Running Open Source platforms on AWS

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Agenda

- AWS Infrastructure
- VMs & OSes
- Language SDKs
- Docker
- Development infrastructure
- Databases
- Data Processing
- Conclusion

AWS Infrastructure

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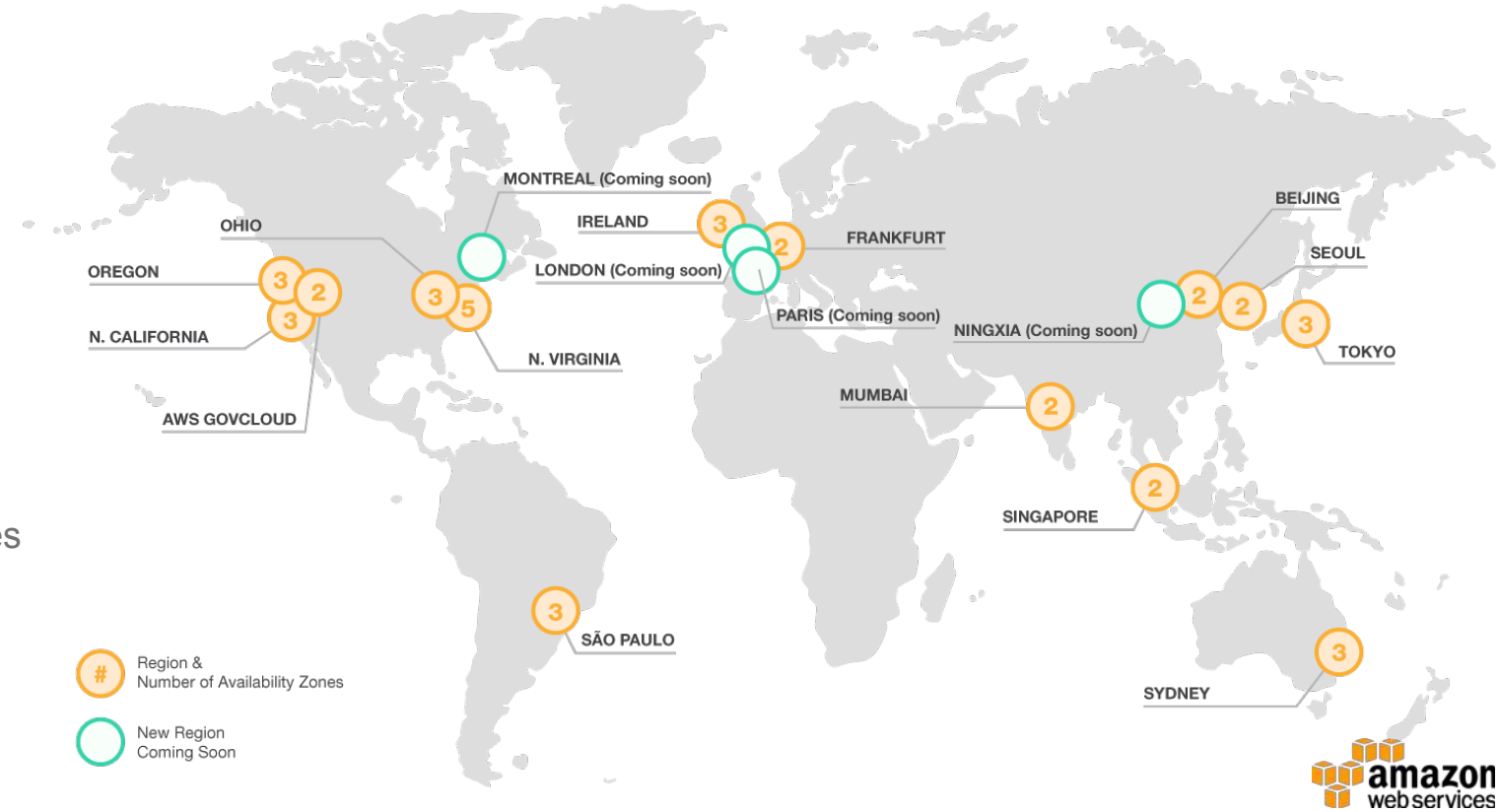
AWS Global Infrastructure



14 Regions

38 Availability Zones

63 Edge Locations

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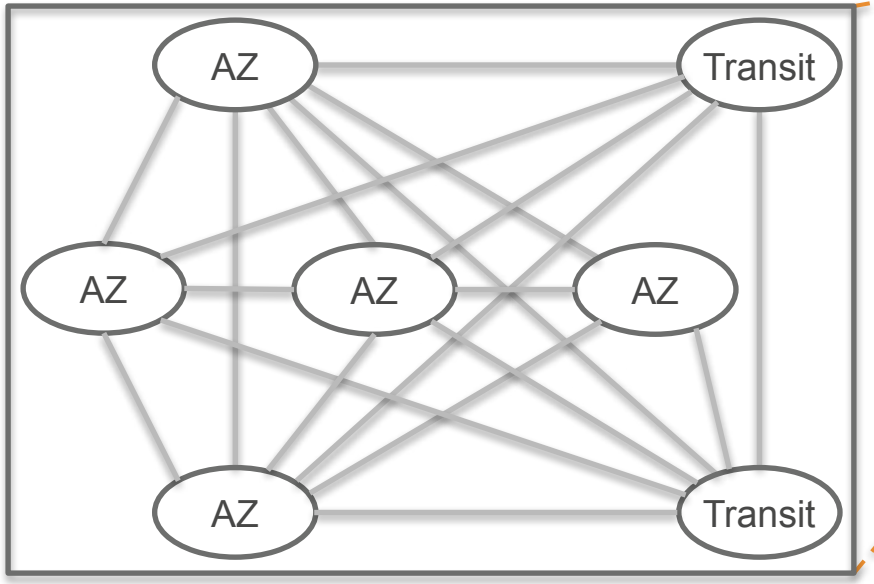
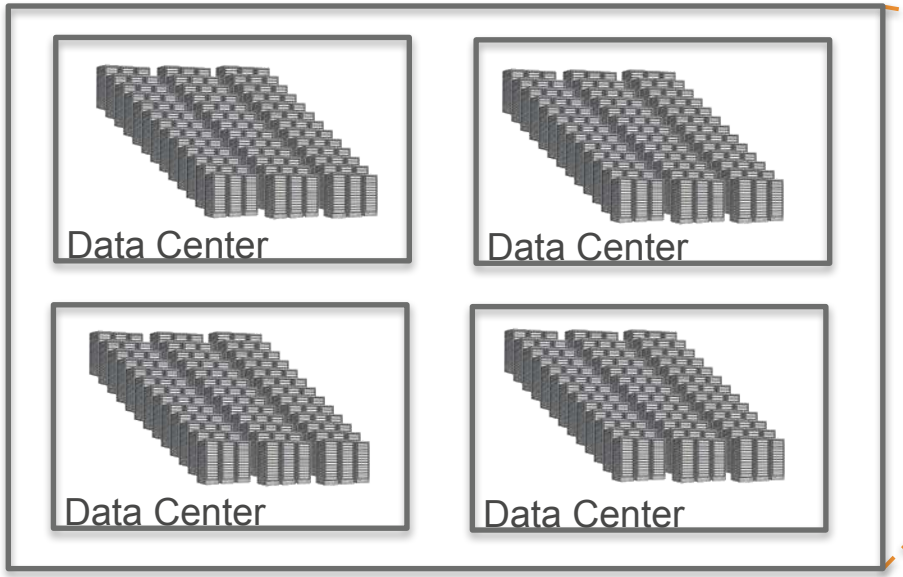
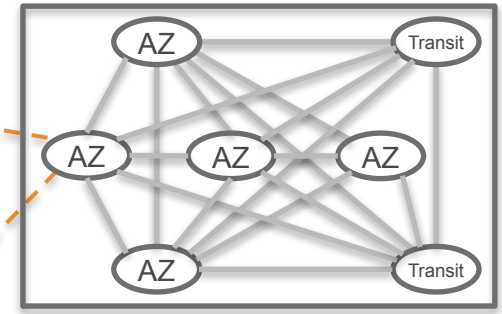
Example AWS Region



- Redundant paths to transit centers
- Transit centers connect to:
  - Private links to other AWS regions
  - Private links to AWS Direct Connect customers
  - Internet through peering & paid transit
- Metro-area DWDM links between AZs
- AZs <2ms apart & usually <1ms

Example AWS Availability Zone





- All regions have 2 or more AZs
- Each AZ is 1 or more DC
  - No data center is in two AZs
  - Some AZs have as many as 6 DCs
- DCs in AZ less than ¼ ms apart

AWS re:Invent 2014 | (SPOT301) AWS Innovation at Scale
https://www.youtube.com/watch?v=JIQETrFC_SQ

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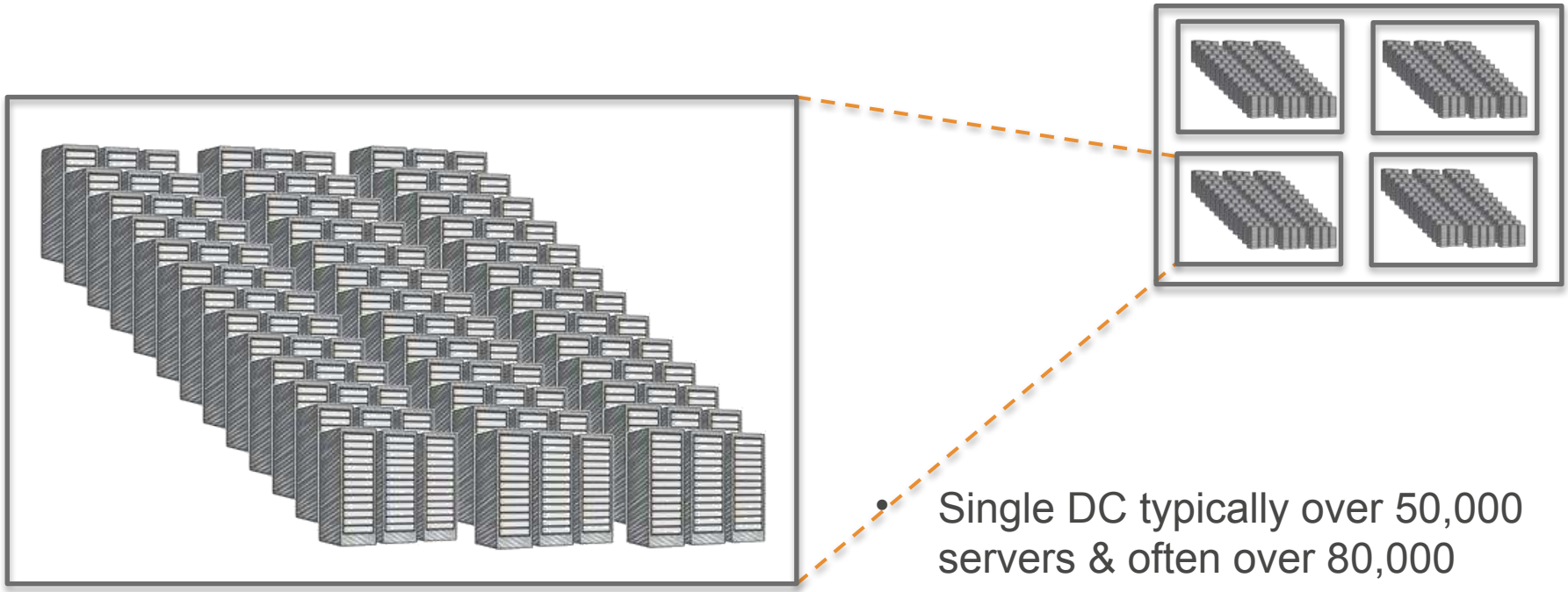
Example AWS Data Center



- Single DC typically over 50,000 servers & often over 80,000
  - Larger DCs undesirable (blast radius)
- Custom network equipment
- Custom protocol stack

AWS re:Invent 2014 | (SPOT301) AWS Innovation at Scale
https://www.youtube.com/watch?v=JIQETrFC_SQ

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Virtual Machines & Operating Systems

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Amazon EC2 AWS Free Tier

- Infrastructure as a Service, launched in 2006
- Virtual machines (“EC2 instances”) and images (“Amazon Machine Image”, “AMI”)
- Amazon AMIs, vendor AMIs (“EC2 Marketplace”), community AMIs, or your own

- All-inclusive: networking (Virtual Private Cloud), storage (Elastic Block Storage), firewalling (Security Group), load balancing (Elastic Load Balancing), high availability (Availability Zones), automatic scaling (Auto Scaling groups), monitoring (Cloudwatch)

- Pay on an hourly basis: Reserved Instances and Spot Instances for large savings

https://aws.amazon.com/ec2/
http://aws.amazon.com/free/
https://aws.amazon.com/ec2/pricing/reserved-instances/
https://aws.amazon.com/ec2/spot/

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« *I can get less expensive VMs at X, Y or Z* »

- Comparing apples and oranges?

- Take a long, hard look at:
  - Geographical coverage
  - Width and depth of technical services
  - High availability: not all “regions” are born equal
  - Scalability
  - Security
  - Compliance

05/01/16 https://aws.amazon.com/blogs/aws/happy-new-year-ec2-price-reduction-c4-m4-and-r3-instances/
11/08/16 https://aws.amazon.com/blogs/aws/amazon-elastic-block-store-ebs-update-snapshot-price-reduction-more-piopsgib/
14/11/16 https://aws.amazon.com/blogs/aws/ec2-price-reduction-c4-m4-and-t2-instances/

Instances Types

<Family><Generation>.<Size>, e.g. m4.xlarge

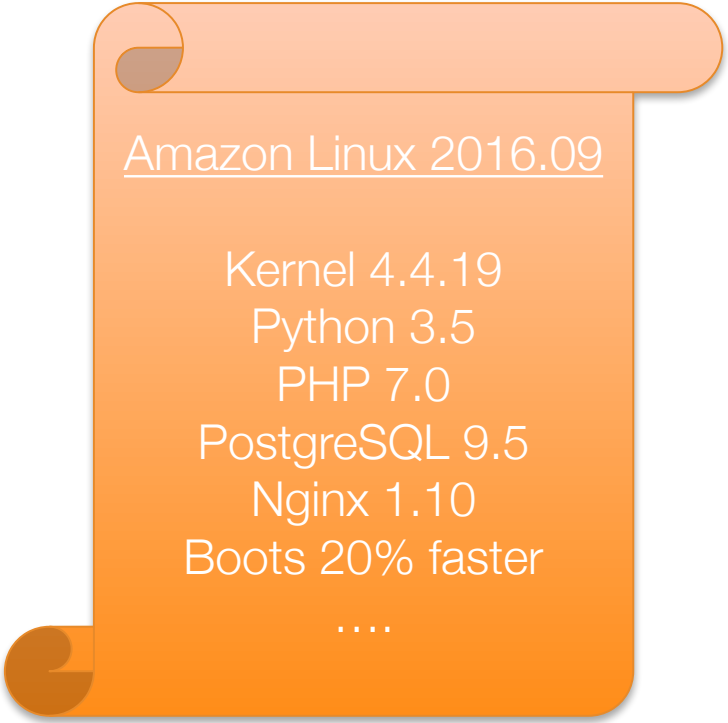
General purpose: t2 (burstable), m3, m4
Compute-optimized: c3, c4
Storage-optimized: i2 (I/O), d2 (Density)
Memory-optimized: r3, x1,
GPU: g2, p2

t2.nano: 1 vCPU, 512MB RAM, EBS storage
x1.32xlarge: 128 vCPU, 2TB RAM, 4TB SSD, 10Gb network

https://aws.amazon.com/ec2/instance-types/

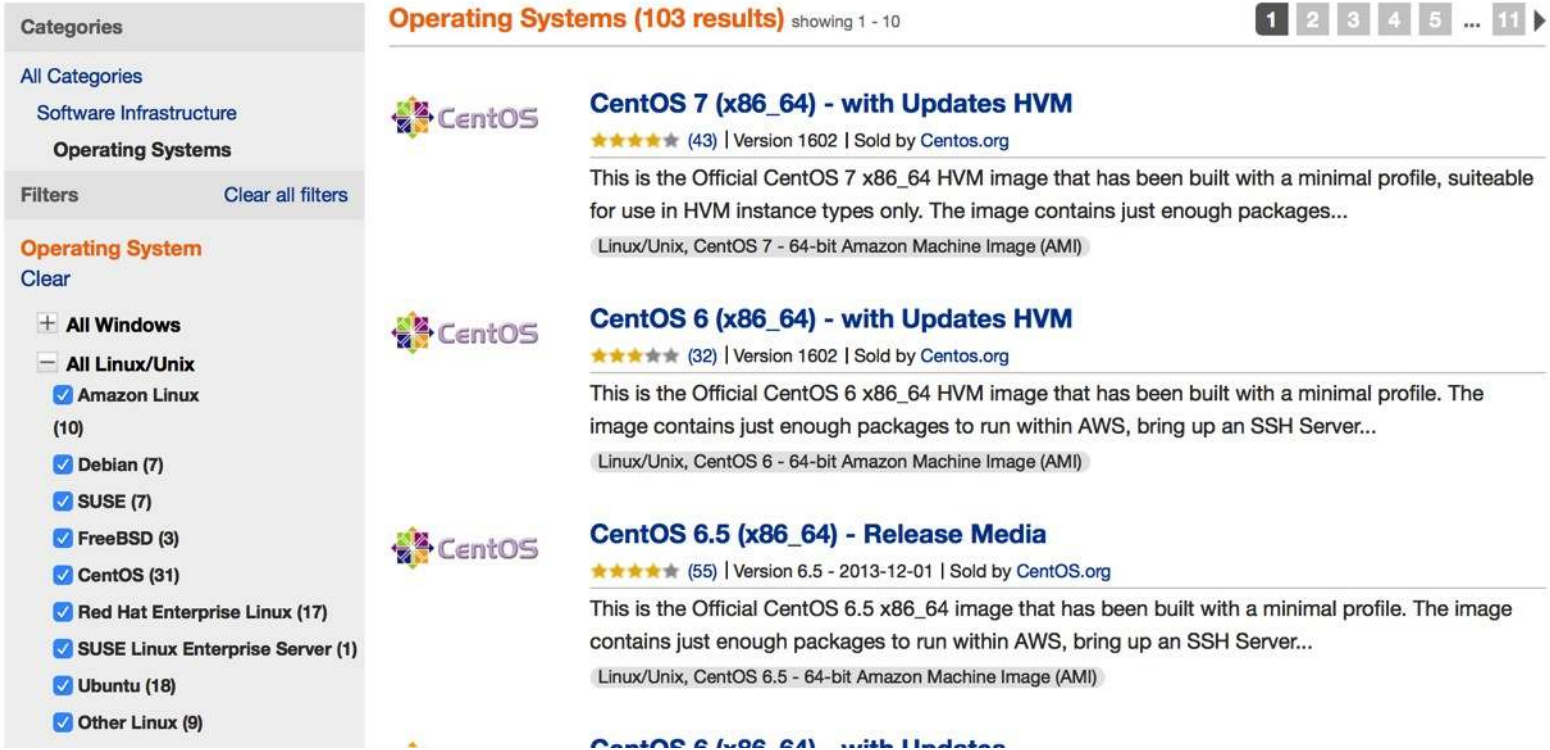
Amazon Linux

- Evolved from CentOS
- AWS Integration
- Secure Configuration
- Package Repository Access
- Security Updates
- Lightweight
- AWS Support
- Available as Docker container



https://aws.amazon.com/amazon-linux-ami/
https://aws.amazon.com/amazon-linux-ami/2016.09-release-notes/
https://docs.aws.amazon.com/AmazonECR/latest/userguide/amazon_linux_container_image.html

100 Linux AMIs on the AWS Marketplace



FreeBSD

NetBSD

OpenBSD

CentOS debian redhat SUSE ubuntu

We adapt. You succeed.

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https://**aws**.amazon.com/**marketplace**/

Baking your own AMI

- AWS CLI: aws ec2 create-image
- Aminator: Netflix tool, EC2 only for Red Hat and CentOS
- Packer: Hashicorp tool, more features

http://docs.aws.amazon.com/cli/latest/reference/ec2/create-image.html
https://github.com/Netflix/aminator
https://www.packer.io

« *VMs are all I need. I can build everything else* »

- Everything? Really?
- How long will it take to build AND maintain?
  - Daily sysadmin: monitoring, logs, backups, etc.
  - Upgrading, capacity planning, scaling, etc.
  - Security audits, patches, etc.
  - Fixing whatever broke down at 2AM…
- How much is your own time worth?
- Your company's time?

Software Development Kits

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10 environments supported

- Android
  https://github.com/aws/aws-sdk-android
- C++
  https://github.com/aws/aws-sdk-cpp
- Go
  https://github.com/aws/aws-sdk-go
- iOS
  https://github.com/aws/aws-sdk-ios
- Java
  https://github.com/aws/aws-sdk-java
- Javascript / Node.js
  https://github.com/aws/aws-sdk-js
- .NET
  https://github.com/aws/aws-sdk-net
- Python
  https://github.com/boto/boto3
- PHP
  https://github.com/aws/aws-sdk-php
- Ruby
  https://github.com/aws/aws-sdk-ruby

https://github.com/aws/aws-toolkit-eclipse
https://aws.amazon.com/visualstudio/

Notable Open Source projects @ Amazon

- Amazon Labs https://github.com/amznlabs
  - Amazon Ion for Java https://github.com/amznlabs/ion-java
  - DSSTNE https://github.com/amznlabs/amazon-dsstne
- AWS Labs https://github.com/awslabs
  - s2n https://github.com/awslabs/s2n
  - chalice https://github.com/awslabs/chalice

Docker

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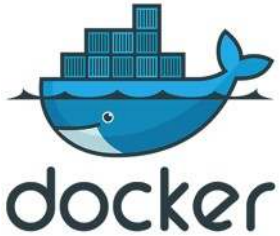
Running Docker on AWS

- Use docker-machine to start EC2 instances
- Start Docker-enabled AMIs
- Build Docker clusters
- Use Docker-based PaaS platforms

https://convox.com/blog/docker-in-production/

Docker-machine




```
docker-machine create \
        --driver amazonec2 \
        --amazonec2-region region \
        --amazonec2-zone az \
        --amazonec2-instance-type type \
         instance_name

docker-machine ssh instance_name
```

https://docs.docker.com/machine/drivers/aws/

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Docker-enabled AMIs

Available on the AWS Marketplace

RancherOS

Rancher Server runs as a container

CoreOS

CloudFormation template for multiple instances on CoreOS page

EC2 REGION	AMI TYPE	AMI ID	CLOUDFORMATION
eu-central-1	PV	ami-72867d1d	Launch Stack
	HVM	ami-27877c48	Launch Stack

Amazon ECS-optimized AMI

Amazon Linux + Amazon ECS Agent + Docker 1.11.2

More on ECS in a minute ☺

http://docs.rancher.com/os/running-rancheros/cloud/aws/
https://coreos.com/os/docs/latest/booting-on-ec2.html
http://docs.aws.amazon.com/AmazonECS/latest/developerguide/ecs-optimized_AMI.html

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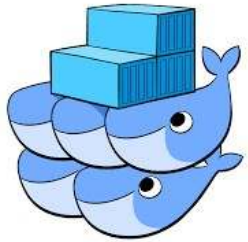
Docker orchestrators

Docker Swarm



- Manual installation
- Installation with docker-machine
- Docker for AWS (beta)

  Create Swarm with CloudFormation
- Docker Datacenter
  - End-to-end platform for container management
  - Ready in 20-30 minutes

http://docs.docker.com/swarm/install-manual/
http://blog.scottlowe.org/2016/03/25/docker-swarm-aws-docker-machine/
https://beta.docker.com/docs/aws/
https://aws.amazon.com/about-aws/whats-new/2016/06/docker-datacenter-on-the-aws-cloud-quick-start-reference-deployment/

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Kubernetes

kubernetes

```
$ kube-aws init \
--cluster-name=my-cluster-name \
--external-dns-name=my-cluster-endpoint \
--region=region-name \
--availability-zone=az-name \
--key-name=key-pair-name \
--kms-key-arn=key-arn
```

```
$ kube-aws render
```
→ CloudFormation template

```
$ kube-aws up
```

https://coreos.com/kubernetes/docs/latest/kubernetes-on-aws.html

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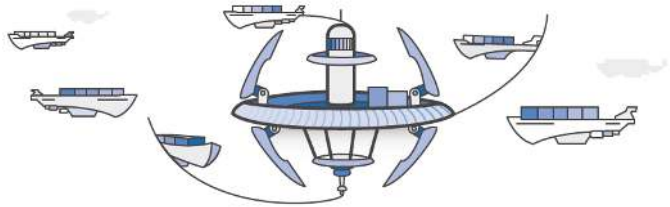
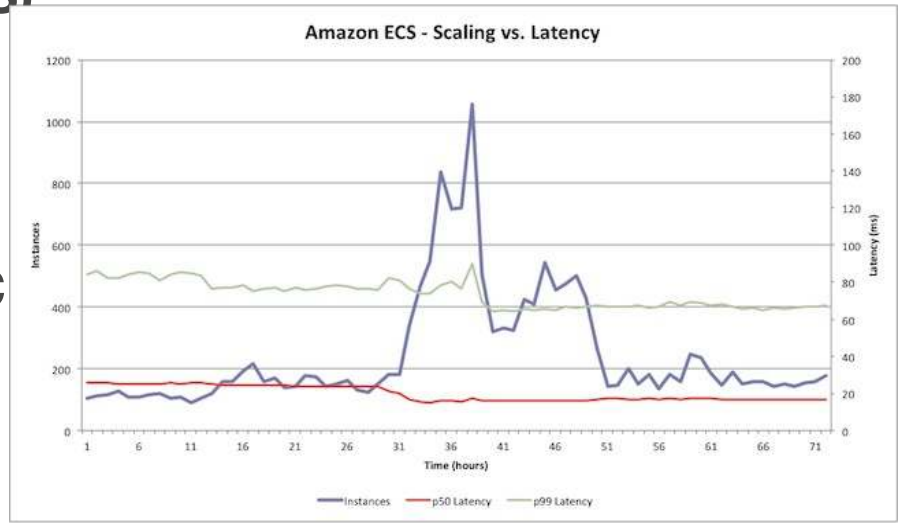
Amazon ECS and ECR AWS Free Tier



Amazon EC2 Container Service (ECS)

- Launched in 04/2015
- Orchestration of Docker clusters
- No charge



http://www.allthingsdistributed.com/2014/11/amazon-ec2-container-service.html
http://www.allthingsdistributed.com/2015/04/state-management-and-scheduling-with-ecs.html
http://www.allthingsdistributed.com/2015/07/under-the-hood-of-the-amazon-ec2-container-service.html

Amazon EC2 Container Registry (EC

- Launched in 12/2015
- Managed private Docker Registry
- Free tier: 500MB / month for a year
- $0.10 / GB / month + outgoing traffic

https://aws.amazon.com/ecs/
https://aws.amazon.com/ecr/

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The Amazon ECS CLI in one slide

```
ecs-cli configure --cluster cluster_name --region region_name
ecs-cli up --keypair keypair --capability-iam –size nb_nodes

ecs-cli compose service up
ecs-cli compose service ps
ecs-cli compose service scale nb_containers

ecs-cli compose service stop
ecs-cli compose service delete
ecs-cli down cluster_name --force
```

https://github.com/aws/amazon-ecs-cli

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Docker PaaS

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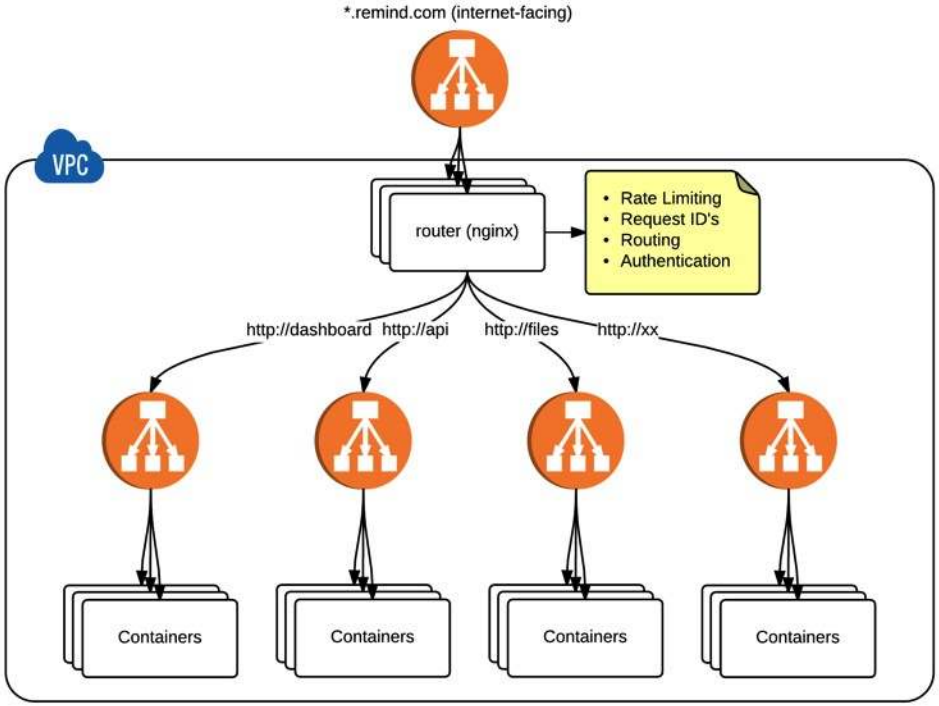
Empire

- Simple Open Source PaaS built by Remind
- Based on Amazon ECS
- Well suited for dockerized 12-factor platforms



http://engineering.remind.com/introducing-empire/
https://github.com/remind101/empire
https://www.youtube.com/watch?v=8zbbQkszP04
https://12factor.net

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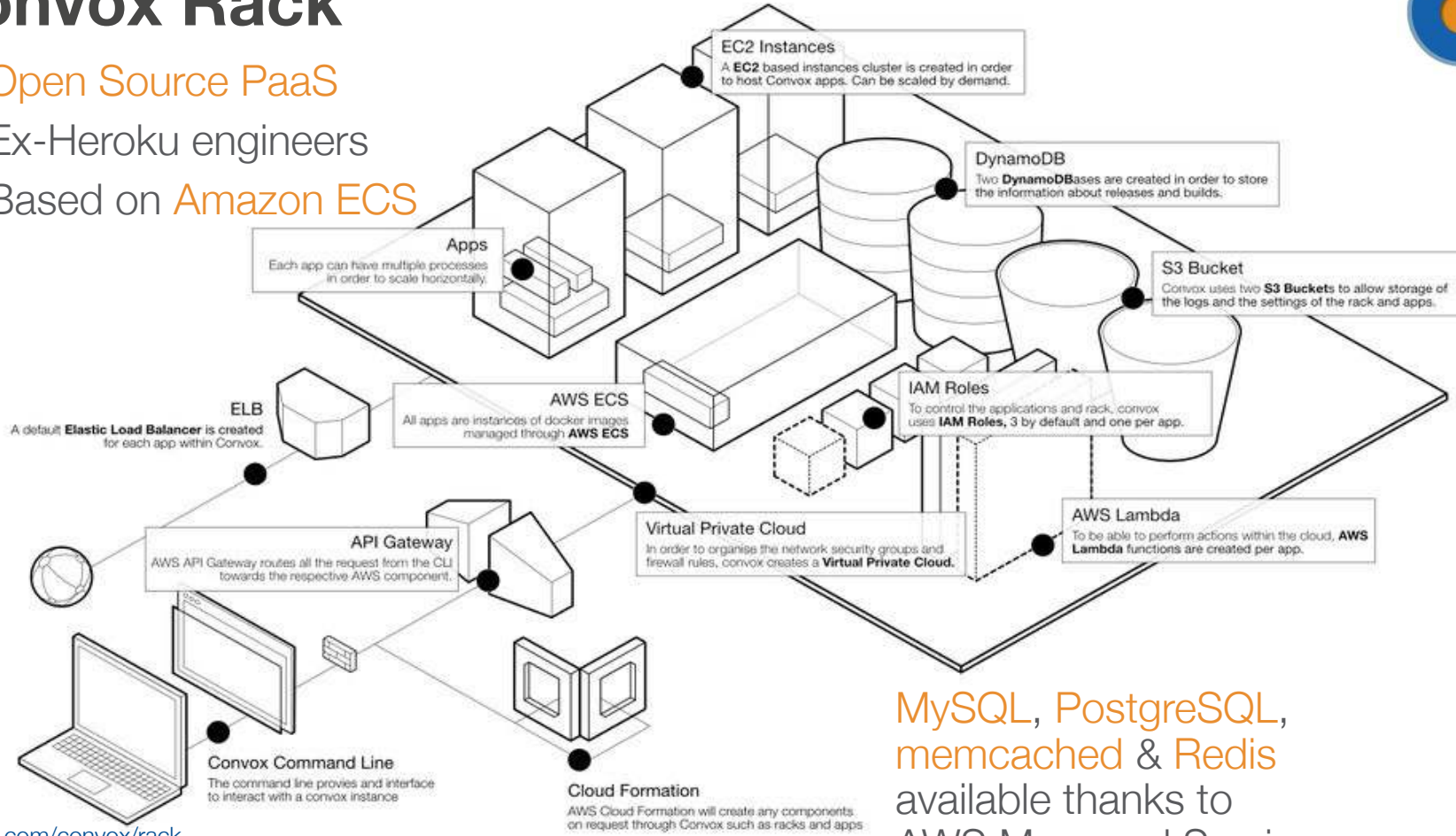
Convox Rack

- Open Source PaaS
- Ex-Heroku engineers
- Based on Amazon ECS



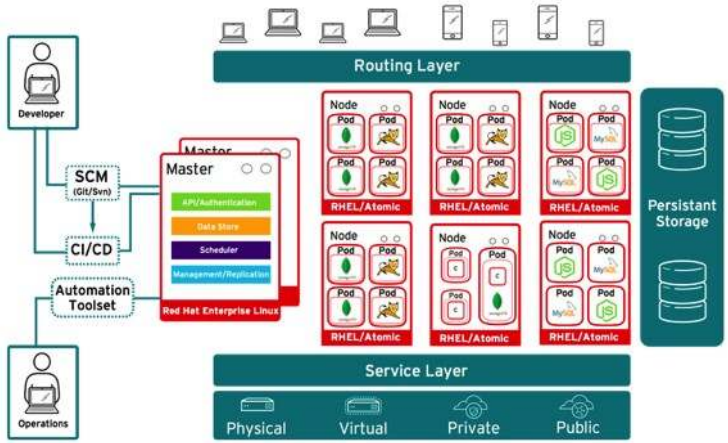
MySQL, PostgreSQL, memcached & Redis available thanks to AWS Managed Services

https://github.com/convox/rack
http://www.slideshare.net/nzoschke/minimum-viable-infrastructure

Openshift

OPENSHIFT

- Open Source PaaS built by Red Hat
- AWS Quick Start reference guide
  - CloudFormation template
- Openshift Dedicated
  - Platform hosted in the AWS cloud



https://github.com/openshift/origin
https://aws.amazon.com/about-aws/whats-new/2016/06/red-hat-openshift-on-the-aws-cloud-quick-start-reference-deployment/
https://www.openshift.com/dedicated/

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Development Infrastructure

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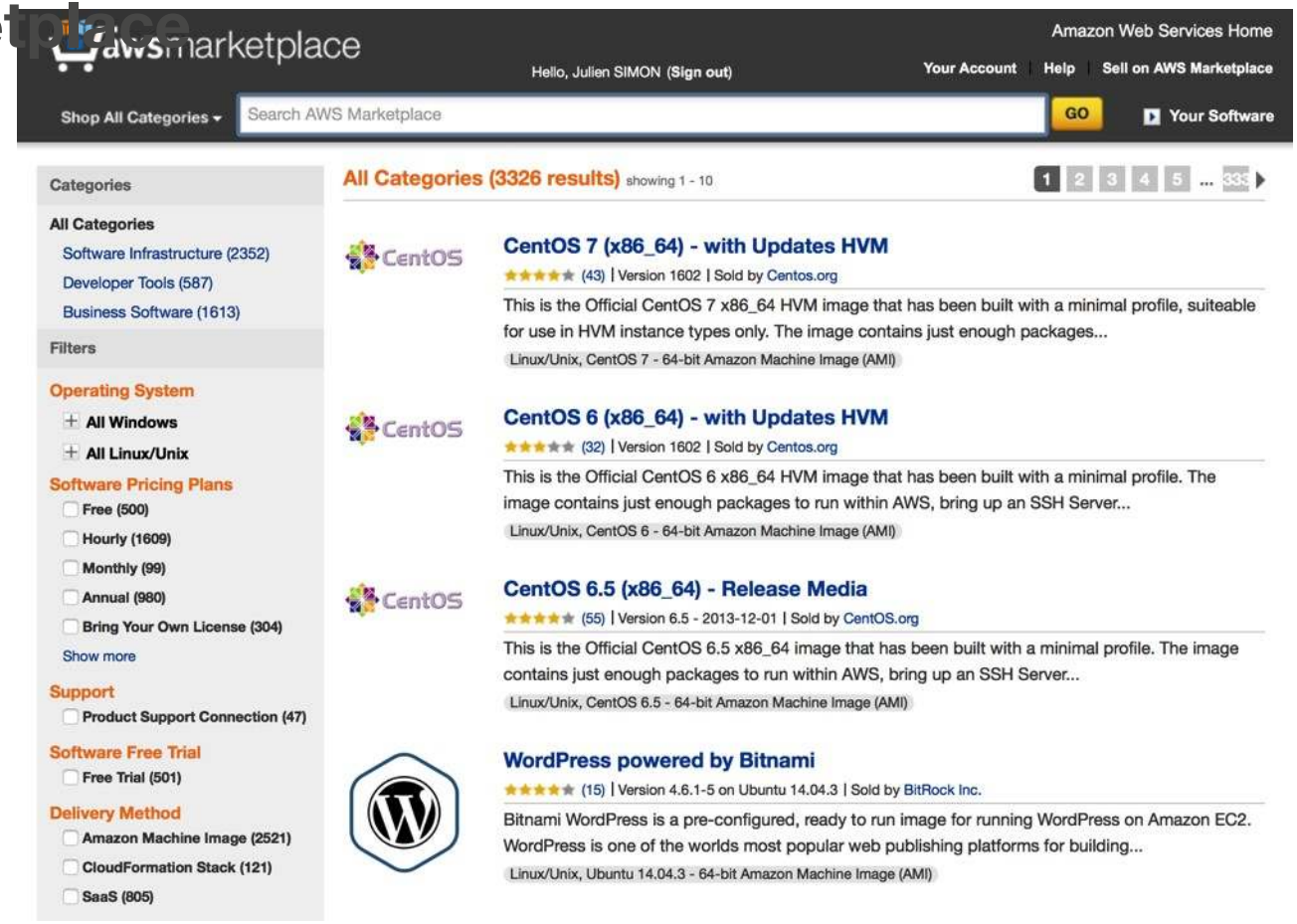
Your CI/CD tools, right?

Most of them (and many more) are available on the Marketplace



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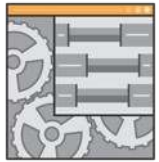
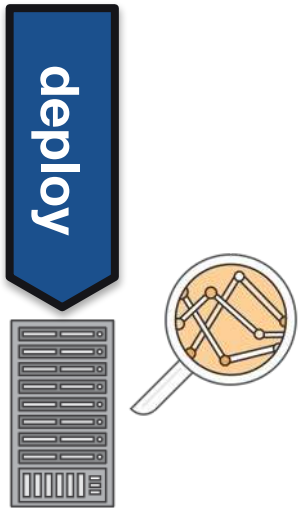
They all work with our DevOps tools (aka Code*)

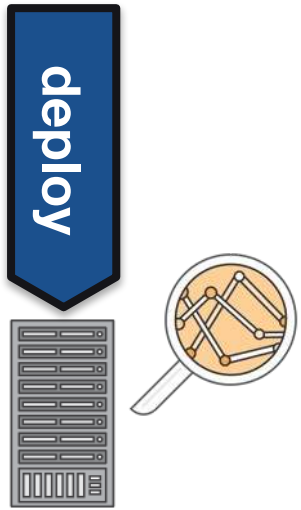
AWS Free Tier

AWS Code Pipeline ($1/pipeline/month)

Source | Build | Testing | Staging | Production







AWS CodeCommit
(first 5 users free)

https://aws.amazon.com/codecommit/
https://aws.amazon.com/codepipeline/
https://aws.amazon.com/codedeploy/

AWS CodeDeploy (no charge for EC2)

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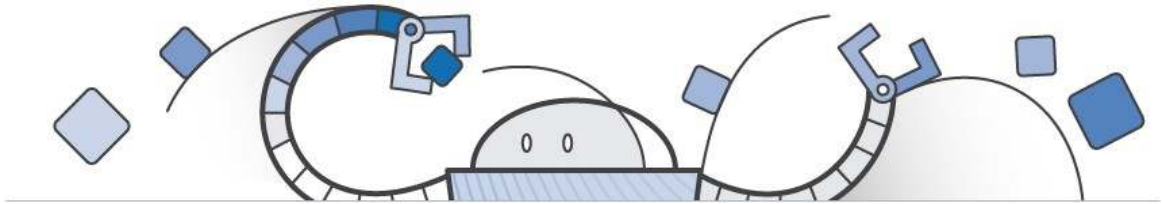
AWS OpsWorks



- Managed Chef
  - Chef 12, 11.10, 11.4 and 0.9 for Linux stacks
  - Chef 12.2 for Windows stacks
- Auto Healing
- Automatic Instance Scaling
- Monitoring
- On-Premises Support
- Permissions and Policy Management with IAM
- No charge for EC2

https://aws.amazon.com/opsworks/ http://docs.aws.amazon.com/opsworks/latest/userguide/best-practices-server-migrate.html

Relational Databases

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Amazon Relational Database Service (RDS)

AWS Free Tier

- Managed infrastructure
  - SLA >= 99.95% for multi-AZ setups
  - Automatic backups & minor upgrades
  - No access to the database host operating system
- Scalable compute & storage
  - No downtime in most cases
  - Max storage for MySQL, MariaDB, PostgreSQL: 6 TB
- 3 Open Source engines
  - MySQL: 5.5.40a → 5.7.11
  - MariaDB: 10.0.17 → 10.1.14
  - PostgreSQL: 9.3.1 → 9.6.1

MySQL

MariaDB

PostgreSQL

https://aws.amazon.com/rds/
https://aws.amazon.com/releasenotes/Amazon-RDS
https://aws.amazon.com/rds/sla/

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Amazon RDS: the small print ☺

- Using the rds_superuser Role
- Supported PostgreSQL Database Versions
- Supported PostgreSQL Features and Extensions
- Limits for PostgreSQL DB Instances
- Upgrading a PostgreSQL DB Instance
- Using SSL with a PostgreSQL DB Instance
- Creating Roles
- Managing PostgreSQL Database Access
- Working with PostgreSQL Parameters
- Working with PostgreSQL Autovacuum on Amazon RDS
- Audit Logging for a PostgreSQL DB Instance
- Setting up PostGIS
- Using pgBadger for Log Analysis with PostgreSQL
- Viewing the Contents of pg_config

http://docs.aws.amazon.com/AmazonRDS/latest/UserGuide/CHAP_PostgreSQL.html#PostgreSQL.Concepts.General.FeatureSupport
http://docs.aws.amazon.com/AmazonRDS/latest/UserGuide/Appendix.PostgreSQL.CommonDBATasks.html

- Killing a Session or Query
- Skipping the Current Replication Error
- Working with InnoDB Tablespaces to Improve Crash Recovery Times
- Managing the Global Status History

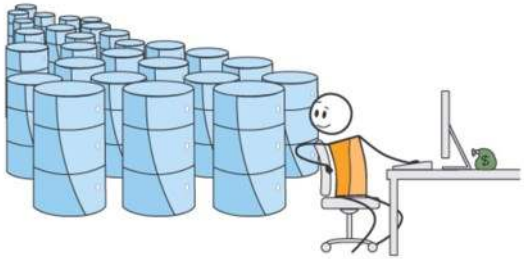
http://docs.aws.amazon.com/AmazonRDS/latest/UserGuide/Appendix.MySQL.CommonDBATasks.html

Appendix: Parameters for MariaDB

http://docs.aws.amazon.com/AmazonRDS/latest/UserGuide/Appendix.MariaDB.Parameters.html

Amazon Aurora

fastest growing service in AWS history



- Compatible with MySQL 5.6
- Scalable compute & storage (up to 64TB)
- 5x the throughput of MySQL on the same hardware: up to 500K reads and 100K writes per second
- 10 ms latency on up to 15 read replicas
- Availability > 99.99%, failover < 30s
- 6 copies of your data in 3 AZ + continuous backup to S3
- Customers report using smaller instances and/or less instances than MySQL → Aurora is less expensive!

https://**aws**.amazon.com/rds/**aurora**/
https://d0.awsstatic.com/product-marketing/Aurora/RDS_Aurora_Performance_Assessment_Benchmarking_v1-2.pdf

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NoSQL

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Memcached & Redis

- Build your own on EC2
- Amazon ElastiCache
  - Managed service for in-memory data
  - Memcached
    - 1.4.5 → 1.4.24
    - Automatic node discovery
  - Redis
    - 2.8.21 → 3.2.4
    - Scale up without losing data thanks to replication
    - Scale out: up to 15 shards with 5 read replicas each → 3.5 TB, 20M reads and 4.5M writes per second
    - Snapshot exports to S3

AWS Free Tier

https://redislabs.com/blog/5-tips-for-running-redis-over-aws
https://aws.amazon.com/elasticache/
https://d0.awsstatic.com/whitepapers/performance-at-scale-with-amazon-elasticache.pdf

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MongoDB

- Build your own on EC2
- AWS Quick Start reference guide
  - CloudFormation template for v2.6 or v3.0
  - Build a sharded cluster running on Amazon Linux in 15 minutes
- MongoDB Cloud Manager

  Provision and monitor instances in AWS
- MongoDB Atlas (06/16): MongoDB as a Service on AWS

https://docs.mongodb.com/ecosystem/platforms/amazon-ec2/
http://docs.aws.amazon.com/quickstart/latest/mongodb/welcome.html
https://www.mongodb.com/cloud/cloud-manager
https://www.mongodb.com/cloud/atlas

Apache Cassandra

- Build your own on EC2

  Please read our whitepaper for guidelines and best pratices

- Use the Datastax AMI

  Caveat: http://www.techrepublic.com/article/the-battle-for-apache-cassandra-highlights-major-problem-with-open-source-projects/

- Instaclustr: Cassandra as a Service on AWS
- Alternative: Amazon DynamoDB

```
aws dynamodb create-table
```

https://d0.awsstatic.com/whitepapers/Cassandra_on_AWS.pdf
https://docs.datastax.com/en/cassandra/2.1/cassandra/install/installAMI.html
https://github.com/riptano/comboami

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Data Processing

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Elasticsearch

- Build your own on EC2
- Amazon Elasticsearch Service
  - Managed service (v1.5 & v2.3)
  - Scale compute and storage without downtime
  - Automatic detection and replacement of failed nodes
  - Snapshots to S3
  - Easy integration with LogStash and CloudWatch Logs
  - Built-in Kibana 3 & 4

AWS Free Tier

https://www.elastic.co/blog/running-elasticsearch-on-aws
https://aws.amazon.com/elasticsearch-service/
https://github.com/awslabs/logstash-output-amazon_es
http://docs.aws.amazon.com/AmazonCloudWatch/latest/logs/CWL_ES_Stream.html

amazon web services

RabbitMQ

- Build your own on EC2
- CloudAMQP: RabbitMQ as a Service on AWS
- Alternative: Amazon SQS

```
aws sqs create-queue --queue-name name
```

https://www.rabbitmq.com/ec2.html
https://www.cloudamqp.com/blog/2014-11-14-amazon-vpc-peering.html
https://aws.amazon.com/sqs/

amazon web services

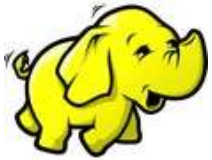
Apache Kafka

- Build your own on EC2
- Cloudkafka: Kafka as a Service on AWS
- Alternative: Amazon Kinesis

```
aws kinesis create-stream --stream-name name --shard-count nb_shards
```

https://aws.amazon.com/blogs/big-data/real-time-stream-processing-using-apache-spark-streaming-and-apache-kafka-on-aws/
https://www.confluent.io/blog/design-and-deployment-considerations-for-deploying-apache-kafka-on-aws/
https://www.cloudkafka.com
https://aws.amazon.com/kinesis/

Apache Hadoop, Spark, etc

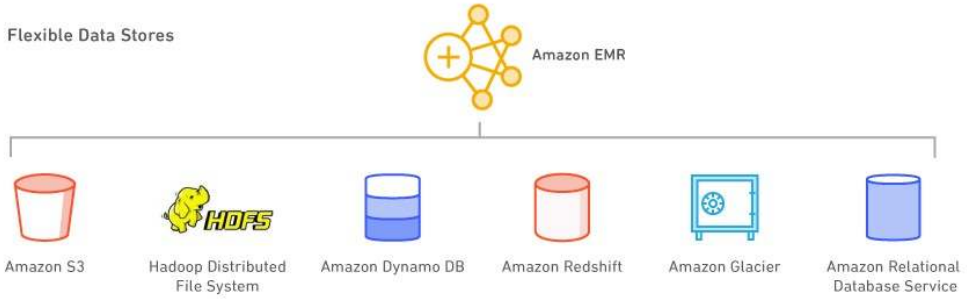


- Cloudera
  - Build your own on EC2
  - AWS Quick Start reference guide: CloudFormation template
- Hortonworks
  - Build your own on EC2
  - Hortonworks Data Cloud: CloudFormation template on AWS Marketplace

http://blog.cloudera.com/blog/2013/03/how-to-create-a-cdh-cluster-on-amazon-ec2-via-cloudera-manager/
http://docs.aws.amazon.com/quickstart/latest/cloudera/welcome.html
http://fr.hortonworks.com/blog/deploying-hadoop-cluster-amazon-ec2-hortonworks/
https://fr.hortonworks.com/products/cloud/aws/

Amazon Elastic Map Reduce (EMR)

- Apache Hadoop, Spark, Flink & friends
- Managed service
- Easy to start, resize & terminate clusters
- Cost-efficient, especially with Spot Instances
- Integration with backends



https://aws.amazon.com/emr/

Conclusion

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CentOS
debian
GNU/Linux
redhat.
SUSE
We adapt. You succeed.
ubuntu
FreeBSD
NetBSD
OpenBSD
iOS
Java
node
Microsoft
.NET
python
php
docker
kubernetes
RANCHER
CoreOS
OPENSHIFT
MySQL
ANSIBLE
GitHub
SALTSTACK
puppet
labs
CHEF
Jenkins
MariaDB
mongoDB
redis
cassandra
RabbitMQ
PostgreSQL
Spark
presto
HIVE
APACHE
HBASE
amazon
web services

AWS is a rich and lively environment for Open Source platforms

Your choice: DIY, Marketplace, Partners, AWS Managed Services

The tools & projects you love, without the infrastructure drama

Built-in high availability, scalability, security & compliance

Focus on creativity and productivity, not on plumbing

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Thank you!

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