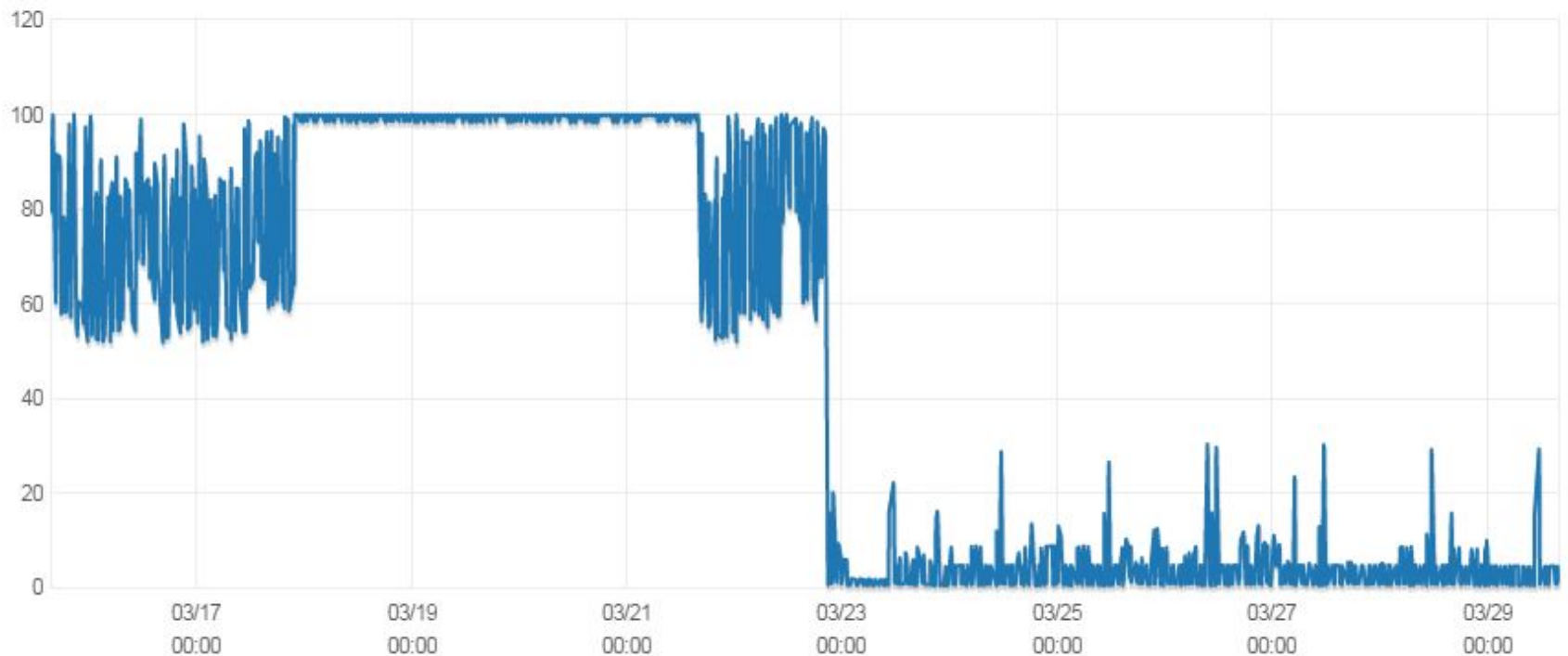
CPU Utilization (Percent) ▾



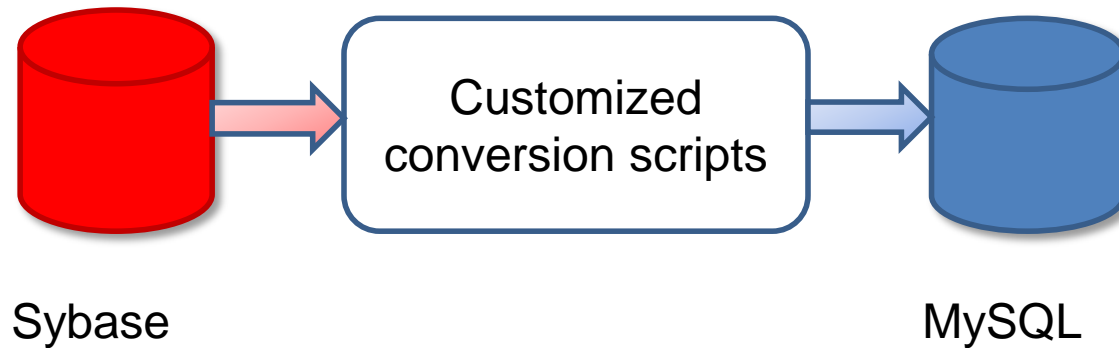
Statistic: **Average** ▾

Time Range: **Last 2 Weeks** ▾

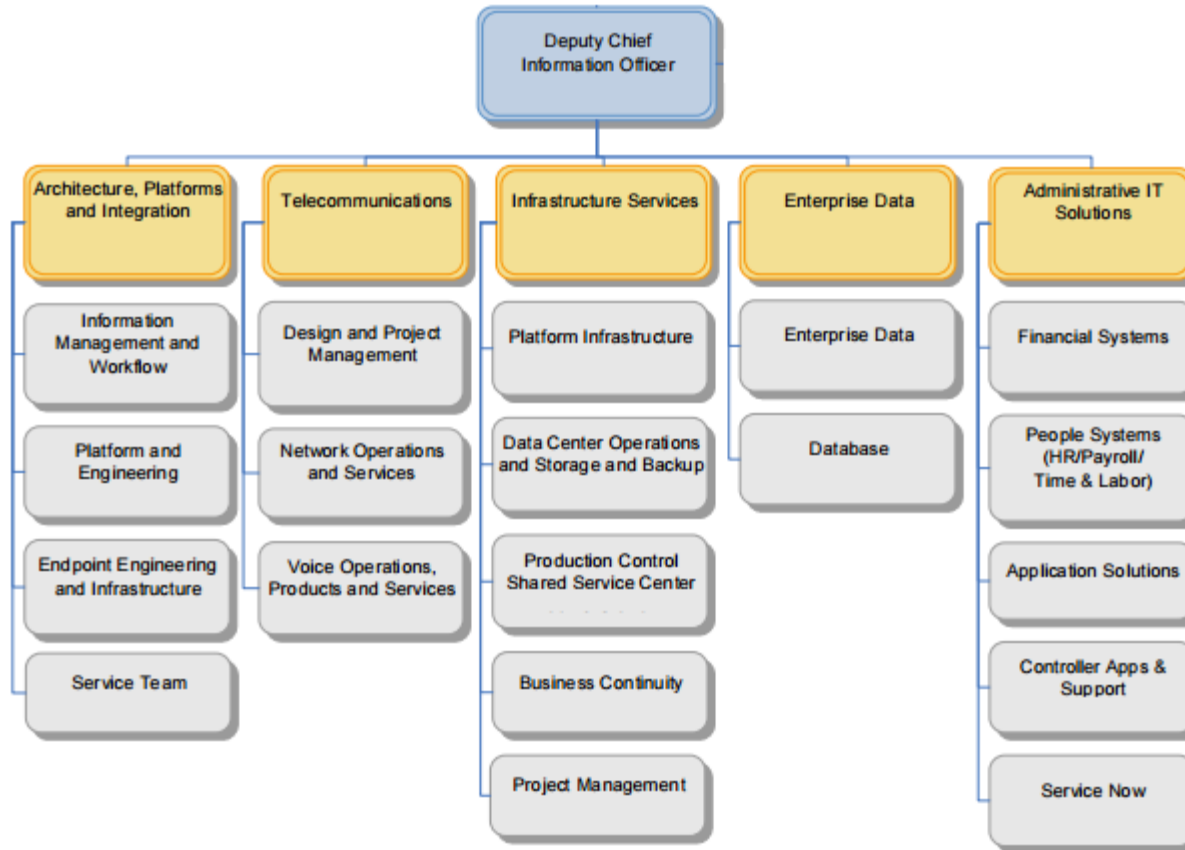
Period: **1 Minute** ▾



Migration Strategy



Staffing



Existing Data Center Investment



JULY 12, 2009

SEISMIC REPLACEMENT BUILDING #1

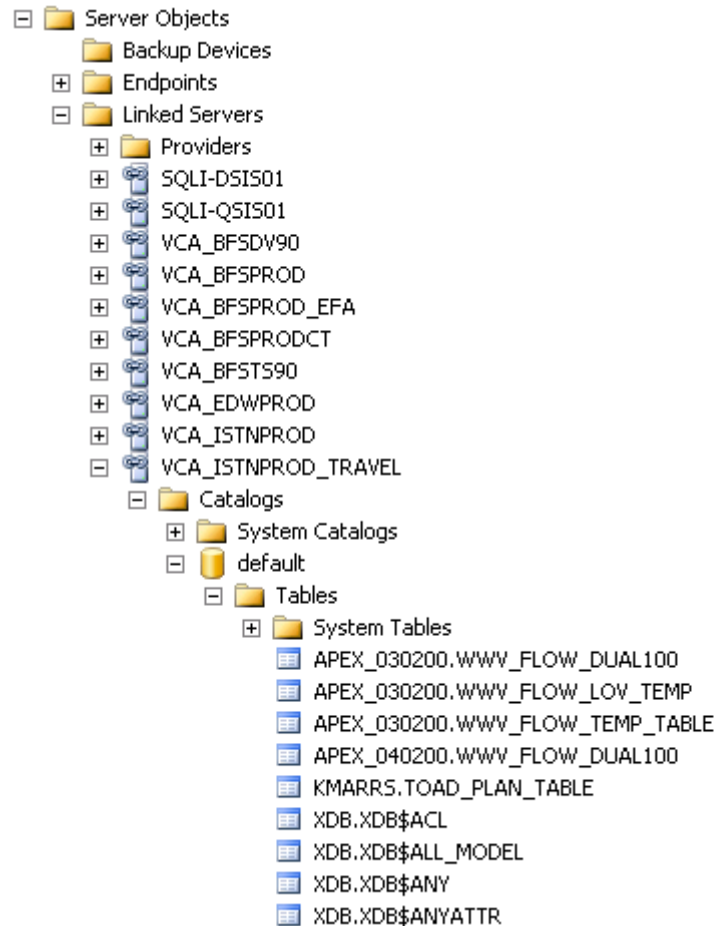
VIEW FROM OXFORD STREET

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Integration



RDS Costs

- Amazon Cost Calculator
 - <http://calculator.s3.amazonaws.com/index.html#s=RDS>
- Costs are based on
 - Region
 - Instance type
 - Single-AZ vs. Multi-AZ
 - Data transfer
 - Storage
 - Reserved vs. on-demand
- Example: One-year reservation
 - db.t2.small Single-AZ \$195
 - db.m3.2xlarge Multi-AZ \$7903

CDL RDS Cost

Instance Type	Cost	Annual
Reserved Instances (35)	1-year reservation	\$36,400
On-demand Instances	Average monthly \$4,226	\$50,715
		\$87,115

Cost - UCB Database Service

We offer:

- Standard Service:

- 10 GB Storage
- Separate development/QA/production environments
- Firewall configuration
- 30 day backup retention
- All database upgrades and patching
- 4 hours DBA support a year, 8-5 Monday – Friday

Add ons:

- Additional Storage
- Extended Service
 - 44 hours DBA support a year, 24x7
- Dedicated instance
- Dedicated VM
- Replication to SDSC

Summary

- Use RDS for workloads already in AWS
- Consider the entire environment
 - Type of data
 - Security
 - Staffing
 - Custom requirements
- Don't make a decision based on cost alone

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