Deploying a Ruby on Rails Application with Amazon Web Services OpsWorks

The Idiot's Guide to Migrating a full stack Rails Application from Heroku to AWS: A Guide made by an Idiot, for Idiots

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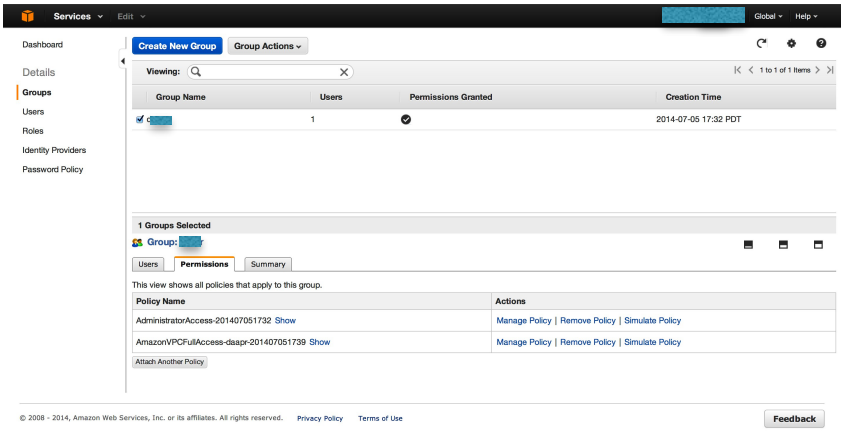
IAM Security Group and User

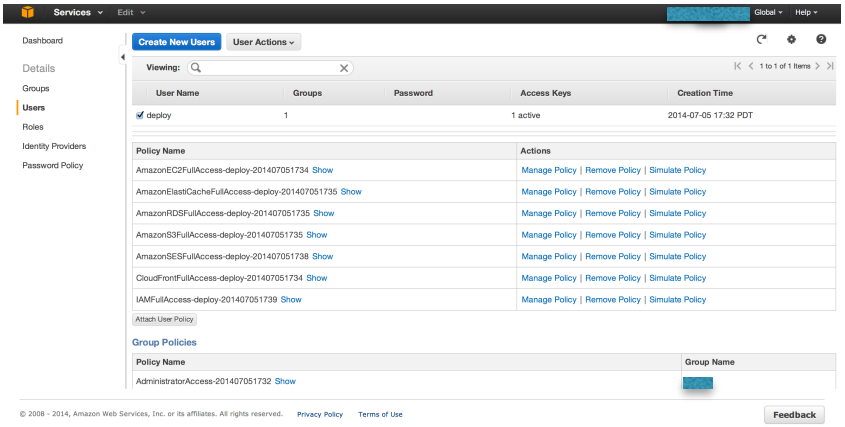
IAM Security Groups and Users are virtual groups and users that allow you to designate permissions and control to certain AWS features. This is helpful for assigning groups to users in your organization, or for creating virtual users to allow external resources (like Github) gain access to AWS through your explicit permission. Different organizations have different use cases for IAM roles. In this guide, IAM roles are used to create a virtual user that can SSH into Github to deploy code to our instances. For more on IAM roles, read this: http://aws.amazon.com/iam/

Note: This tutorial does not utilize IAM roles to their fullest extent.

Steps

(1) Create an IAM Security Group name
  (1) Give Administrator and Virtual Private Cloud Full Access Permissions
(2) Create user "deploy". Deploy is your administrator user.
  (1) Download the .csv file with the Access Key and Secret Access Key and store this file in a safe place. You will need it later.
  (2) Give EC2 Full Access, RDS Full Access, S3 Full Access, SES Full Access, CloudFront Full Access, IAM Full Access





Amazon EC2 Key Pairs

Amazon EC2 Key Pairs are PEM keys (in the format .pem) that you use in order to ssh into your EC2 instances. It is good practice to save your pem keys in your .ssh folder in your root directory for easy access. You will also need to change the permissions on the .pem key to 400 (e.g. chmod 400 yourkeyname.pem). This changes the permissions so only the owner can read the key. The protocol for using ssh to access your EC2 instance is:

ssh -i ~/.ssh/yourkeyname.pem ubuntu@ec2.publicDNS.computer.amazonaws.com

We will cover this more later. For more information on PEM keys read this: http://docs.aws.amazon.com/AWSEC2/latest/UserGuide/ec2-key-pairs.html

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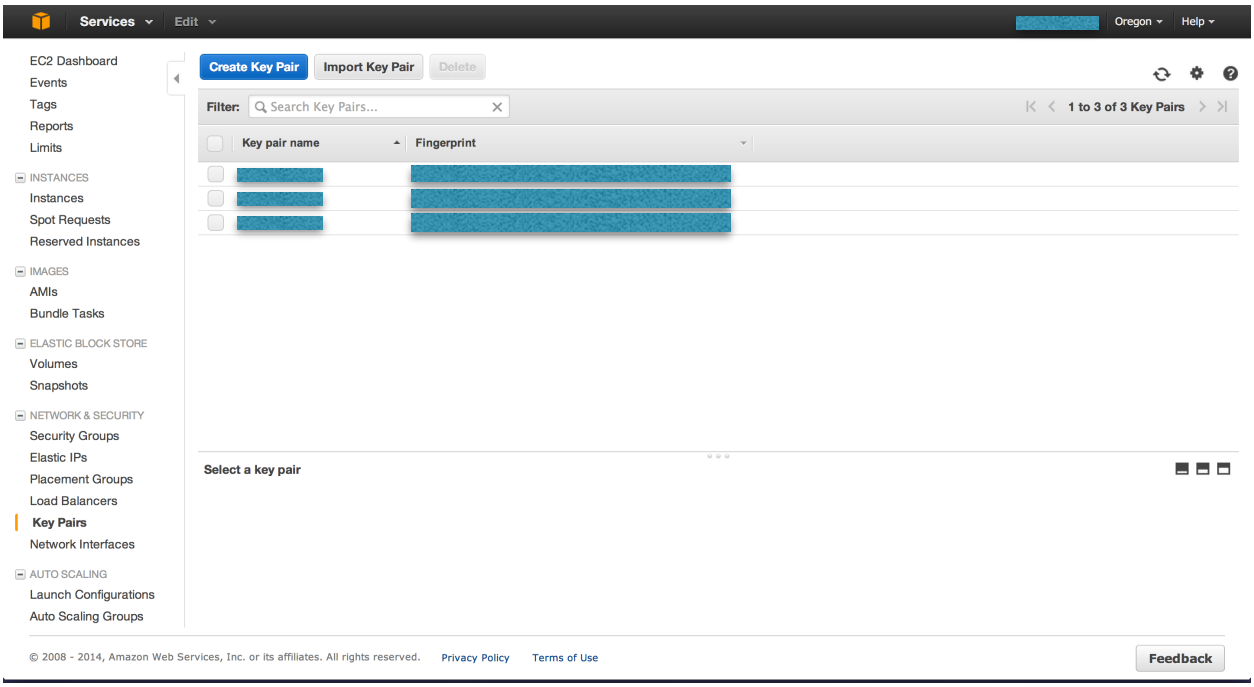
Steps

(1) Create Security PEM Key in EC2 Panel
(2) Download the PEM Key and move it into your .ssh folder in your root directory
(3) chmod 400 yourkeyname.pem

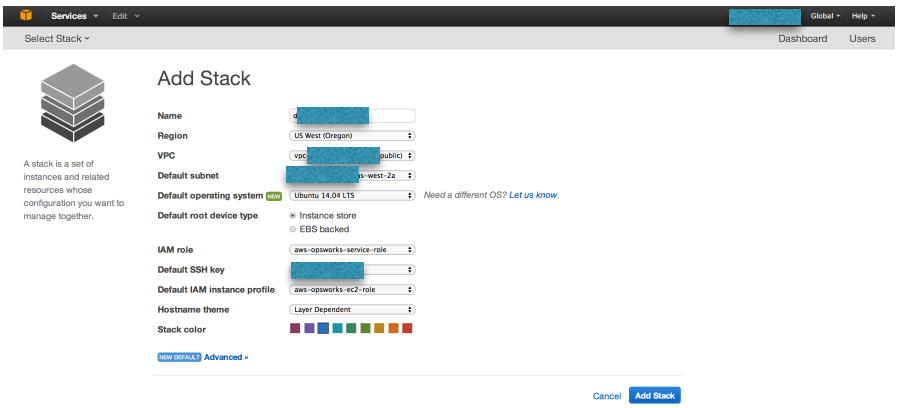


AWS OpsWorks Stack

AWS OpsWorks is a tool that allows you to manage the architecture of your application. It also makes it easy to deploy your application. OpsWorks allows you to create different layers that define different server roles for your application. Additionally, OpsWorks makes it easy to scale horizontally without any downtime for your application. OpsWorks leverages Chef for the customizable configuration of servers. To learn more about AWS OpsWorks, read this: http://aws.amazon.com/opsworks/ and to learn more about Chef, read this: http://www.getchef.com/chef/

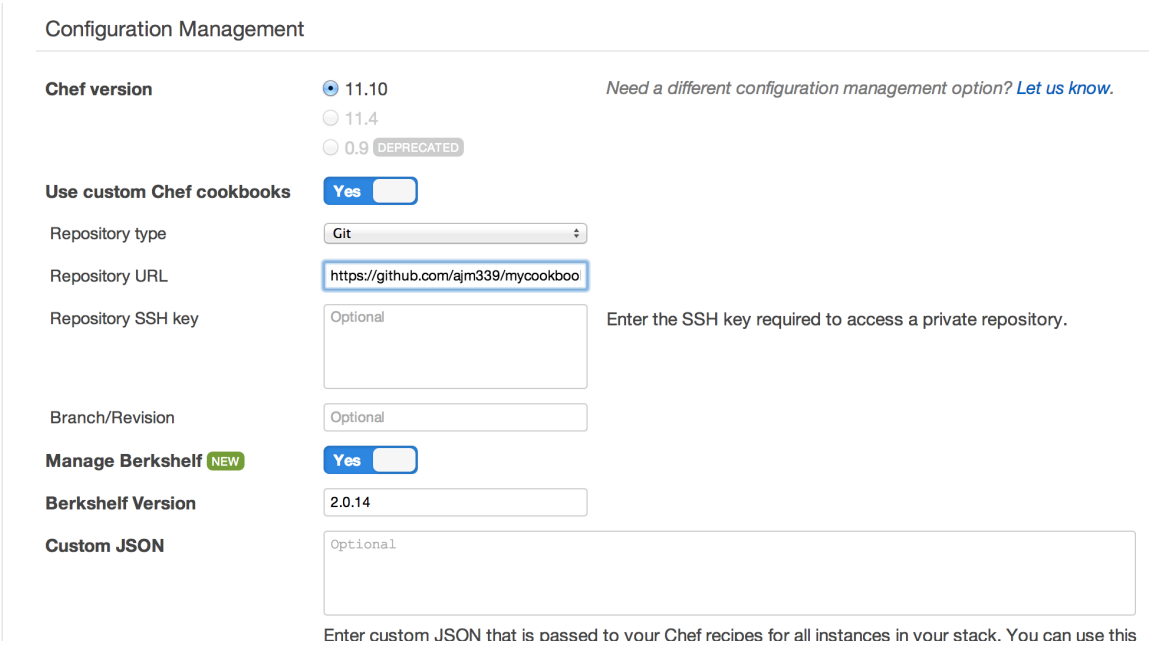
Steps

(1) Navigate to OpsWorks and create a stack
(2) Create a name for the stack. Choose wisely because this name will come into play in other parts of this tutorial.
(3) Choose the region that you want your stack to be in (this is where all the EC2 and RDS instances will be located).
(4) Choose a default subnet (this does not really matter, you can boot instances in whichever subnet you want later)
(5) Choose your Default operating system. This defaults to Amazon's AMI. This tutorial focuses on configurations optimized for Ubuntu 14.04 LTS, so I would recommend going with that.
(6) Choose your default root type. This can be adjusted in the layer settings later on. For this demo I recommend using Instance store. ***
(7) IAM role choose the default role.
(8) Choose the default SSH key that you set up in the previous step.
(9) Hostname theme is just a setting that can auto-generate names for your EC2 instances based on a theme. I chose cities in my application. This setting does not matter.
(10) Stack color is also irrelevant. Choose whatever you like best.



***Instance store means the hard drive is with the Virtual Private Server (VPS) so if and when you remove that instance, the data on the disk goes with it. EBS is Amazon's proprietary system that is essentially a virtual hard drive removed from the instance that AWS can move from instance to instance. In other words, if the hardware on the VPS fails, you can transfer the EBS data to another VPS. For my configuration, the EBS does not store a database or any critical data (the database is in an RDS, which I will delve into more later), so I chose Instance store since it is cheaper and ideal for my application. For more information on EBS vs Instance store read this: http://stackoverflow.com/questions/3630506/benefits-of-ebs-vs-instance-store-and-vice-versa

(11) Edit the Stack settings to meet your application's requirements. I used the newest version of Chef, and I have custom Chef cookbooks that will be necessary to prepare the server for my application. If you are running an application with similar configurations as mine, feel free to use my repository of cookbooks. It is a collection of open source community cookbooks. (https://github.com/ajm339/mycookbooks)
    (1) If your repository for custom cookbooks is private, you will need to create an RSA key to access it. I cover how to do this in the section for configuring and deploying your application.
(12) Allow the stack to use Berkshelf. It is a tool for grabbing dependencies for your cookbooks.



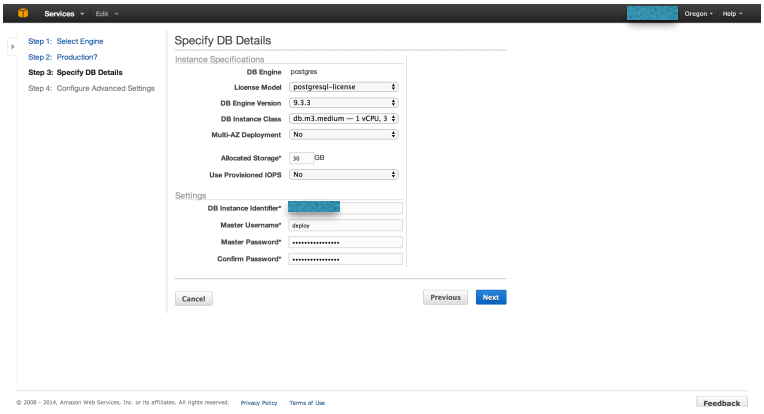
Relational Database Service (RDS)

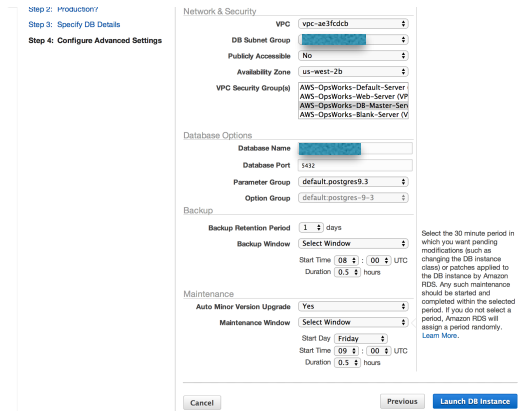
RDS is a service optimized for setting up highly scalable databases. They automatically backup nightly. There is also the option for increased data input/output and slave databases. This is also ideal for setting up a horizontally scalable application. This sample application utilizes a Postgres Database. RDS also support MySQL, Oracle SQL, and Microsoft SQL. For more information read this: http://aws.amazon.com/rds/

Steps

(1) Create RDS for your database in the default VPC.
(2) Select whether to use Multi-AZ Deployment and Provisioned IOPS. This tutorial does not cover those features.***
(3) Fill in the following options as desired. 30GB is the maximum memory allocated under the RDS free tier. Note the DB Instance Identifier, Master Username, and Master Password as you will need them later on.
(4) Assign it the OpsWorks Master DB Security Layer

***Provisioned IOPS gives higher Input/Output Per Second. Multi A-Z deployment has a database that stays in sync with the primary database. This is helpful because if your DB fails, it automatically switches your app to work with the cloned database (but it is very expensive).





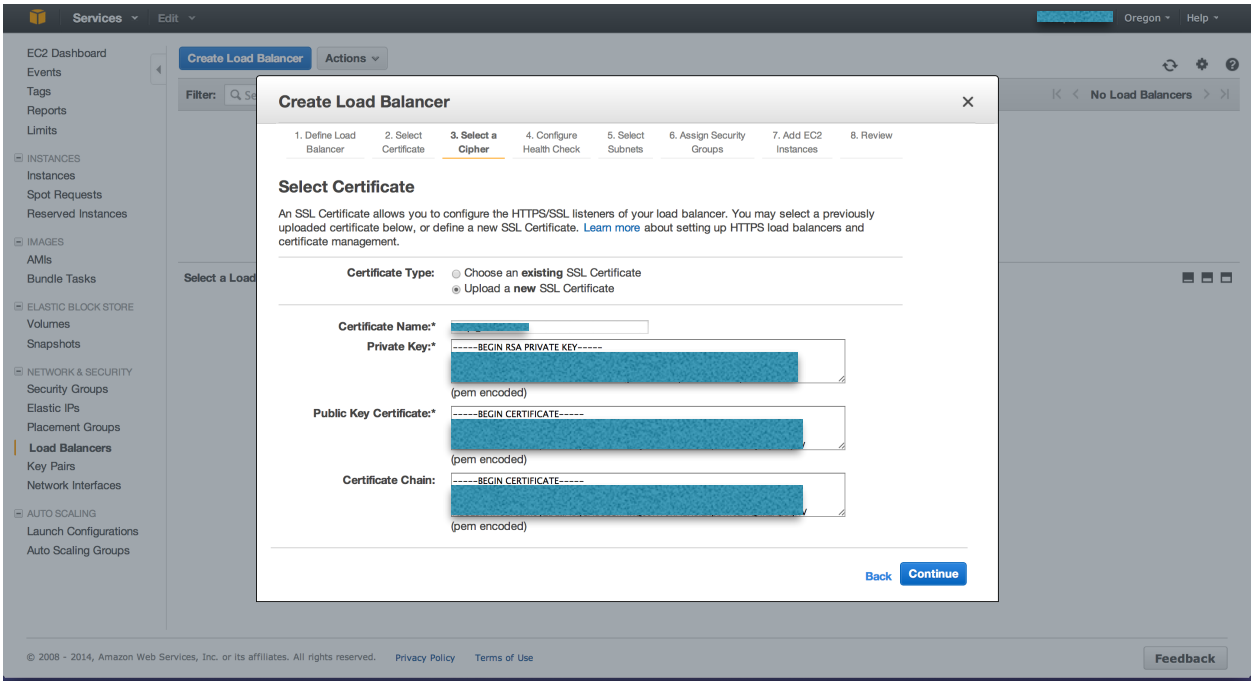
Elastic Load Balancer (ELB)

ELBs distribute incoming traffic across multiple EC2 instances to help fault tolerance and maintain application performance. It is helpful for horizontal scaling. This tutorial places an ELB in front of a Rails Application layer. For more information on ELBs read this: http://aws.amazon.com/elasticloadbalancing/

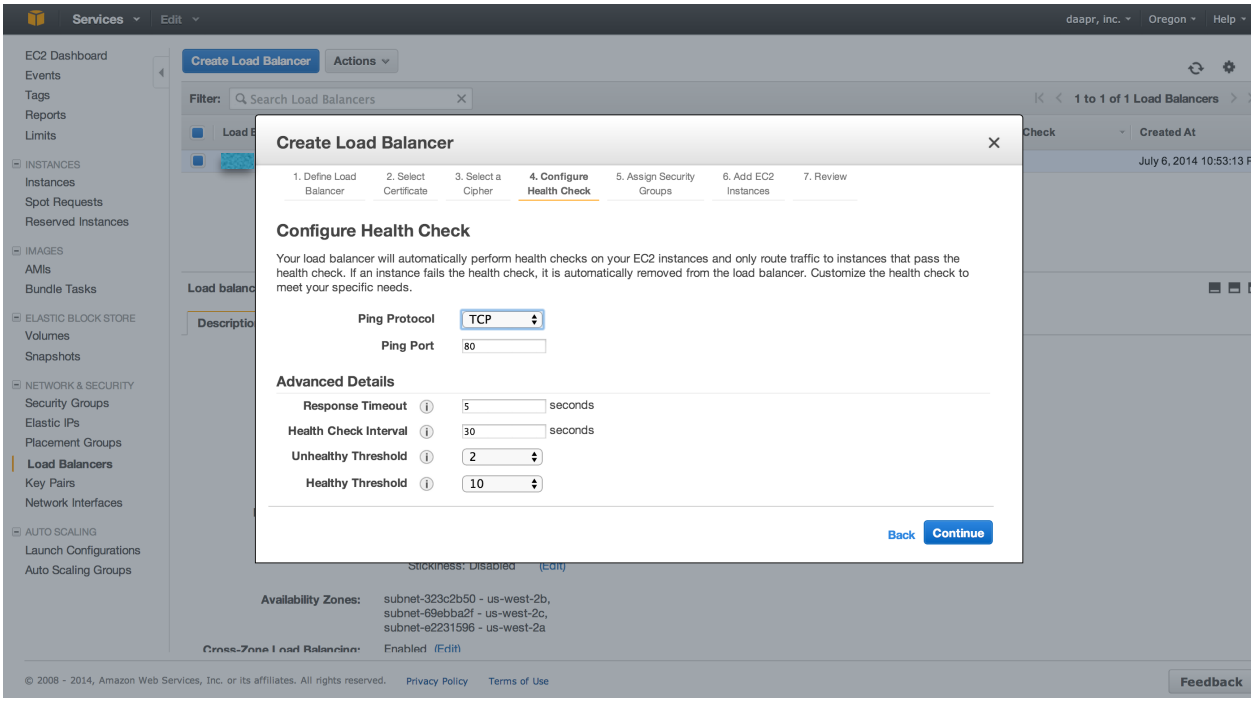
Steps

(1) Make sure you have your SSL for the ELB. For more information see the Appendix.
(2) Create Elastic Load Balancer for the app servers in the EC2 Console.
(3) Convert your private key to pem format for the Private Key input.
    (1) openssl rsa -in your-private-key-filename -outform PEM
(4) Convert your public ww_domain_crt to pem format for the Public Certificate input.
    (1) openssl x509 -inform PEM -in your-public-certificate-filename
(5) Concatenate the 2nd intermediary certificate, the first intermediary certificate, and the root certificate into bundle_ca.crt.
    (1) cat COMODORSADomainValidationSecureServerCA.crt COMODORSAAddTrustCA.crt AddTrustExternalCARoot.crt >> bundle_ca.crt
(6) Then get the bundle_ca.crt in PEM format for the Certificate Chain input.
    (1) openssl x509 -inform PEM -in your-certificate-chain-filename

***For clarification on these steps read: https://docs.aws.amazon.com/ElasticLoadBalancing/latest/DeveloperGuide/ssl-server-cert.html



(7) Configure the health check to use TCP or SSL and port 80. You can use HTTP or HTTPS at the root of your application (/) but sometimes this does not execute properly.
(8) Set the interval to whatever you think is appropriate.
(9) Associate the AWS OpsWorks Security Group for LB with the ELB. Additionally add security rule for inbound requests that allows all inbound traffic from instances in the default VPC.
(10) Do not add any EC2 instances to the ELB, OpsWorks will take care of this.



Rails Application Layer

OpsWorks is divided into different layers based on application type. This tutorial covers using the Rails Application layer. OpsWorks also supports PHP, Java, Node.js as well as Database, Worker, and Load Balancing layers. For more information on the Rails Application layer, read: http://docs.aws.amazon.com/opsworks/latest/userguide/workinglayers-rails.html

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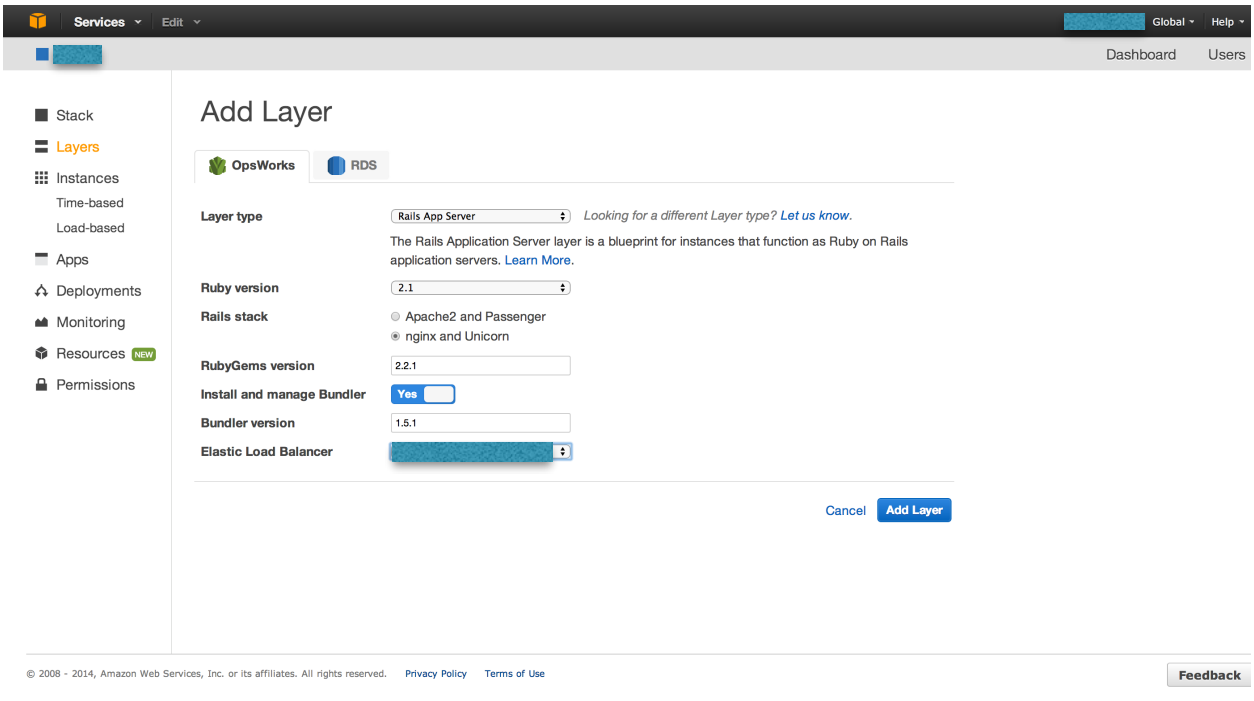
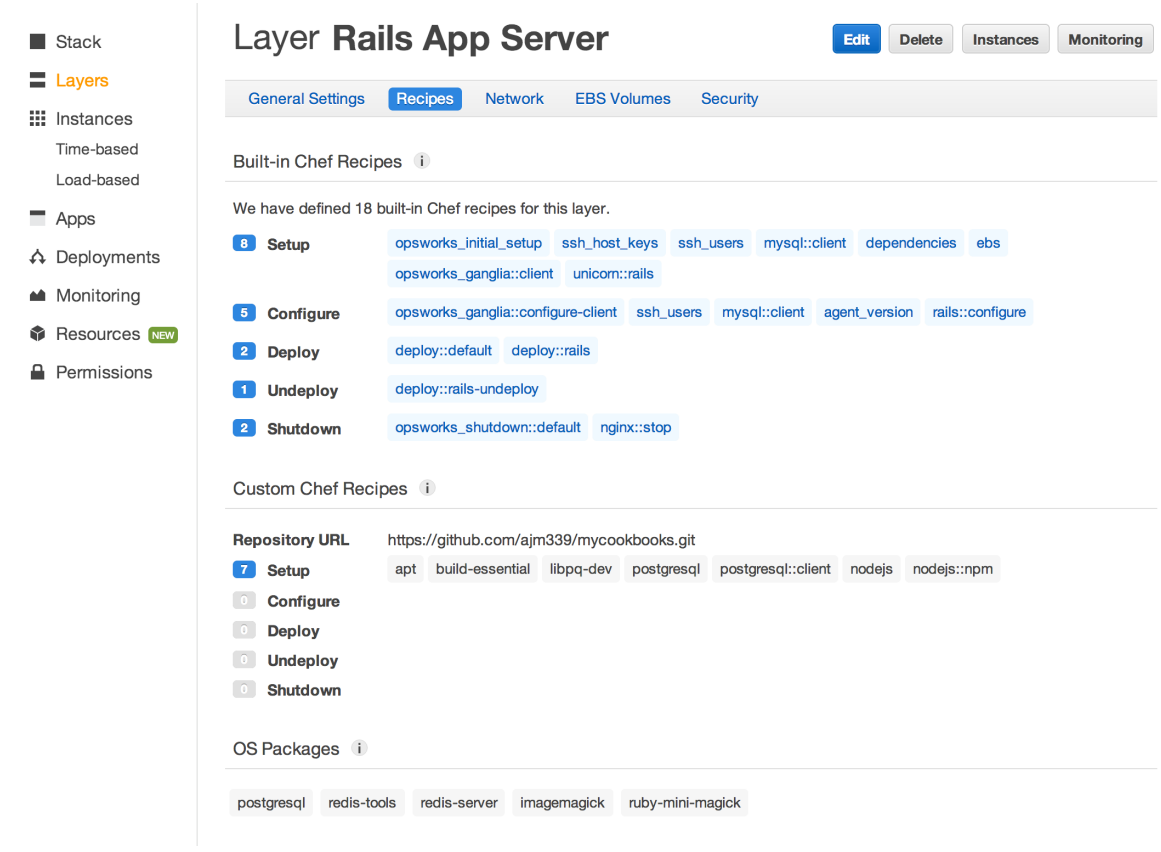
Steps

(1) Add a Rails Application Layer.
(2) This tutorial covers using Ruby version 2.1 with nginx and Unicorn.
(3) Add the Elastic Load Balancer that you configured earlier.



(4) Next edit the layer's custom recipes to include the necessary dependencies. If you are using a configuration similar to this tutorial, use the following configuration.
(5) On the Setup stage, include:
    (1) apt
    (2) build-essential
    (3) libpq-dev
    (4) postgresql
    (5) postgresql::client
    (6) nodejs
    (7) nodejs::npm
(6) In OS Packages use the following:
    (1) postgresql
    (2) redid-tools
    (3) redis-server
    (4) imagemagick
    (5) ruby-mini-magick

Note: If updating cookbooks, go to Stack -> Run Command



Relational Database System Layer

The RDS layer is where the application hosts its database. The point of having a separate layer for this is so that multiple application servers can utilize a single database and allow horizontal scaling. For more information read: http://docs.aws.amazon.com/opsworks/latest/userguide/workinglayers-db-rds.html

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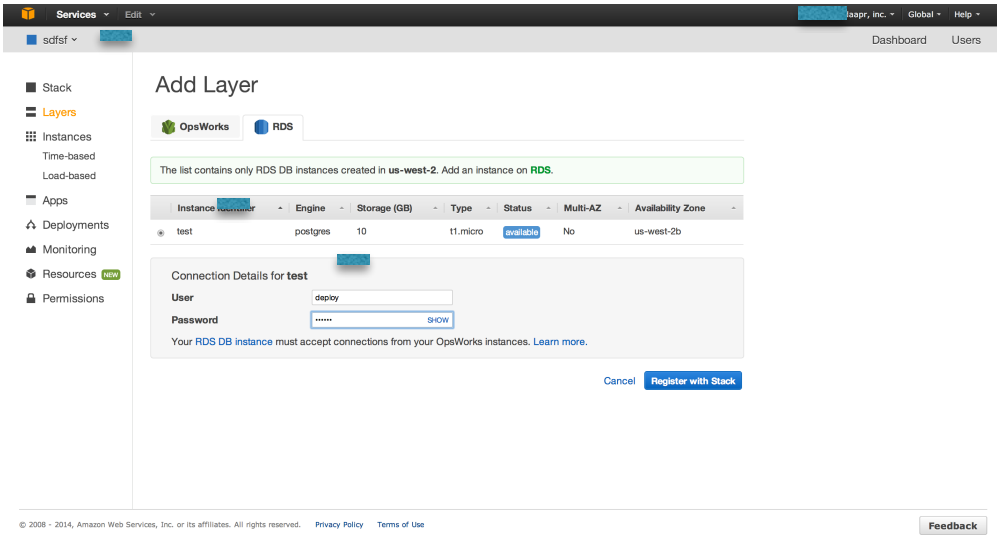
Steps

(1) Using the RDS initialized earlier in this tutorial, simply add a new layer, select the RDS tab, and select the RDS instance you created earlier.
(2) Make sure to input the correct Master Username and Password you set for the RDS.
(3) If you are using PostgreSQL, OpsWorks has a bug that automatically defaults to the MySQL adapter when deploying. To override this, add this code to your Custom JSON in your Stack Settings.
(4) If you are migrating a database from Heroku, see the database migration section in the appendix.

```
{
  "deploy" : {
    "appname" : {
      "database" : {
        "adapter" : "postgresql",
        "database" : "databasename",
        "host" : "hosturl",
        "password" : "dbpassword",
        "port" : portnumber,
        "reconnect" : true,
        "username" : "dbusername"
      }
    }
  }
}
```

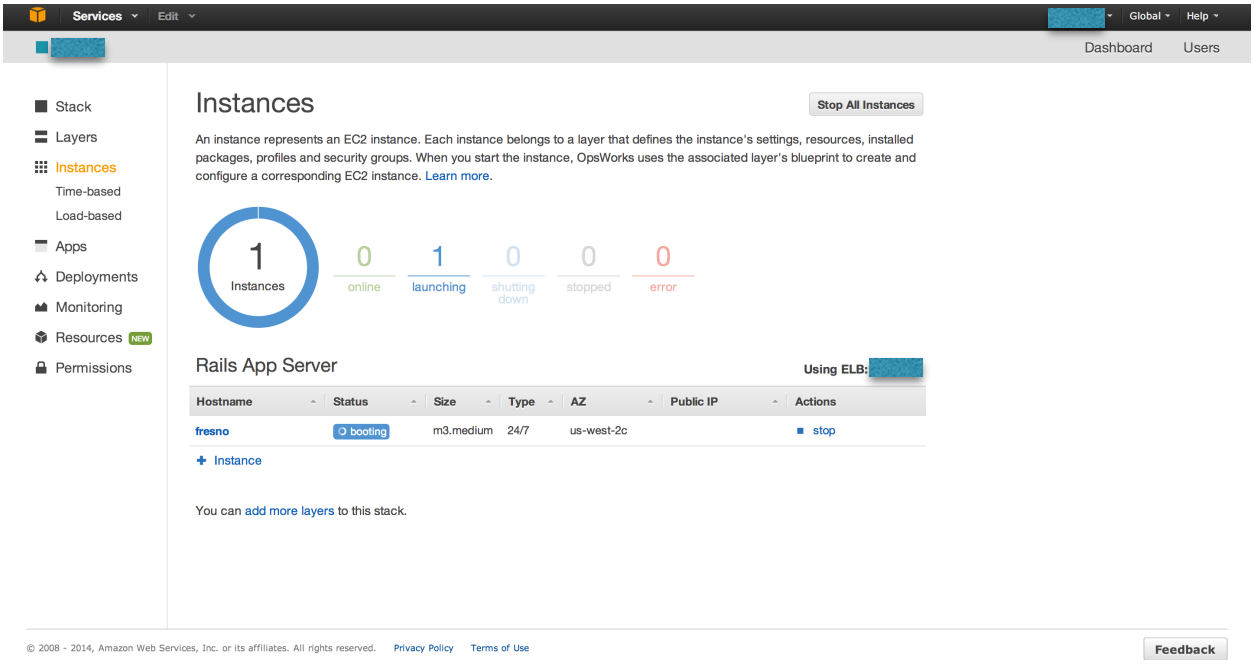


Test Application Configuration

Now test your application configuration by booting an application server.

Steps

(1) Add an instance to the Rails Application Layer. If everything is configured correctly, this should boot properly. If not view the logs and determine the error.



Set-up Application Repository

OpsWorks also has the ability to deploy application code with similar functionality to Capistrano. OpsWorks can host multiple applications for specific layers. This tutorial focuses on setting up a single Ruby on Rails applications. For more information read: http://docs.aws.amazon.com/opsworks/latest/userguide/workingapps-creating.html

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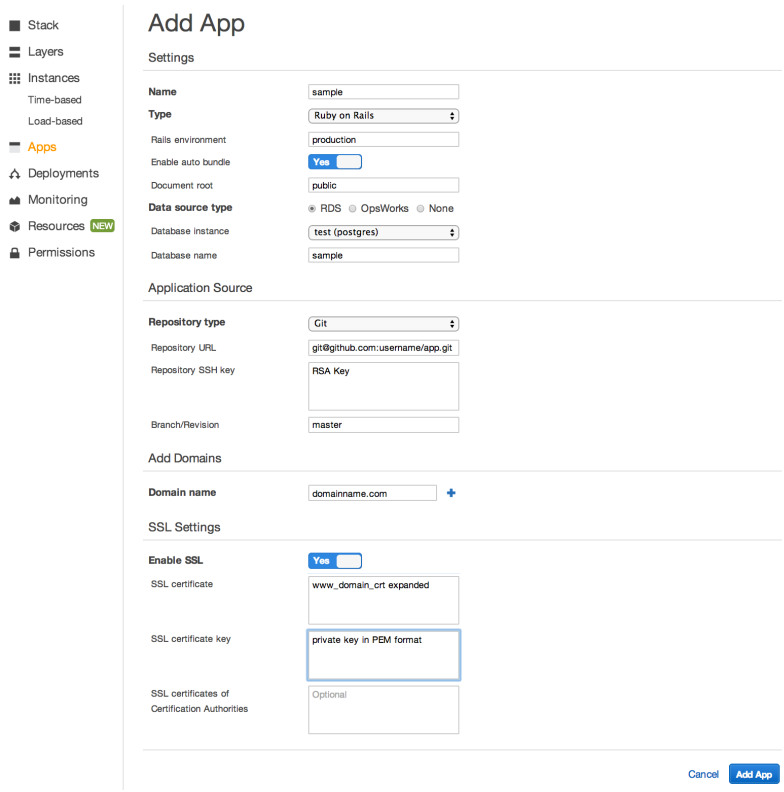
Steps

(1) Create a Ruby on Rails Application.
(2) Make sure the name matches the name in your application files.
(3) Specify the environment as production.
(4) Specify the database to use RDS.
(5) Specify your repository URL. If your repository is private, see the Private Github Access section in the appendix. Additionally you can deploy from an S3 Archive, Http Archive, or Subversion.
(6) Enable SSL for the application
(7) Put the www_domain_crt in the SSL certificate input
(8) Put the private key in pem format in the SSL certificate key
(9) Leave the SSL certificates of Certification Authorities blank if you are using nginx

For more information on App SSLs read: http://docs.aws.amazon.com/opsworks/latest/userguide/workingsecurity-ssl.html



Deploy an Application

OpsWorks has many options for deployments. The options include Deploy, Undeploy, Rollback, Start Web Server, Stop Web Server, and Restart Web Server. Deployments can also run database migrations. You can also target a deployment to specific to layers and instances as well as specify Custom JSON for certain Recipes. For more information read: http://docs.aws.amazon.com/opsworks/latest/userguide/workingapps-deploying.html

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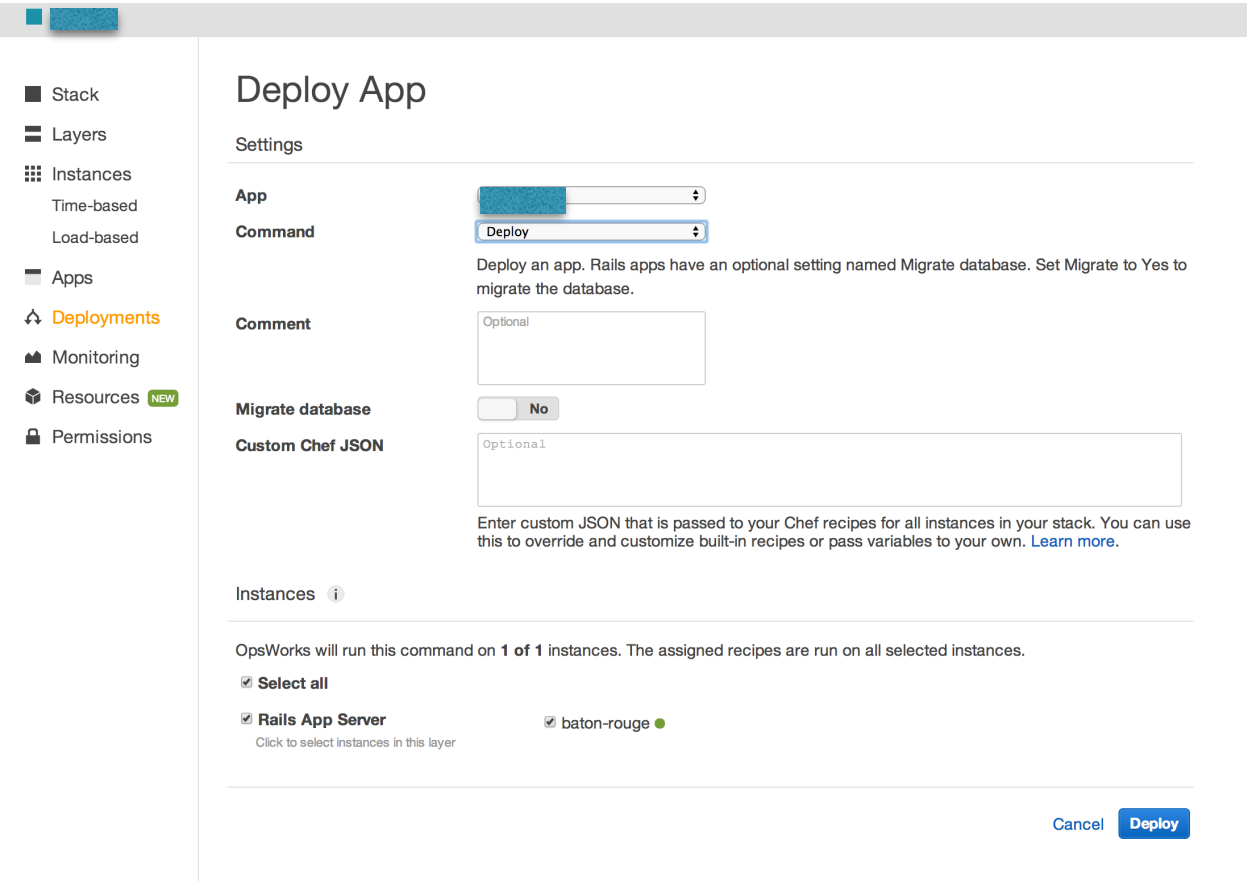
Steps

(1) Choose which type of Deployment you are running.
(2) Choose whether you need run a migration.
(3) Specify any necessary Custom JSON
(4) Specify the layers and/or instances you want to target.



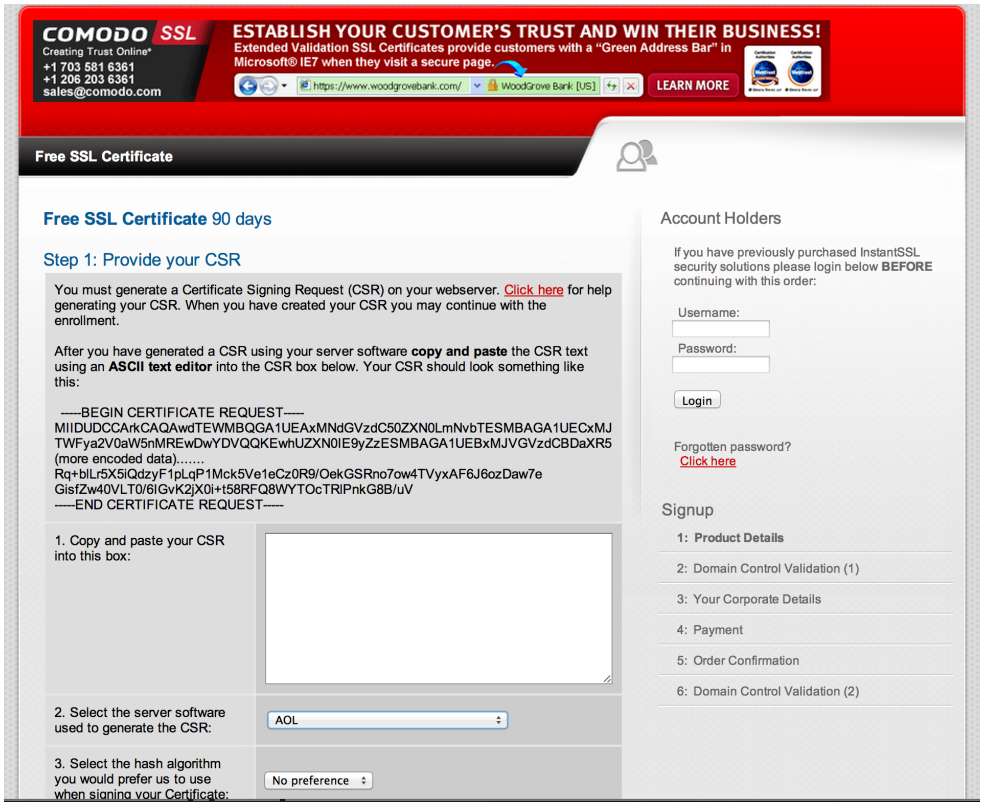
Appendix

Generate Secure Sockets Layer (SSL)

SSL certificates are on any website with login credentials. SSLs provide a layer of encryption and ensure secure logins. For more information on SSLs read: http://info.ssl.com/article.aspx?id=10241

Steps

(1) Generate a CSR and private key (openssl req -out CSR.csr -new -newkey rsa:2048 -nodes -keyout privateKey.key) as seen here: http://www.sslshopper.com/article-most-common-openssl-commands.html NOTE: Make sure you have openssl installed, and do not put a paraphrase on the key.
(2) Create a free 90 day SSL here: http://www.instantssl.com/ssl-certificate-products/free-ssl-certificate.html
(3) Copy and Paste the CSR including BEGIN and END request tags. Select nginx as the server software for the purposes of this tutorial.
(4) Follow the on screen instructions.



Migrate Database from Heroku to RDS

This section covers migrating an exiting database to RDS. If you are migrating from Heroku, simply download the dump file and load it into the new database. For more information read this: https://devcenter.heroku.com/articles/heroku-postgres-import-export

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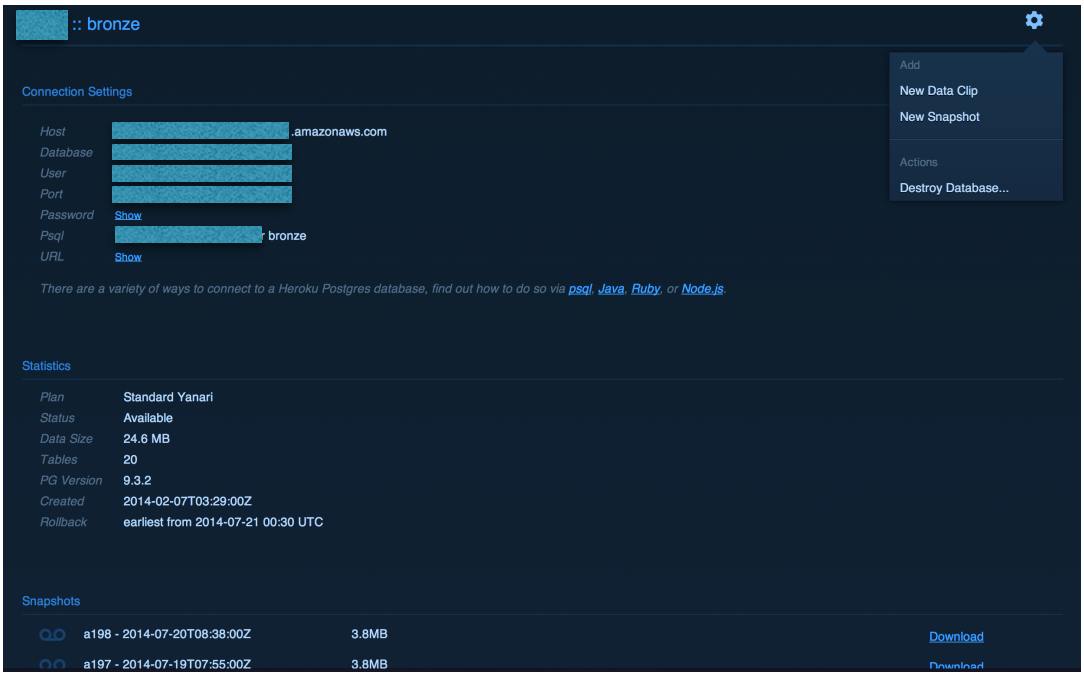
Steps

(1) If you are migrating a Database, download the .dump file of the old database.
    (1) For Heroku
    (2) Go to the application resources
    (3) Click on the database
    (4) Click on the Settings Icon
    (5) Click New Snapshot, then download that snapshot
(2) Change RDS Security group to default to accept any TCP/IP Connections (Will replace with old security afterwards)
(3) Upload the dump file into the database
    (1) pg_restore --host=rds_hostname.amazonaws.com --username=rds_username --dbname=db_username --clean filename.dump
    (2) If necessary, read more here: http://www.postgresql.org/docs/9.3/static/app-pgdump.html
(4) Once you are done, change the RDS security group back to the AWS OpsWorks MasterDB Security Group

***Note: Running commands like 'heroku run rails console' need to be done by SSHing into the instance and then run the command as the root user in the folder '/srv/www/app_name/current'



Private Github Access

Most production applications are saved in private Git repositories. This is helpful to keep your production code protected. If your application is in a private Github repository, then you need to give AWS special access to it. For additional information about giving AWS access to private Github repositories, read the following: http://docs.aws.amazon.com/opsworks/latest/userguide/workingapps-deploykeys.html, https://developer.github.com/guides/managing-deploy-keys/#deploy-keys, https://help.github.com/articles/generating-ssh-keys

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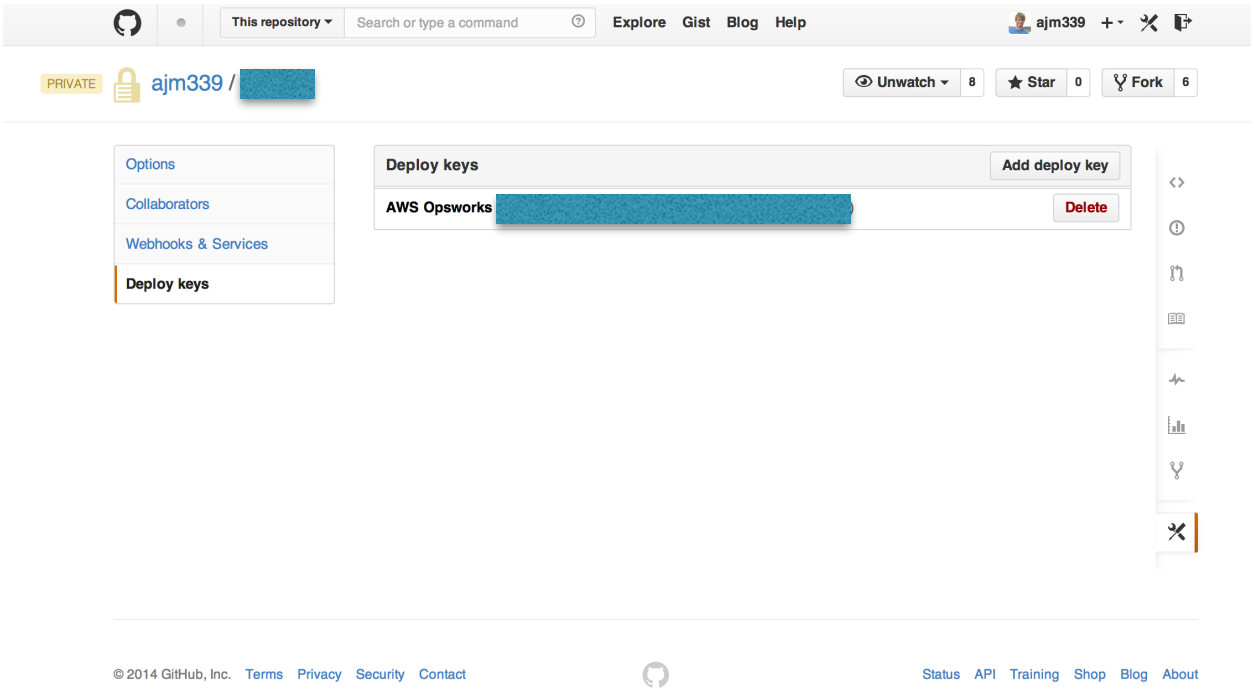
Steps

(1) Create a Public and Private RSA keys for Github to use.
    (1) ssh-keygen -t rsa -C "your_email@example.com"
(2) Add the public RSA key to Deploy Keys of your application via the Settings of the Application repository
    (1) cat name_you_chose.pub
    (2) Copy and Paste into the Github Public SSH Keys
(3) Copy and paste the Private RSA Key into the Repository SSH keys in the Application Settings



Amazon CloudFront

CloudFront is a Content Delivery Network (CDN) that is a great solution for serving static assets for your application. This sample application uses CloudFront to serve its CSS and JavaScript files. This is helpful because the application server does not need to serve them up, hence lightening their load. Additionally, CDNs have cache servers across the world that have speedy read access which can serve static assets faster than normal servers. This tutorial uses the gem Asset Sync to sync the Ruby on Rails assets to Amazon S3, which contains an archive of the assets for CloudFront. For more information on CloudFront read: http://aws.amazon.com/cloudfront/ and for information on Asset Sync read: https://github.com/rumblelabs/asset_sync

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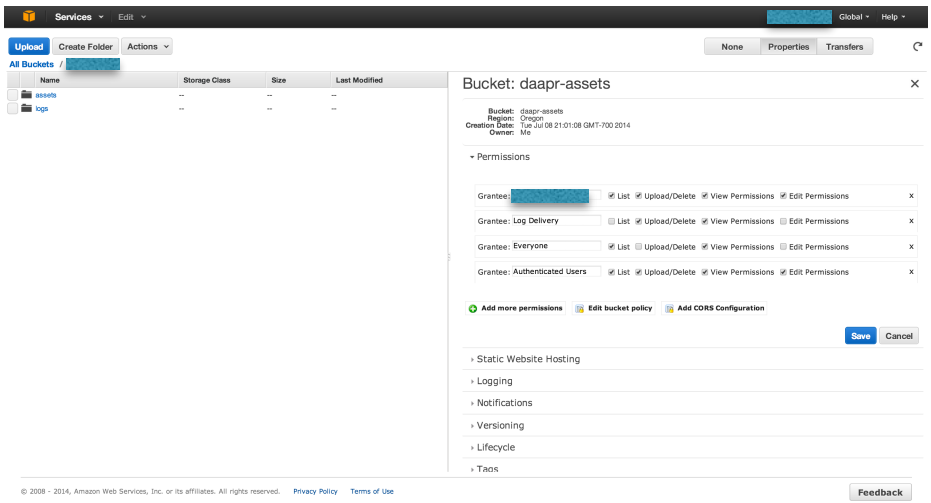
Steps

(1) Create an S3 bucket for your assets
(2) Give Read and List permissions to Everyone so the CDN can access the bucket.
(3) Modify the CORS policy to be accessible by these entities.
    (1) For more on Bucket Policies read: https://docs.aws.amazon.com/AmazonS3/latest/dev/example-bucket-policies.html

```
{
 "Version": "2012-10-17",
 "Statement": [
        {
                "Sid": "AddPerm",
                "Effect": "Allow",
                "Principal": {
                        "AWS": "*"
                },
                "Action": "s3:GetObject",
                "Resource": "arn:aws:s3:::daapr-assets/*"
        }
 ]
}
```



(4) Configure CloudFront.
    (1) Create a Web Distribution with the default settings. Link to the S3 bucket you created earlier
(5) Configure Asset Sync
    (1) add 'gem asset-sync' to the Gemfile
    (2) Configure the environment sheet: config/environments/production.rb
        (1) Note: make sure to place // in front of the CDN URL, but do not specify http or https.
    (3) Create the initializer: config/initializers/asset_sync.rb
    (4) Create the rake task: lib/tasks/asset_sync.rake
(6) In order to sync assets to S3 run these commands:
    (1) RAILS_ENV=production bundle exec rake assets:precompile
    (2) bundle exec rake assets:sync

Configure **config/environments/production.rb** to use Amazon S3 as the asset host and ensure precompiling is enabled.

```
#config/environments/production.rb
config.action_controller.asset_host = "//#{ENV['FOG_DIRECTORY']}.s3.amazonaws.com"
```

A rake task is included within the **asset_sync** gem to perform the sync:

```
namespace :assets do
  desc "Synchronize assets to S3"
  task :sync => :environment do
    AssetSync.sync
  end
end
```

The generator will create a Rails initializer at `config/initializers/asset_sync.rb`.

```
AssetSync.configure do |config|
  config.fog_provider = 'AWS'
  config.fog_directory = ENV['FOG_DIRECTORY']
  config.aws_access_key_id = ENV['AWS_ACCESS_KEY_ID']
  config.aws_secret_access_key = ENV['AWS_SECRET_ACCESS_KEY']

  # Don't delete files from the store
  # config.existing_remote_files = 'keep'
  #
  # Increase upload performance by configuring your region
  # config.fog_region = 'eu-west-1'
  #
  # Automatically replace files with their equivalent gzip compressed version
  # config.gzip_compression = true
  #
  # Use the Rails generated 'manifest.yml' file to produce the list of files to
  # upload instead of searching the assets directory.
  # config.manifest = true
  #
  # Fail silently.  Useful for environments such as Heroku
  # config.fail_silently = true
end
```

Amazon Simple Email Server (SES)

SES is a great service for helping your applications send automated emails to users. One is able to use the Rails Model Mailer with SES very easily. For more information read: http://aws.amazon.com/ses/ or more instructions read: http://blogs.sequoiainc.com/blogs/getting-started-quickly-with-amazon-email-sending-service-ses-and-ruby-on-rails

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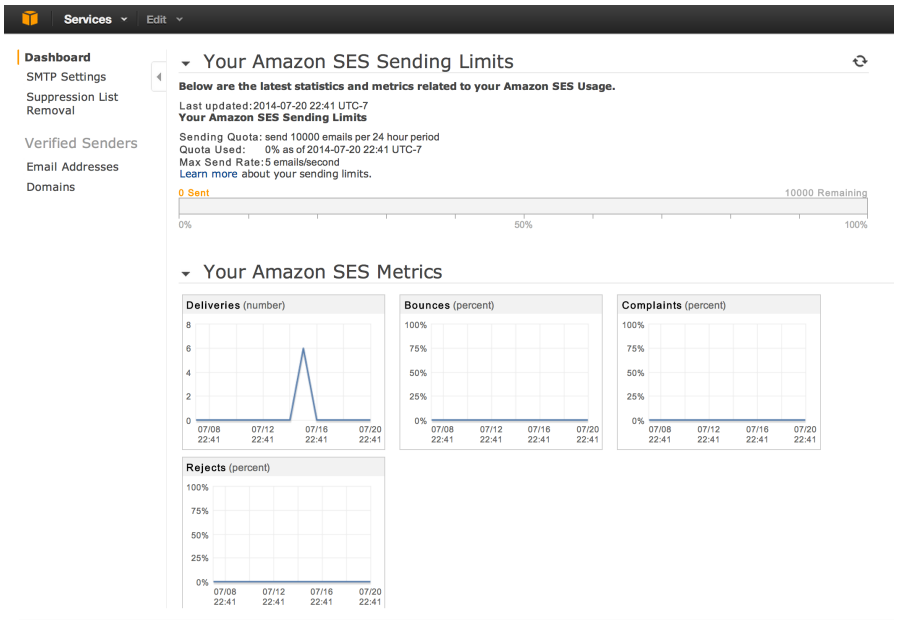
Steps

(1) Add some verified email addresses in order to test the mailer.
(2) Configure your application's mailer by following these directions: http://guides.rubyonrails.org/action_mailer_basics.html
(3) Create a mailer user in the SMTP Settings, and download the CSV file with the User Name and Password for the mailer user.
(4) Verify the domain using the on-screen directions to place the proper credentials with you DNS provider.
(5) Place the settings below in your production environment
(6) Once you have proven the settings, request Production Access to use live.

```
config.action_mailer.delivery_method = :smtp
  config.action_mailer.smtp_settings = {
     :address => 'mailer_region_address.amazonaws.com',
     :authentication => :login,
     :user_name => 'mailer_username',
     :password => 'mailer_password',
     :enable_starttls_auto => true,
     :port => 587
  }
```



Background Processes

Many applications use background processes to handle some of their computations to maintain application performance. This tutorial leverages Redis and Sidekiq for background processes. This tutorial covered installing the necessary dependencies earlier. Sidekiq and background processes run on the same server as the application servers for easy configuration as well as the ability to For more information on Redis read: http://redis.io/ and Sidekiq read: http://sidekiq.org/ Additional directions: http://zaman.io/running-sidekiq-on-opsworks/

Steps

(1) Add the redis-server and redis-tools to allow Redis to run
(2) Follow https://github.com/mperham/sidekiq/wiki/Getting-Started to set up Sidekiq
(3) Make sure to include imagemagick and ruby-mini-magick for any image resizing
(4) Configure the Rails Application to start sidekiq on boot.
    (1) Create a rake task in lib/tasks/sidekiq.rb
    (2) Create a folder deploy in the application root, and a file before_restart.rb to execute when the starts

```
SIDEKIQ_PID = File.expand_path("../../tmp/pids/sidekiq.pid", __FILE__)

namespace :sidekiq do
  def sidekiq_is_running?
    File.exists?(SIDEKIQ_PID) && system("ps x | grep `cat #{SIDEKIQ_PID}` 2>&1 > /dev/null")
  end

  desc "Start sidekiq daemon."
  task :start => :stop do
    if sidekiq_is_running?
      puts "Sidekiq is already running."
    else
      sh "bundle exec sidekiq -d" # -d means daemon
    end
  end

  desc "Stop sidekiq daemon."
  task :stop do
    if File.exists? SIDEKIQ_PID
      sh "sidekiqctl stop #{SIDEKIQ_PID}"
    end
  end

  desc "Show status of sidekiq daemon."
  task :status do
    if sidekiq_is_running?
      puts "Sidekiq is running"
    else
      puts "Sidekiq is stopped"
    end
  end
end
```

```
#Opsworks completes this before restart
node[:deploy].each do |application, deploy|
  if application == 'your_app_name' # app short name
    run "bundle exec rake sidekiq:start"
  end
end
```