Postgres in Amazon RDS

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Lead Database Architect

Who am I ?

- Database Architect with **OmniTI** for last 7+ years
- Expertise in PostgreSQL , Oracle, MySQL, NoSQL
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- Blog: http://www.pateldenish.com
- Providing Solutions for business problems to deliver
  - Scalability
  - Reliability
  - High Availability
  - Consistency
  - Security

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Agenda

- What is Amazon RDS?
- Amazon RDS Service Highlights
- Setting up Postgres RDS Instance
- Postgres RDS Features
- Administration and Limitation
- Q & A

Amazon Relational Database Services

RDS is a **managed RDBMS Service** in the cloud that is simple to deploy, easy to scale and cost effective.

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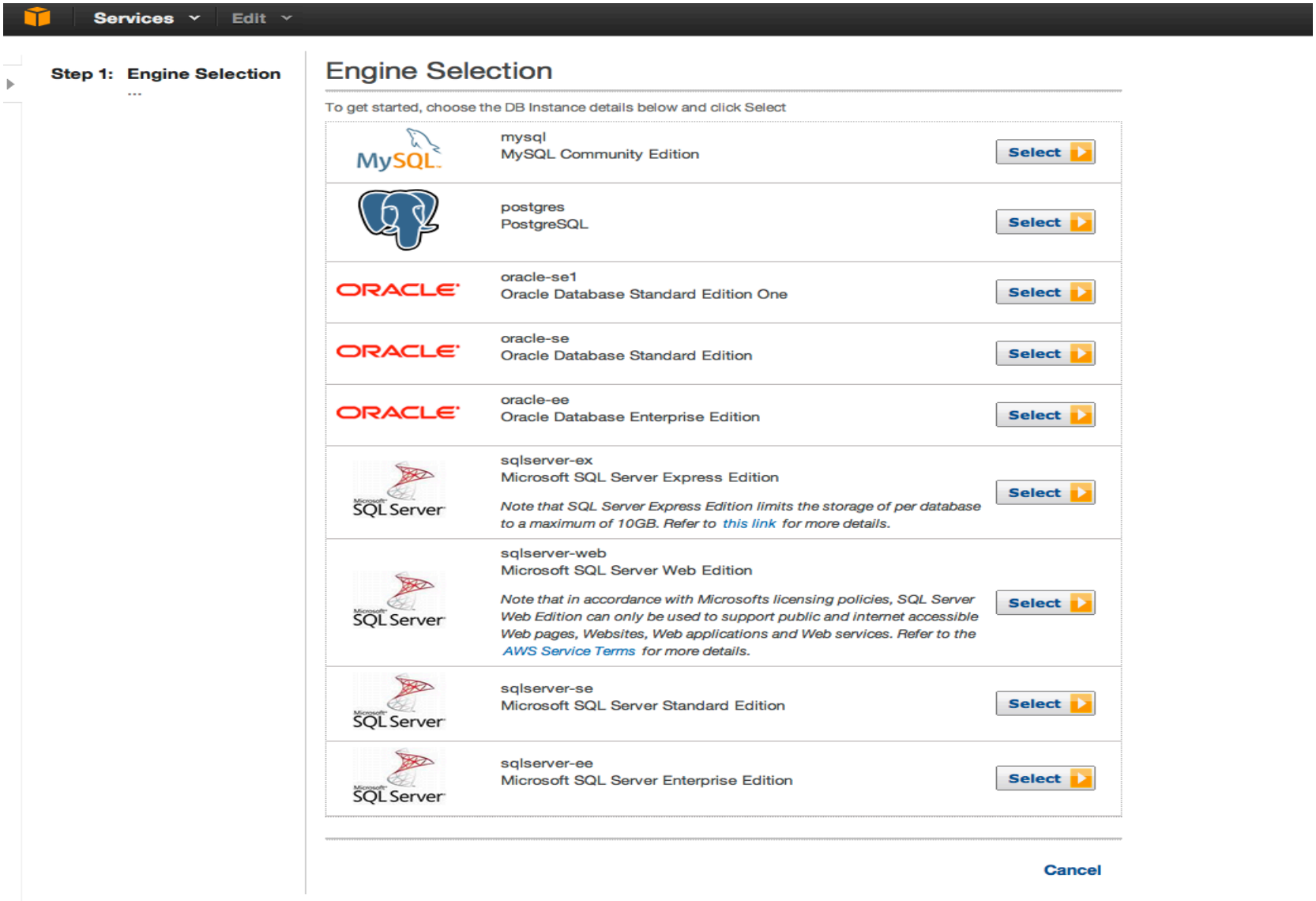
Service Highlights

- Managed
- Compatible
- Scalable Database in the Cloud
- Designed for use with other Amazon Web Services
- Inexpensive

Getting Started with Postgres RDS (Beta)



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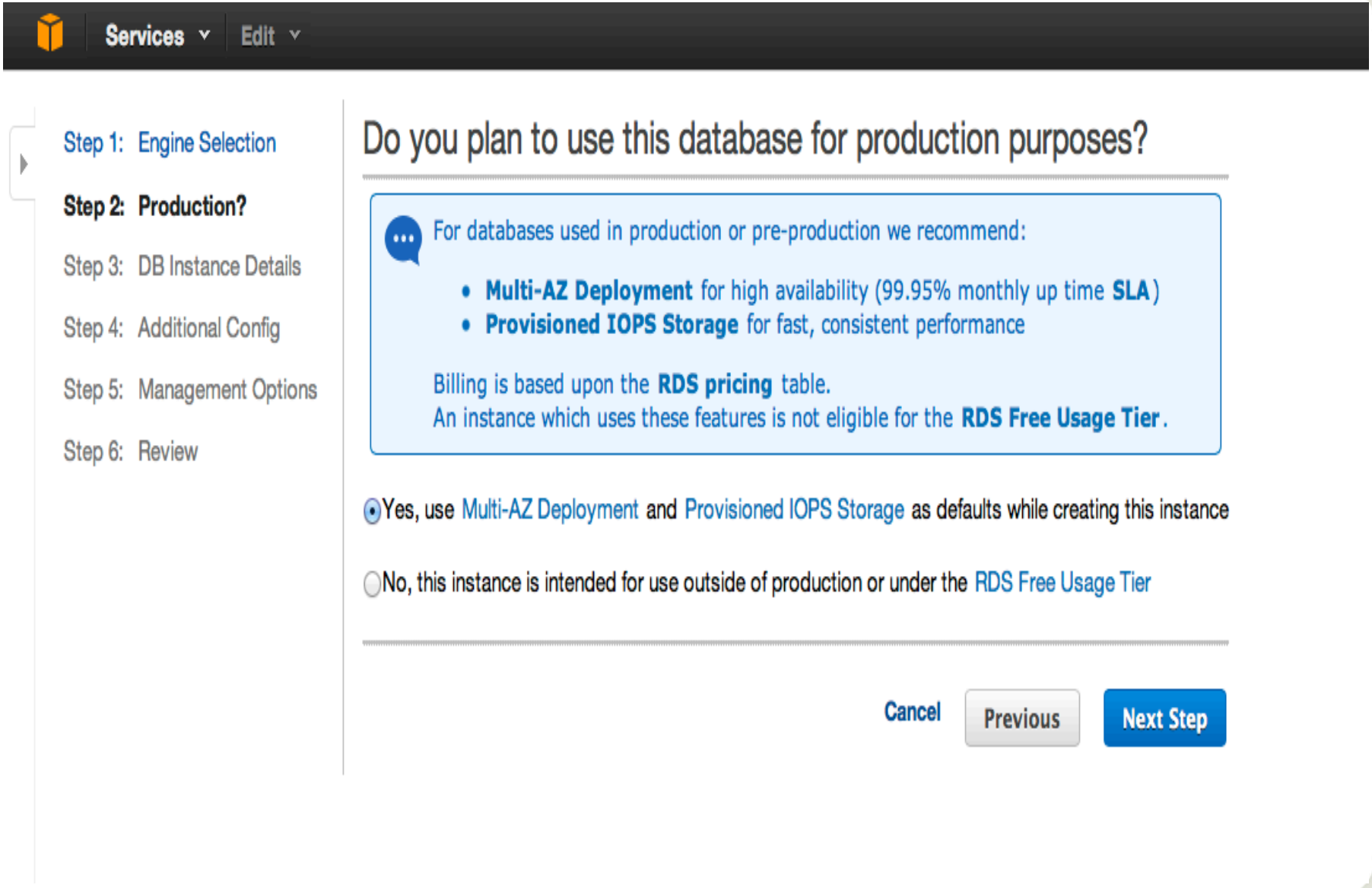
Production?



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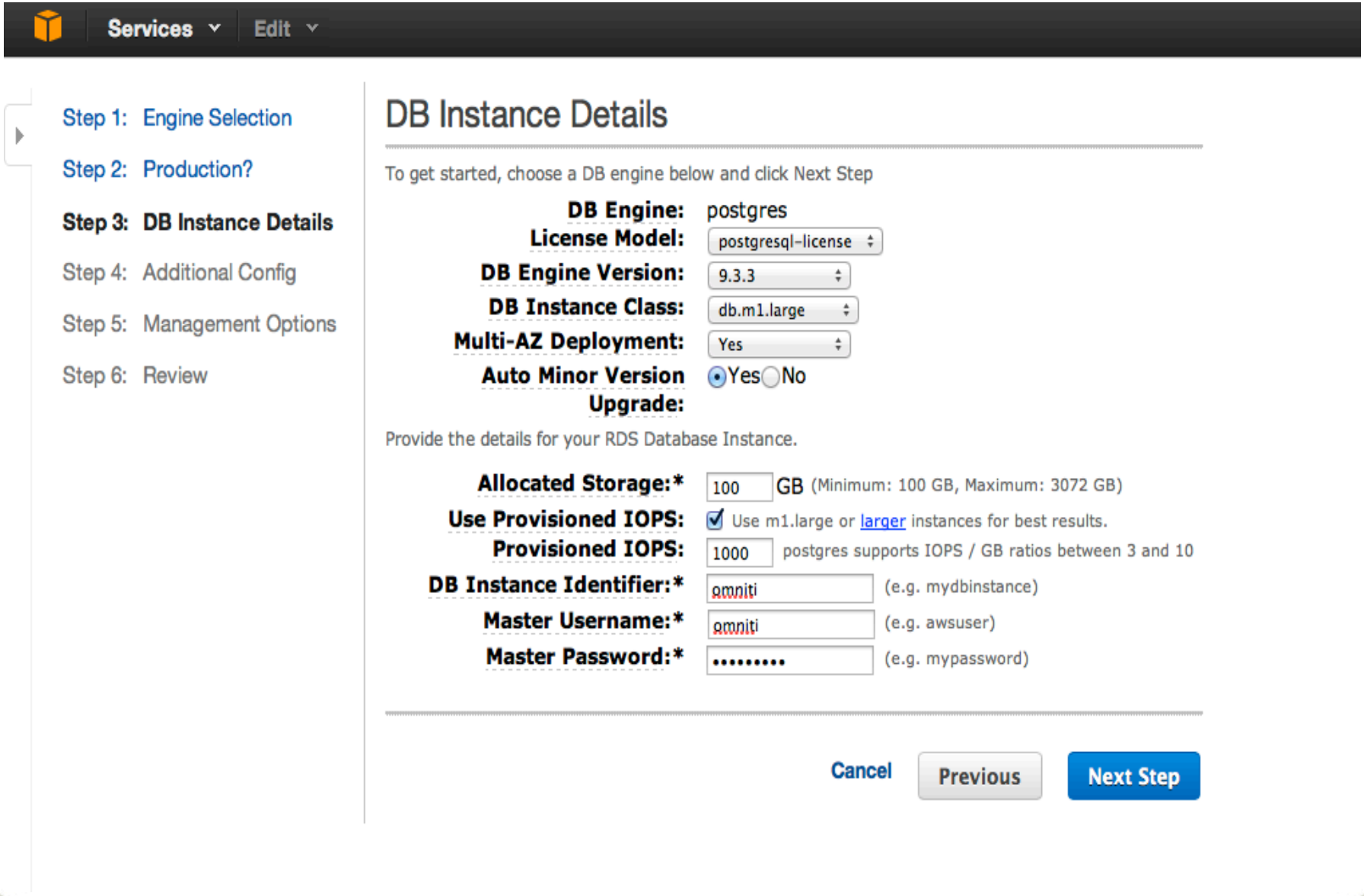
Select Instance Type and Space



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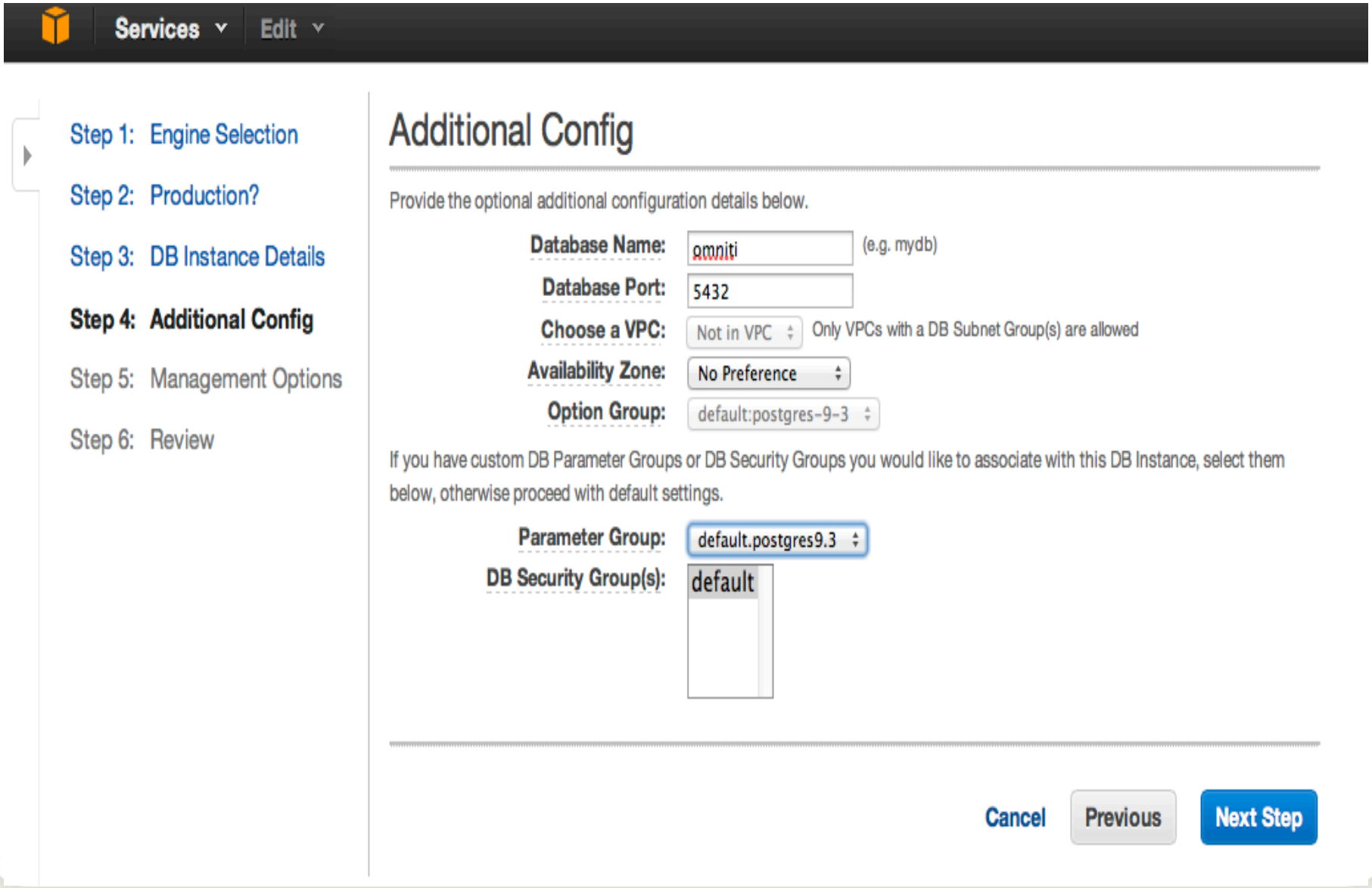
Choose VPC and Postgres config



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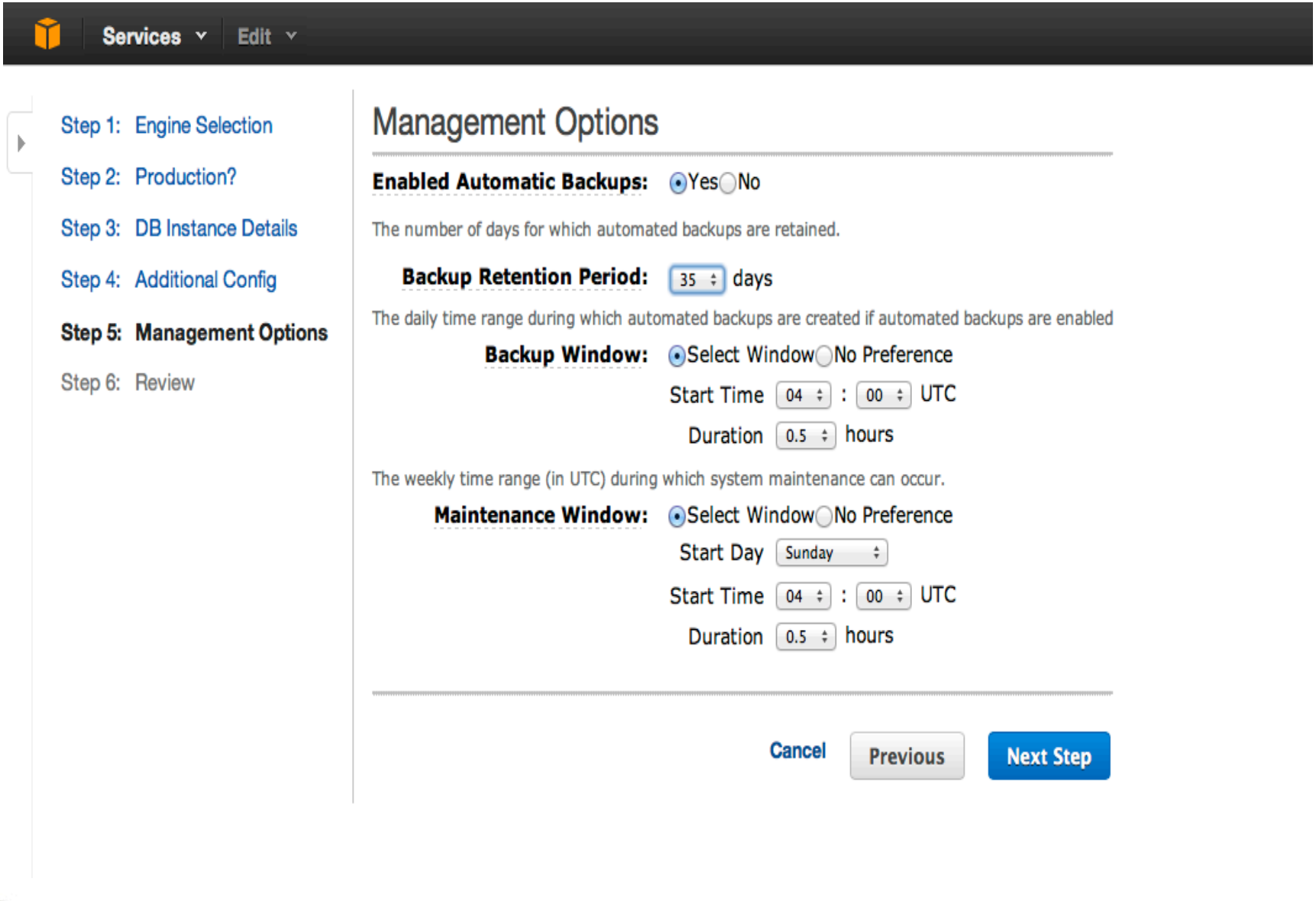
Backups & Maintenance Window



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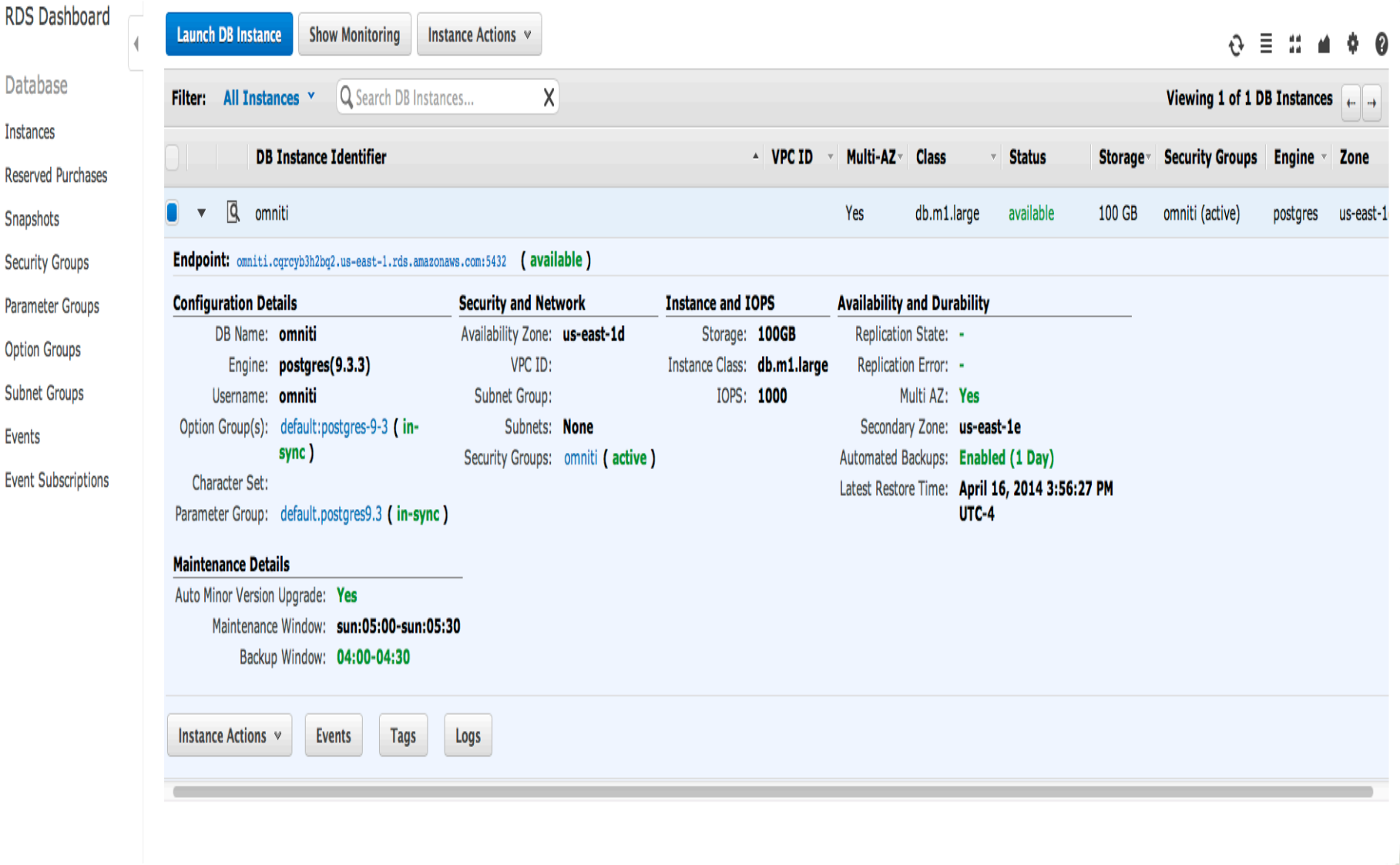
Postgres Instance is Ready ☺



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Let's test it out!

```
localhost:~ denish$ psql -h omniti.cqrcyb3h2bq2.us-east-1.rds.amazonaws.com -d omniti -p 5432 -U omniti
Password for user omniti:
psql (9.1.9, server 9.3.3)
WARNING: psql version 9.1, server version 9.3.
         Some psql features might not work.
SSL connection (cipher: DHE-RSA-AES256-SHA, bits: 256)
Type "help" for help.

omniti=> \l
                                  List of databases
   Name    |  Owner   | Encoding |   Collate   |    Ctype    |   Access privileges
-----------+----------+----------+-------------+-------------+-----------------------
 omniti    | omniti   | UTF8     | en_US.UTF-8 | en_US.UTF-8 |
 postgres  | omniti   | UTF8     | en_US.UTF-8 | en_US.UTF-8 |
 rdsadmin  | rdsadmin | UTF8     | en_US.UTF-8 | en_US.UTF-8 | rdsadmin=CTc/rdsadmin
 template0 | rdsadmin | UTF8     | en_US.UTF-8 | en_US.UTF-8 | =c/rdsadmin          +
           |          |          |             |             | rdsadmin=CTc/rdsadmin
 template1 | omniti   | UTF8     | en_US.UTF-8 | en_US.UTF-8 | =c/omniti            +
           |          |          |             |             | omniti=CTc/omniti
(5 rows)
```

Pre-configured Parameters

- max_connections= {DBInstanceClassMemory/12582880} ; 604
- effective_cache_size = {DBInstanceClassMemory/16384} ; 3.6GB
- shared_buffers = {DBInstanceClassMemory/32768} ; 1.8GB
- maintenance_work_mem = default ; 16MB (Can be changed)
- work_mem = default ; 1MB (Can be changed)
- log_line_prefix = '%t:%r:%u@%d:[%p]:' **(cannot changed)**
- log_min_duration_statement (disabled by default, **enable it**)

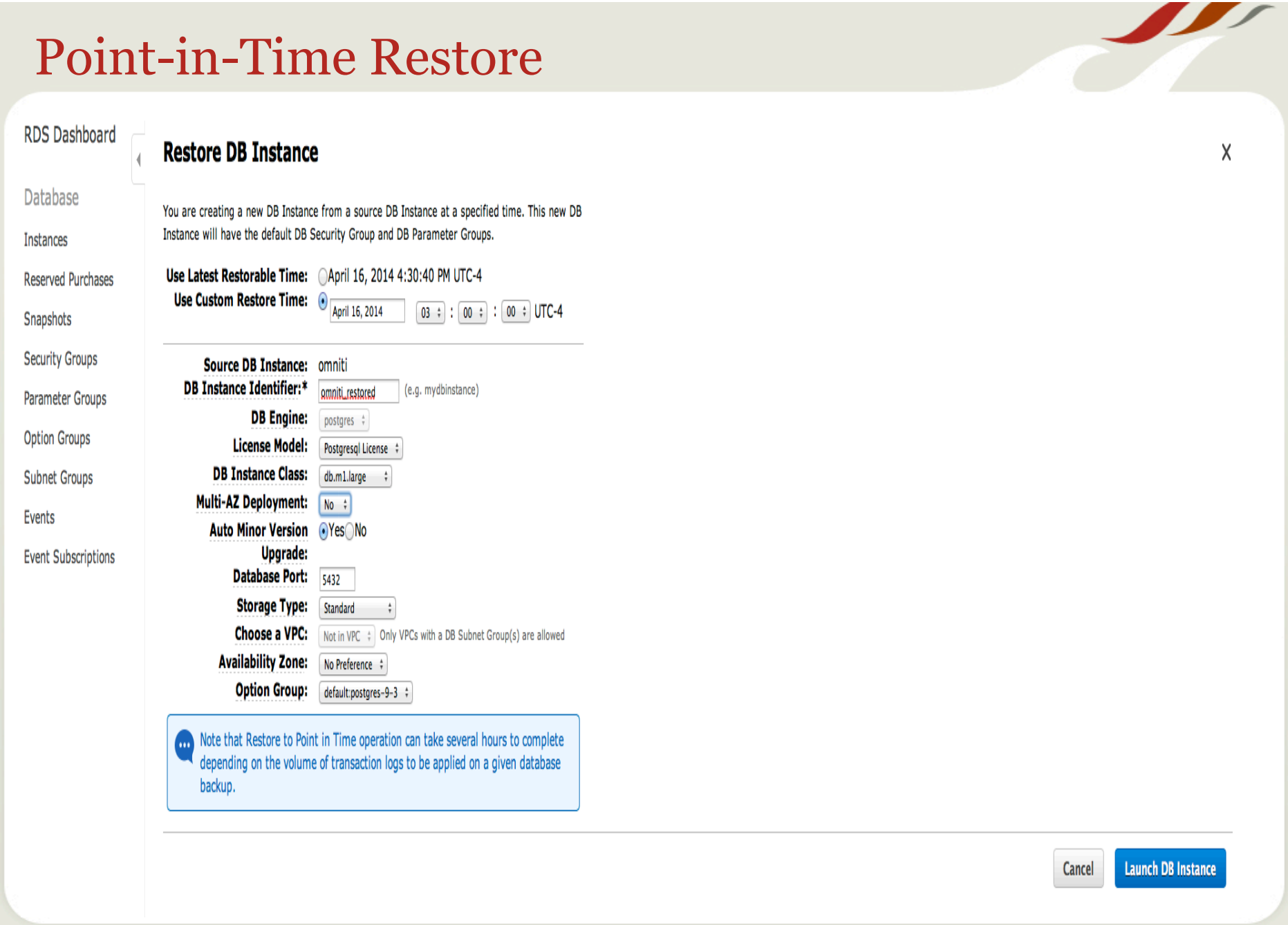
Pre-configured Parameters

- Pros:
  - Easy to create Parameter Groups and apply it to specific instance
    - i.e apply to dev instance vs prod
  - Allow dynamic calculation based on DBInstanceClassMemory
- Cons:
  - Can not change some parameters

Automatic Software Patching

- As of now, Postgres 9.3.1, 9.3.2 and 9.3.3 versions are available
- You can control upgrade time
- You have to wait till the new version is available
- Postgres RDS doesn't support anything older than 9.3
  - Postgres 9.3 replication bugs
  - Delay in upgrade

Point-in-Time Restore



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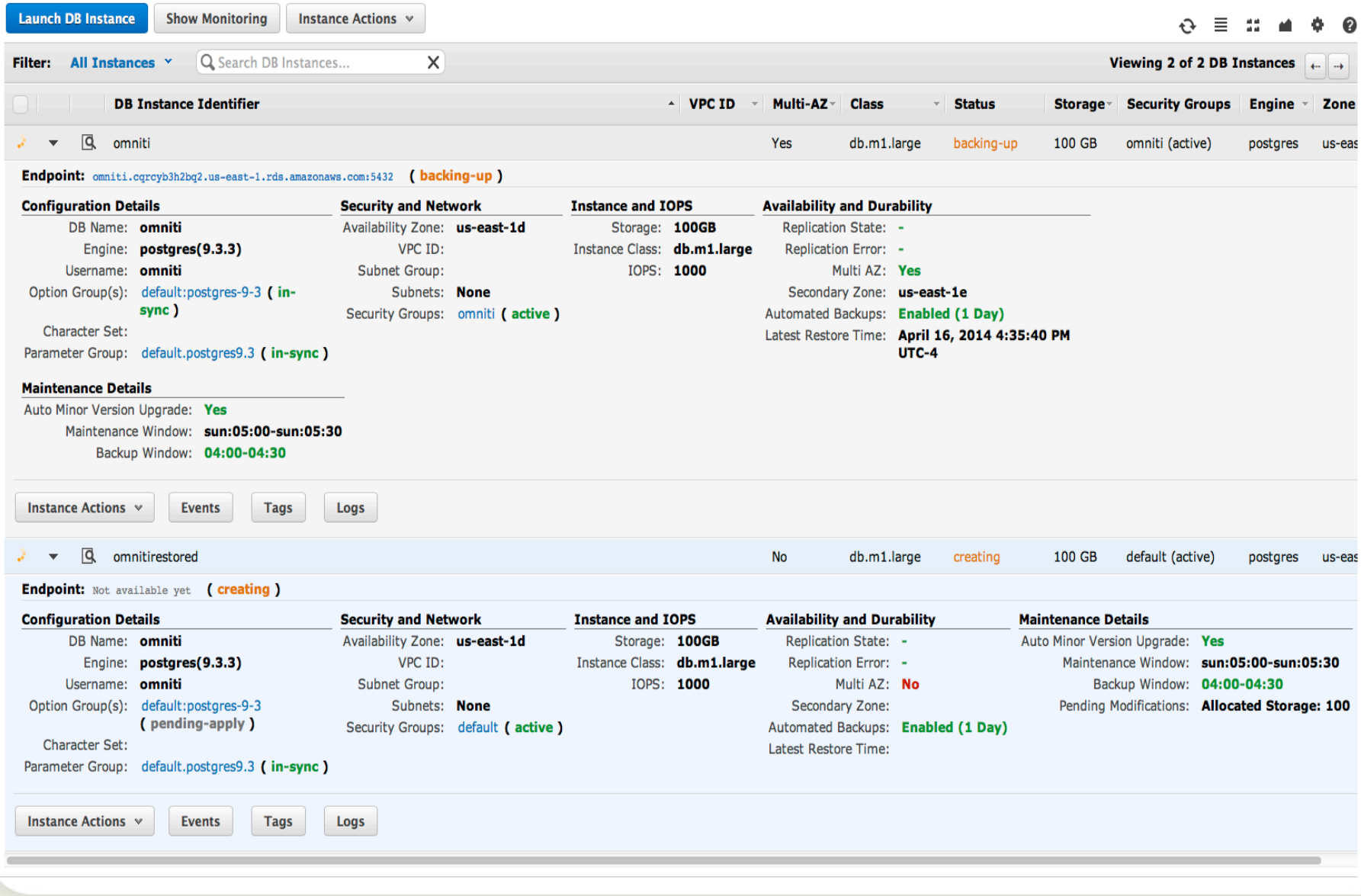
Point-in-Time Restore



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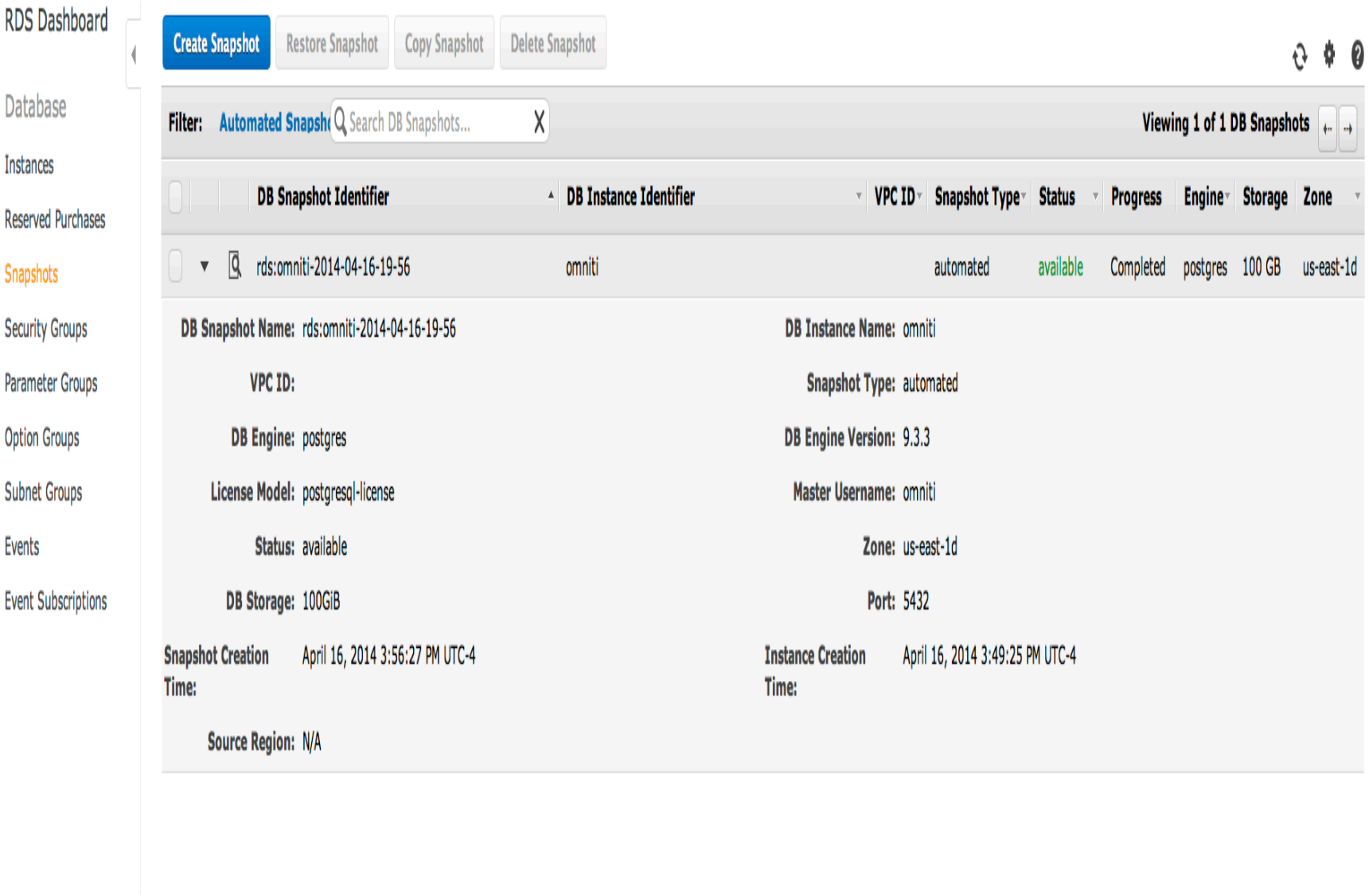
DB Snapshots – Manual or Automated



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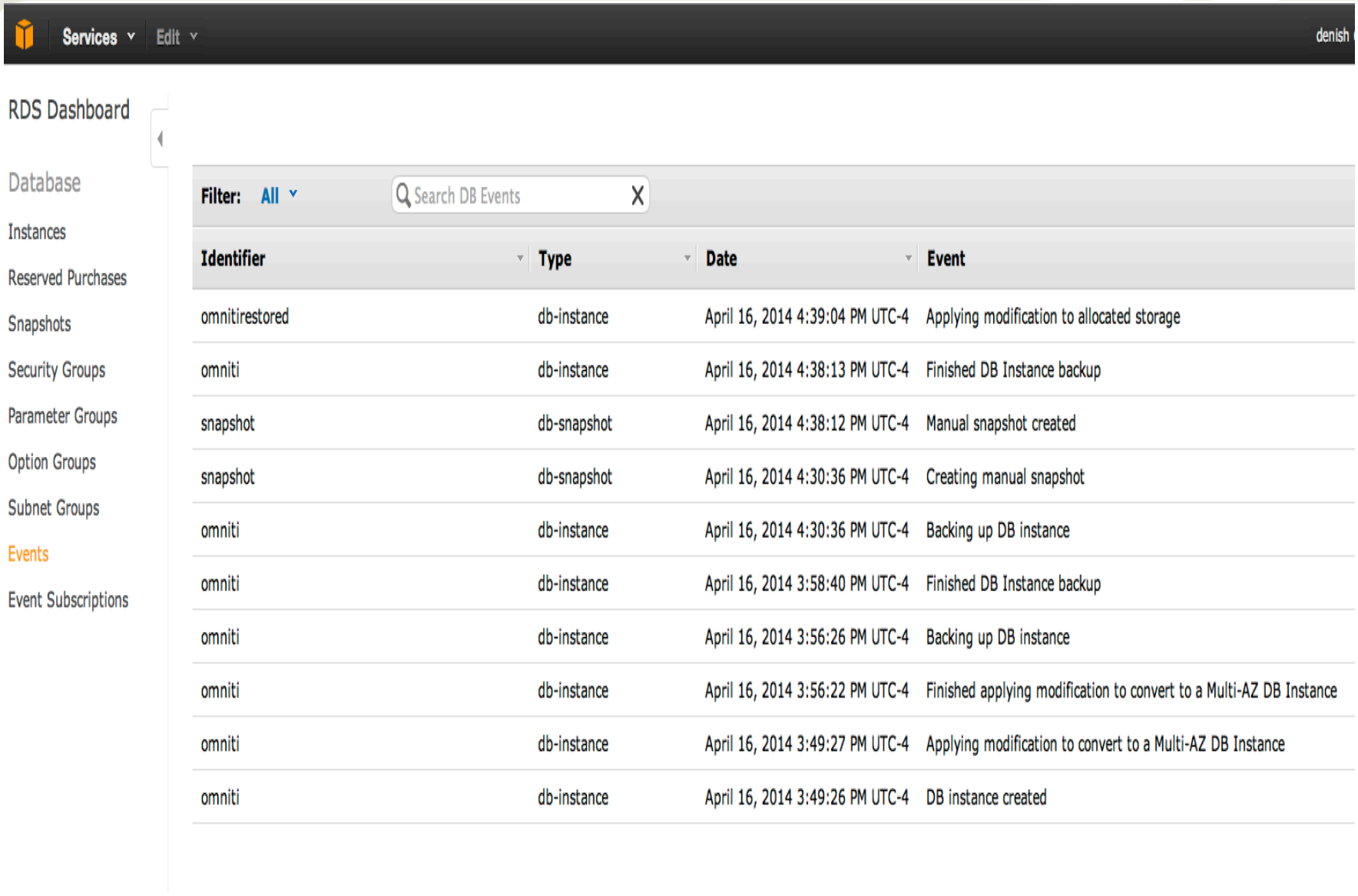
DB Events



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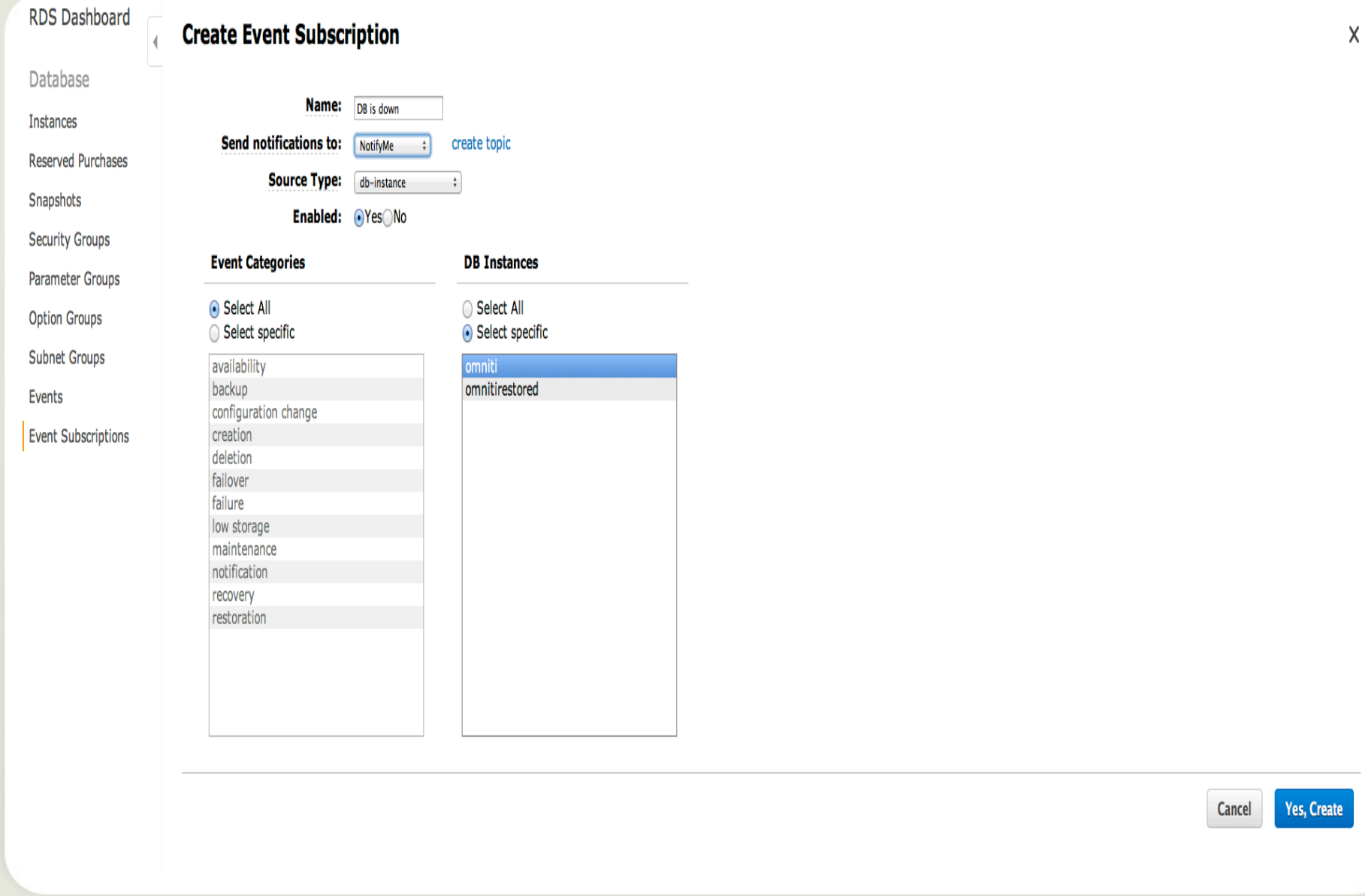
DB Event Notifications



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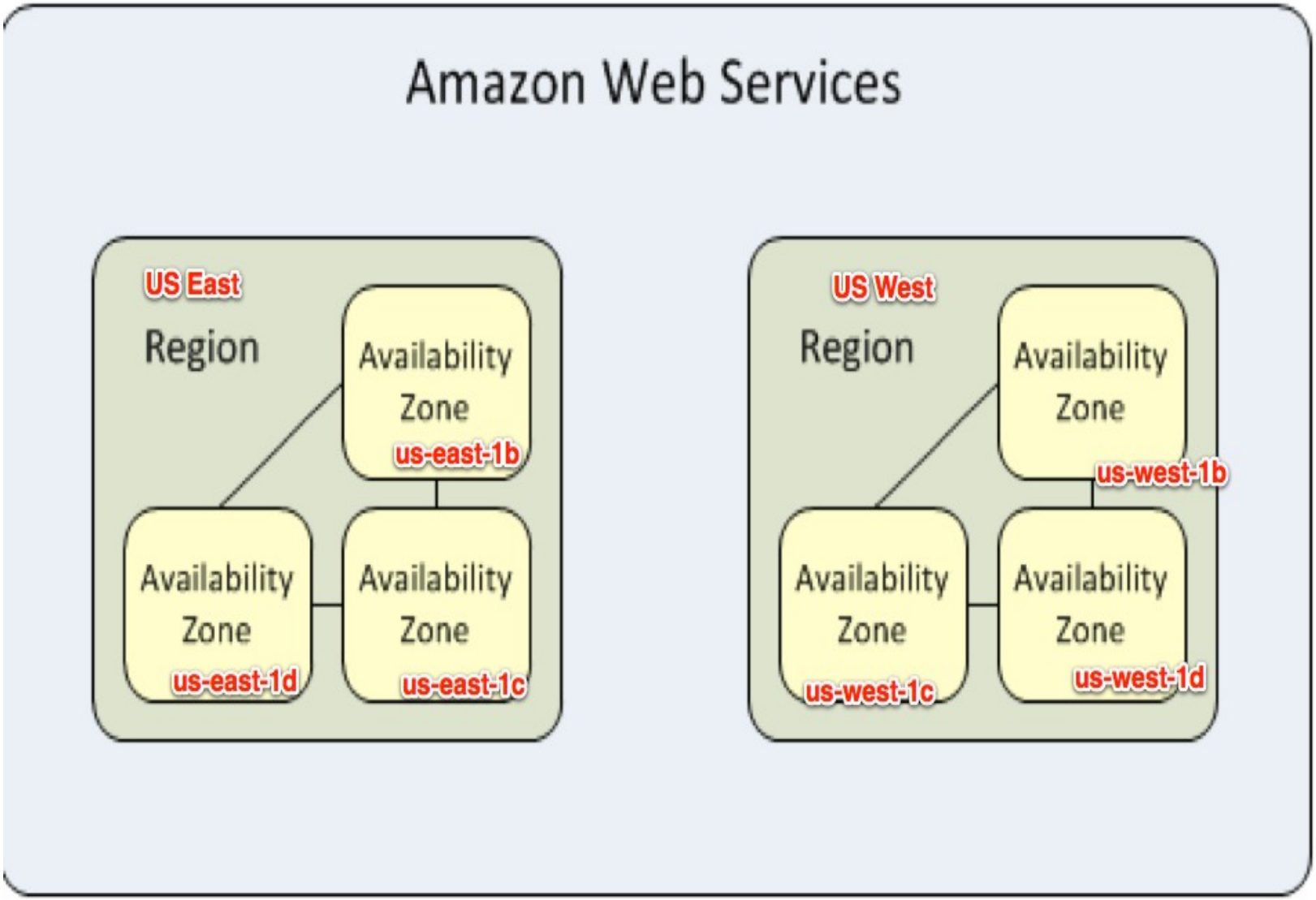
Multi-Availability Zone (Multi-AZ) Deployments



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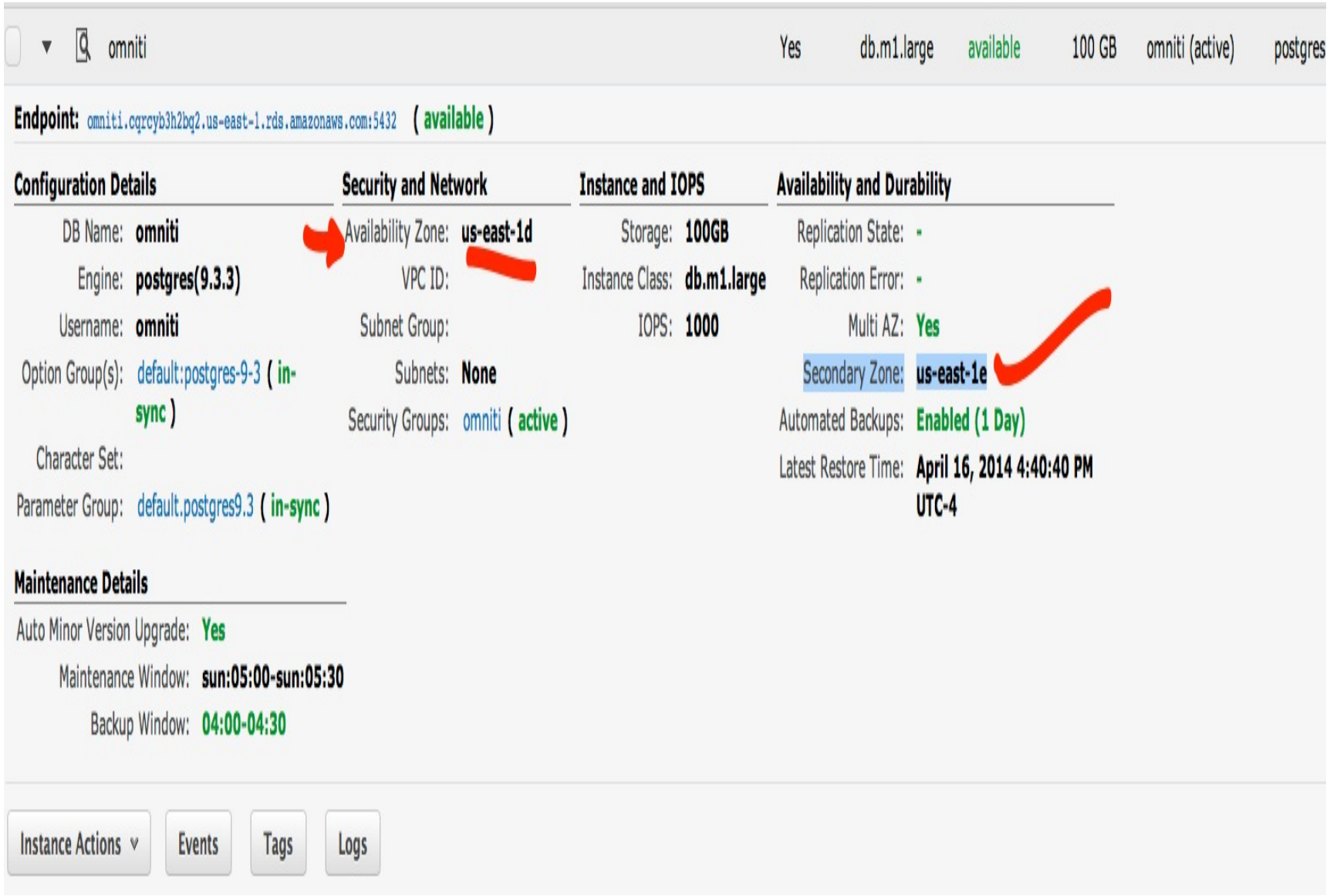
Multi AZ , not Multi Region



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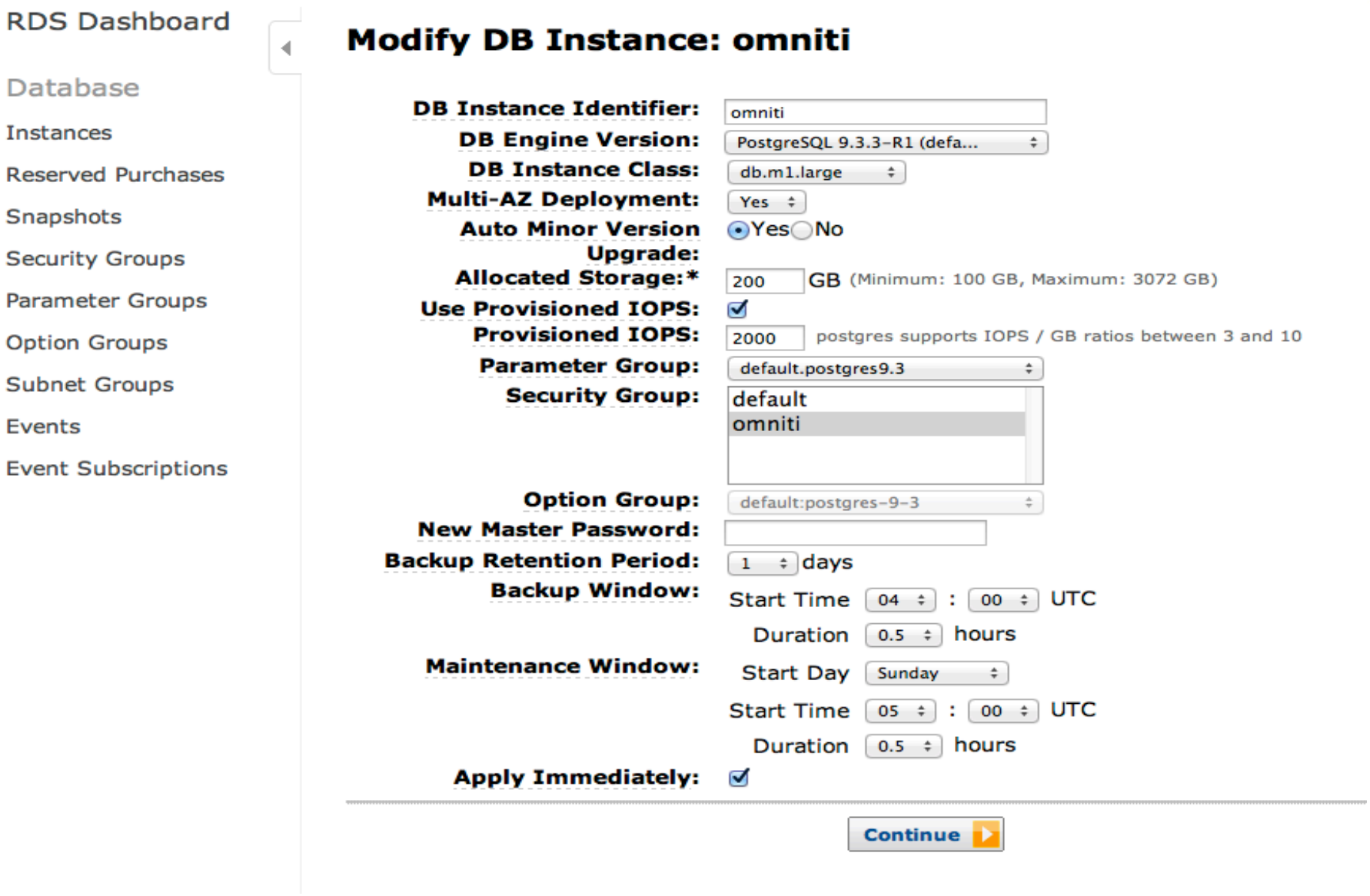
Provisioned IOPS

- IOPS Ranges : 1000 - 30,000
- Storage Ranges : 100 GB - 3 TB
- Range of IOPS to Storage (GB) Ratio : 3:1 – 10:1
- For Example,
  - you could start by provisioning an Postgres DB instance with 1000 IOPS and 200 GB storage (a ratio of 5:1).
  - You could then scale up to 2000 IOPS with 200 GB of storage (a ratio of 10:1), 3000 IOPS with 300 GB of storage
  - Up to the maximum for Postgres DB instance of 30,000 IOPS with 3 TB (3000 GB) of storage.

Push-Button Scaling



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Push-Button Scaling

Identifier	Type	Date	Event
omniti	db-instance	April 16, 2014 6:00:58 PM UTC-4	Finished applying modification to allocated storage
omniti	db-instance	April 16, 2014 5:05:56 PM UTC-4	Applying modification to allocated storage
omnitirestored	db-instance	April 16, 2014 4:39:04 PM UTC-4	Applying modification to allocated storage
omniti	db-instance	April 16, 2014 3:56:22 PM UTC-4	Finished applying modification to convert to a Multi-AZ DB Instance
omniti	db-instance	April 16, 2014 3:49:27 PM UTC-4	Applying modification to convert to a Multi-AZ DB Instance

Increased IOPs

Multi AZ

- Took about an hour to increase IOPs and Disk space from 1000 IOPs (100GB) to 2000 IOPs(200GB)
- Multi AZ was quick because it was applied during instance creation

Isolation and Security

Access from specific CIDR/IP

DB Security Groups > omniti

▾ DB Security Group

Connection Type	Details	Status	Actions
CIDR/IP	**CIDR/IP:** 108.48.124.82/32	authorized	Remove

Access from specific EC2 security group

DB Security Groups > omnitirds

▾ DB Security Group

Connection Type	Details	Status	Actions
EC2 Security Group	**AWS Account ID:** 182711560792 **EC2 Security Group:** ssh	authorized	Remove

Limited Default Roles

```
omniti=> \du
                                   List of roles
   Role name    |                         Attributes                         |    Member of
----------------+------------------------------------------------------------+-----------------
 omniti         | Create role, Create DB                                     | {rds_superuser}
 rds_superuser  | Cannot login                                               | {}
 rdsadmin       | Superuser, Create role, Create DB, Replication             | {}
```

SSL is ON

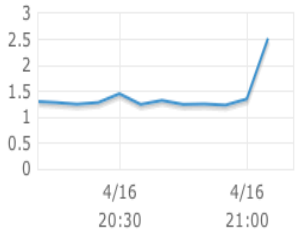
```
omniti=>  show ssl;
 ssl
-----
 on
(1 row)
```

Monitoring & Metrics

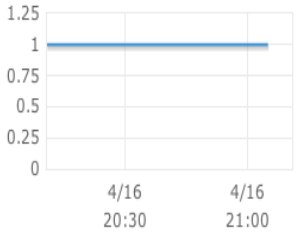
Time Range: Last Hour

Below are your CloudWatch metrics for the selected resources. Click on a graph to see an expanded view. View all CloudWatch metrics

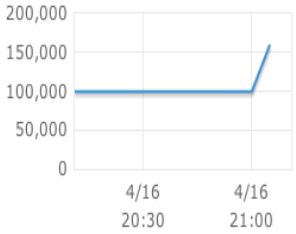
CPU Utilization (Percent)



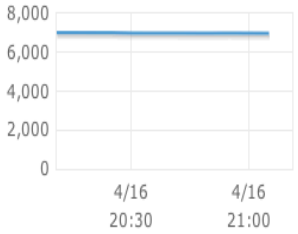
DB Connections (Count)



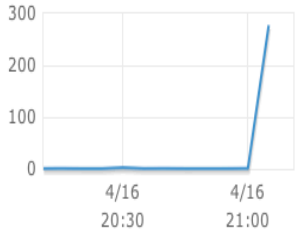
Freeable Space (MB)



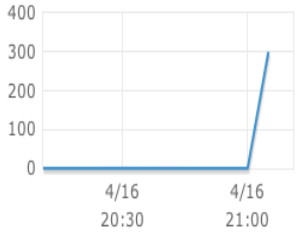
Freeable Memory (MB)



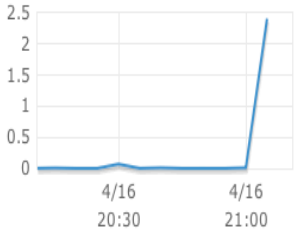
Write IOPS (Count/Second)



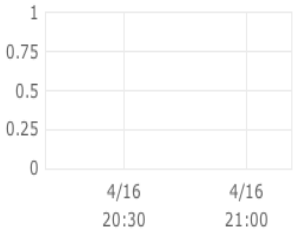
Read IOPS (Count/Second)



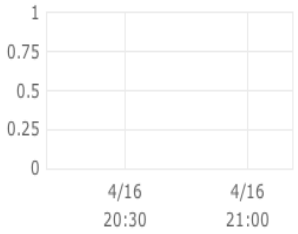
Queue Depth (Count)



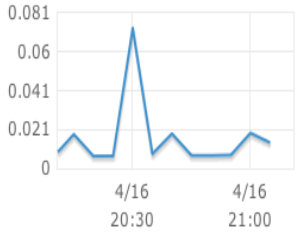
Replica Lag (Seconds)



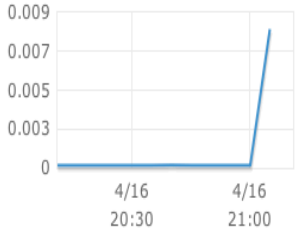
Binary Log Disk Usage (MB)



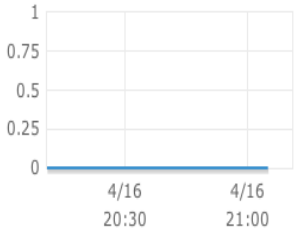
Write Throughput (MB/Second)



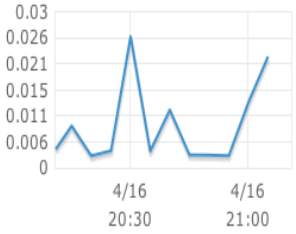
Read Throughput (MB/Second)



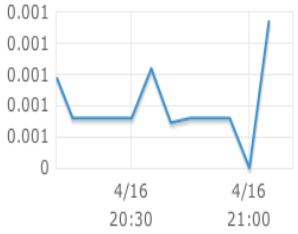
Swap Usage (MB)



Write Latency (Seconds)



Read Latency (Seconds)



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Other Features

- Automatic Host replacement in case of hardware failure
- Replication and automated failover
  - Synchronous replication is used for failover

Postgres Logs Monitoring

- Possible to download postgres logs for analyze with **PgBadger**
  - Install Amazon RDS Command Line Toolkit
  - **rds-watch-db-logfile** omniti --log-file-name error/ postgresql.log.2014-04-16-22
  - **rds-download-db-logfile** DBInstanceIdentifier --log-file-name $filename

PostgreSQL Supported Extensions

```
omniti=> select * from pg_available_extensions;
          name          | default_version | installed_version |                                comment
------------------------+-----------------+-------------------+-----------------------------------------------------------------------
 chkpass                | 1.0             |                   | data type for auto-encrypted passwords
 xml2                   | 1.0             |                   | XPath querying and XSLT
 plpgsql                | 1.0             | 1.0               | PL/pgSQL procedural language
 pgcrypto               | 1.0             |                   | cryptographic functions
 postgres_fdw           | 1.0             |                   | foreign-data wrapper for remote PostgreSQL servers
 fuzzystrmatch          | 1.0             |                   | determine similarities and distance between strings
 ltree                  | 1.0             |                   | data type for hierarchical tree-like structures
 dict_xsyn              | 1.0             |                   | text search dictionary template for extended synonym processing
 postgis_tiger_geocoder | 2.1.0           |                   | PostGIS tiger geocoder and reverse geocoder
 hstore                 | 1.2             |                   | data type for storing sets of (key, value) pairs
 pgrowlocks             | 1.1             |                   | show row-level locking information
 postgis                | 2.1.0           |                   | PostGIS geometry, geography, and raster spatial types and functions
 dblink                 | 1.1             |                   | connect to other PostgreSQL databases from within a database
 earthdistance          | 1.0             |                   | calculate great-circle distances on the surface of the Earth
 unaccent               | 1.0             |                   | text search dictionary that removes accents
 pg_stat_statements     | 1.1             |                   | track execution statistics of all SQL statements executed
 postgis_topology       | 2.1.0           |                   | PostGIS topology spatial types and functions
 pg_buffercache         | 1.0             |                   | examine the shared buffer cache
 isn                    | 1.0             |                   | data types for international product numbering standards
 tablefunc              | 1.0             |                   | functions that manipulate whole tables, including crosstab
 pgstattuple            | 1.1             |                   | show tuple-level statistics
 intagg                 | 1.0             |                   | integer aggregator and enumerator (obsolete)
 pltcl                  | 1.0             |                   | PL/Tcl procedural language
 pg_freespacemap        | 1.0             |                   | examine the free space map (FSM)
 tsearch2               | 1.0             |                   | compatibility package for pre-8.3 text search functions
 uuid-ossp              | 1.0             |                   | generate universally unique identifiers (UUIDs)
 dict_int               | 1.0             |                   | text search dictionary template for integers
 btree_gin              | 1.0             |                   | support for indexing common datatypes in GIN
 cube                   | 1.0             |                   | data type for multidimensional cubes
 pg_trgm                | 1.1             |                   | text similarity measurement and index searching based on trigrams
 intarray               | 1.0             |                   | functions, operators, and index support for 1-D arrays of integers
 btree_gist             | 1.0             |                   | support for indexing common datatypes in GiST
 sslinfo                | 1.0             |                   | information about SSL certificates
 plperl                 | 1.0             |                   | PL/Perl procedural language
 citext                 | 1.0             |                   | data type for case-insensitive character strings
(35 rows)
```

PgBench results

- m1.large
  - Provisioned iops = 1000
  - Number of clients: 100
  - Number of threads: 1
  - Duration: 600 s

	Single AZ	Multi AZ
# of transaction processed	117611	112009
tps (including connections establishing)	195.729775	186.482602
tps (excluding connections establishing)	209.247055	199.764921

Limitations

- Replica feature is missing
  - Streaming replication (Coming up?)
- Limited migration/upgrade options
  - pg_dump/restore
  - What about major upgrade?
- pgbouncer can not be installed on DB server
- Can not install custom extensions
  - mimeo, pg_partman etc.

Pricing

m1.large 2000 IOPs 200GB	**On Demand**	**Reserved (3 yr)**
Single AZ	$400/month	$368/month
Multi AZ	$800/month	$636/month

Reserved instance can be 10-20% cheaper
Price doesn't include bandwidth

References

- http://docs.aws.amazon.com/AmazonRDS/latest/UserGuide/CHAP_GettingStarted.html
- http://docs.aws.amazon.com/AmazonRDS/latest/UserGuide/CHAP_PostgreSQL.html
- Quick Reference CLI Commands: http://awsdocs.s3.amazonaws.com/RDS/latest/rds-qrc.pdf
- http://www.postgresql.org/docs/9.2/static/pgbench.html
- https://console.aws.amazon.com/rds/home

Further Reading ....

- Accessing PostgreSQL from Amazon RDS article on Database Trends and Applications
  - http://www.dbta.com/Editorial/Trends-and-Applications/Accessing-PostgreSQL-from-Amazon-RDS-96507.aspx

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"The exposure to the range of industry was really amazing."

Questions?

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