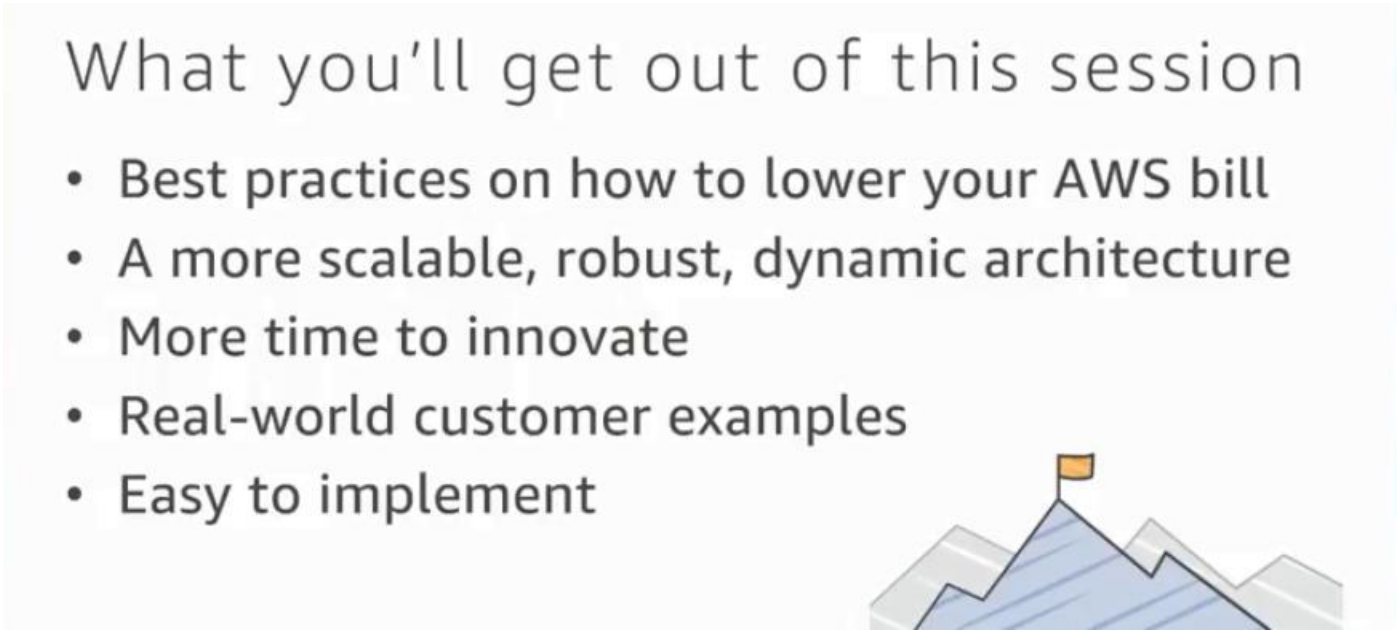
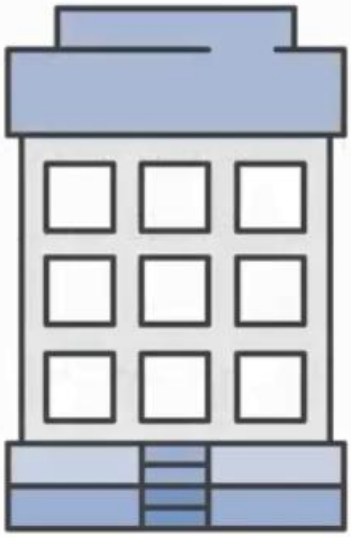
Whether you're a cash-strapped startup or an enterprise optimizing spend, it pays to run cost-efficient architectures on AWS. This session reviews a wide range of cost planning, monitoring, and optimization strategies, featuring real-world experience from AWS customers. We cover how to effectively combine Amazon EC2 On-Demand, Reserved, and Spot Instances to handle different use cases; leveraging Auto Scaling to match capacity to workload; and choosing the optimal instance type through load testing. We discuss taking advantage of tiered storage and caching, offloading content to Amazon CloudFront to reduce back-end load, and getting rid of your back end entirely by serverless. Even if you already enjoy the benefits of serverless architectures, we show you how to select the optimal AWS Lambda memory class and how to maximize networking throughput in order to minimize Lambda run-time and therefore execution cost. We also showcase simple tools to help track and manage costs, including Cost Explorer, billing alerts, and AWS Trusted Advisor. This session is your pocket guide for running cost effectively in the AWS Cloud.



Structure



Business

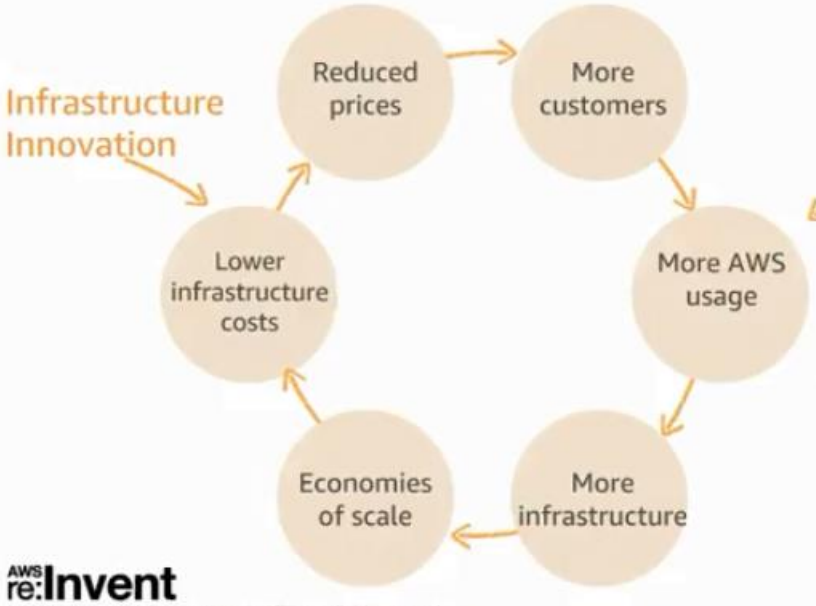
Architecture

Operations

Business goals

"Pay as little as possible for what we use."

AWS pricing philosophy



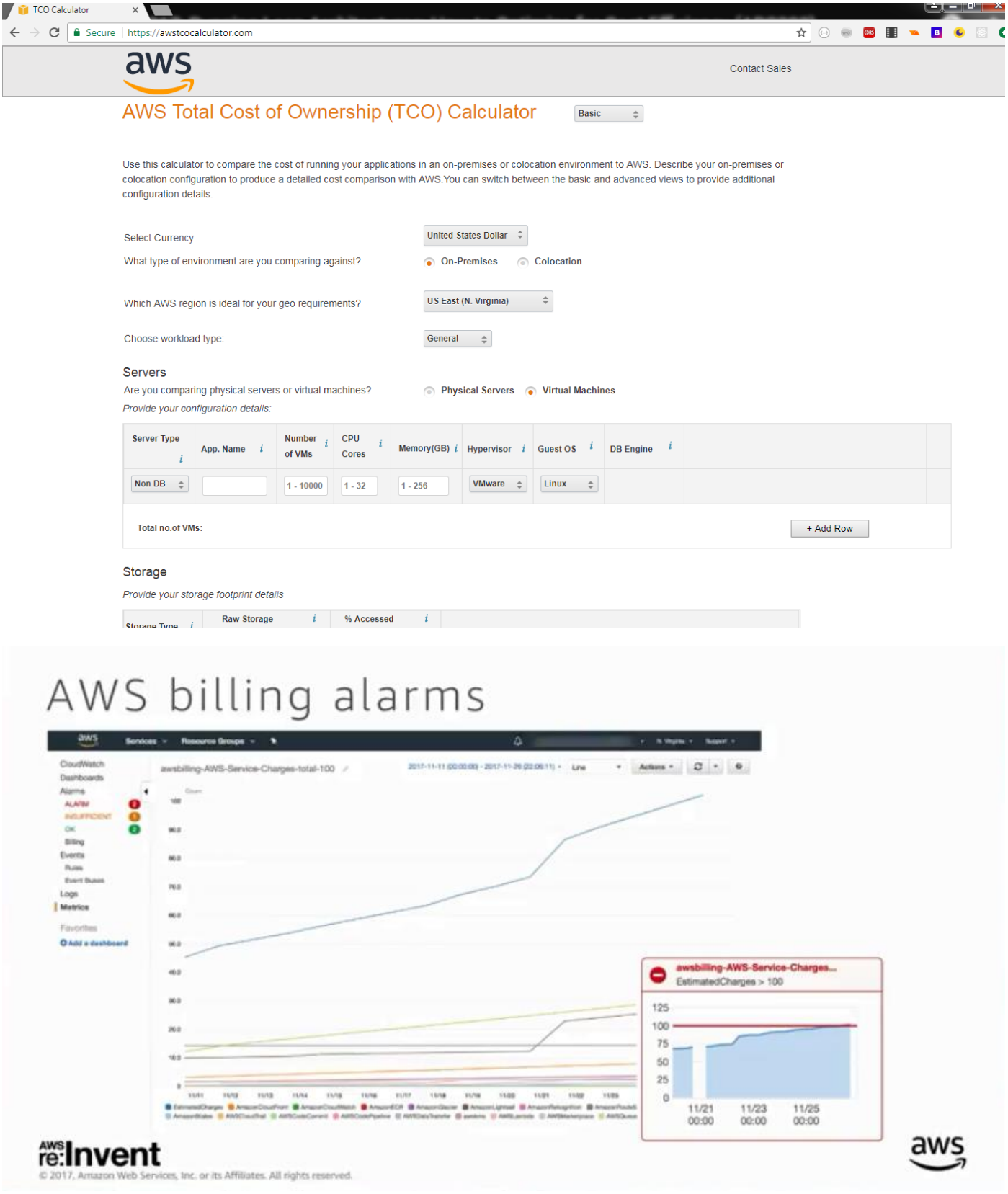
Infrastructure Innovation

Ecosystem
Global footprint
New features
New services

63 price reductions since 2006

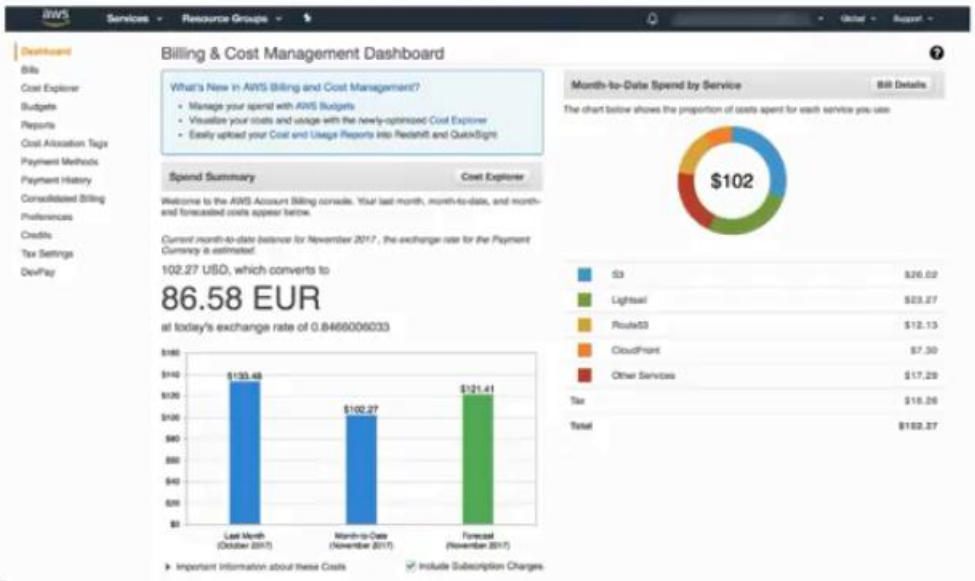
AWS TCO calculator

https://awstcocalculator.com/



You should also set up your AWS Billing alarms for your services

AWS billing dashboard



AWS cost explorer—now with API!

Markus Ostertag
VP of Engineering @ Team Internet

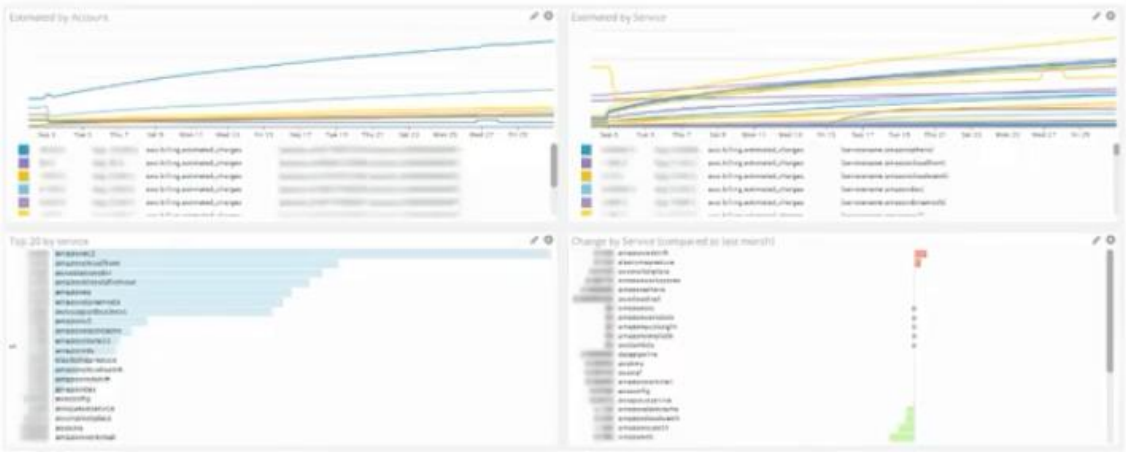
Who is Team Internet?

- Domain monetization business
- 35 people
- HQ in Munich, Germany
- Tech focused

Team Internet
Ideas. Change. Markets.
A MATOMY MEDIA GROUP COMPANY

TONIC.

Diving deep into your bill using Datadog

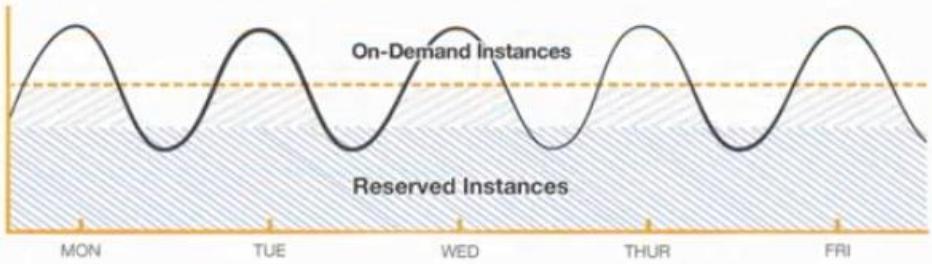


Monitor and use your billing metrics!

We have cost break down by accounts and services used in AWS.

Reserved Instances

Save up to 60% (up to 40% with one year)



Convertible RI

- Change instance family, OS, tenancy
- One year or three years

Reserved Instances—our usage hours

Baseline backed by Reserved Instances

Excess with On-Demand or Spot

New instance size flexibility for RIs

Within the same family **regional Linux/UNIX Reserved Instances with shared tenancy** are instance size flexible now

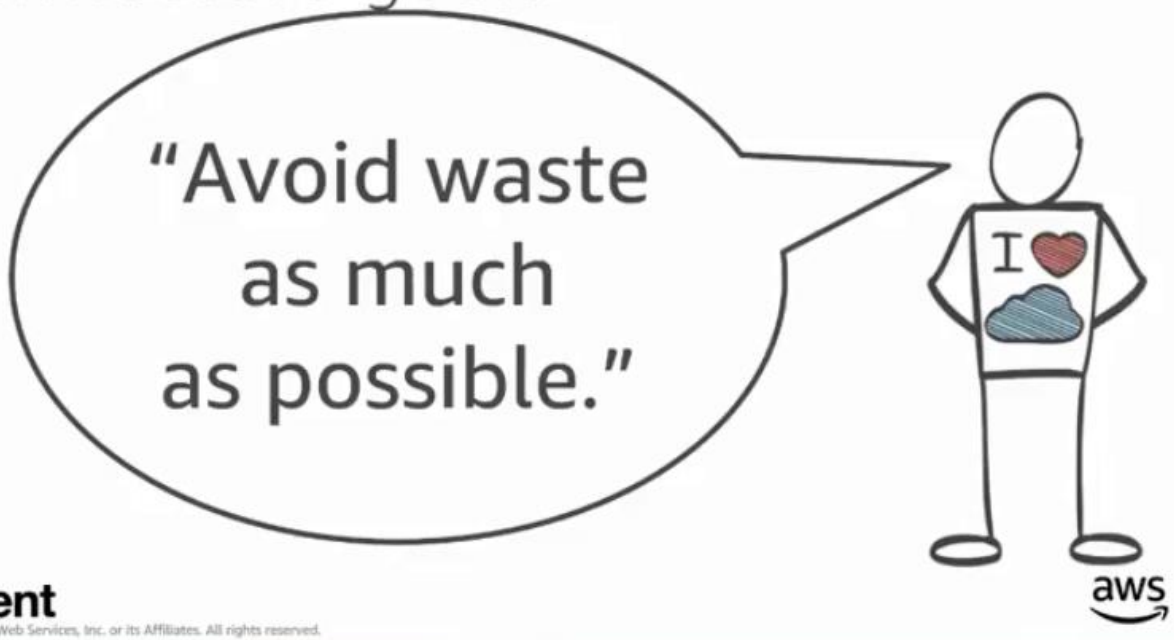
Example:

c4.4xlarge RI counts for

- 2x c4.2xlarge,
- 4x c4.xlarge,
- 8x c4.large, or
- 0.5x c4.8xlarge

Instance Size	Normalization Factor
nano	0.25
micro	0.5
small	1
medium	2
large	4
xlarge	8
2xlarge	16
4xlarge	32
8xlarge	64
10xlarge	80
16xlarge	128
32xlarge	256

Architecture goals

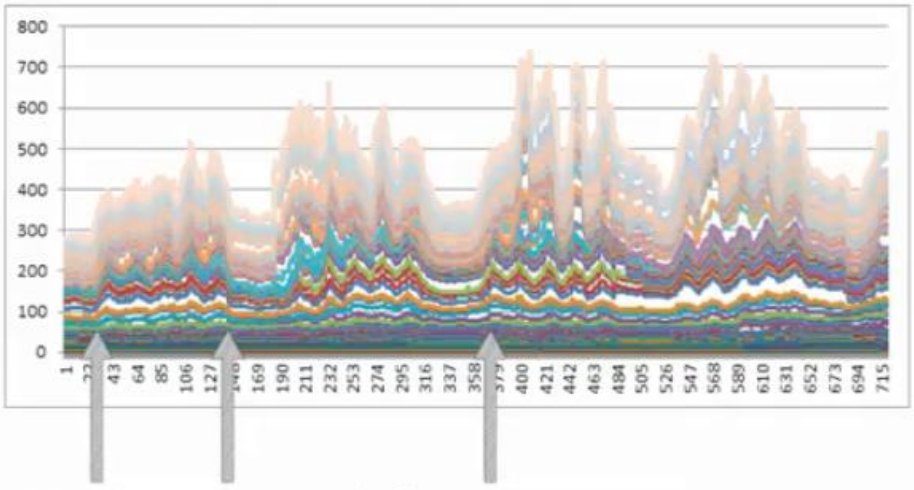


Turn off unused instances

- Developer, test, training instances
- Use simple instance start and stop
  - Even on Amazon Relational Database Service!
- Or tear down and build up all together using AWS CloudFormation
- Instances are disposable!

aws

Customer example



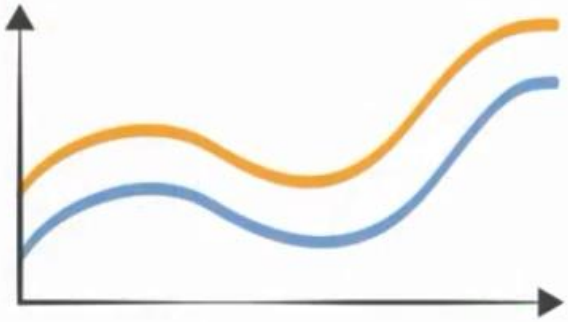
Monday Friday End of vacation season

35% saved

aws

Automate, automate, automate

- AWS SDKs
- AWS Command Line Interface
- AWS CloudFormation
- AWS OpsWorks
- Netflix Janitor Monkey
- Cloudlytics EC2 Scheduler
- Auto Scaling



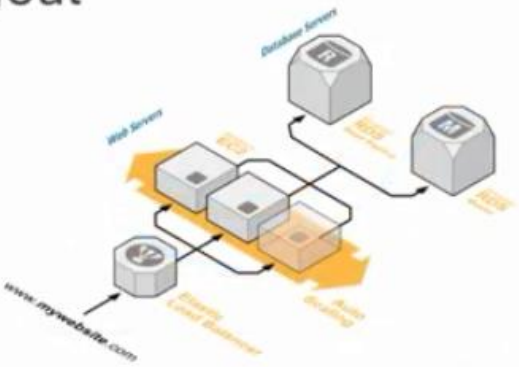
Auto Scaling is always possible!

Auto-Scaling groups are the goal

Side effect: cost optimization

Our to-dos:

- Pet or cattle
- Service discovery
- Deployment strategy



Pets or cattle

We need to automate every step from starting up our server and deleting them

Pets or cattle

User data:

```
#cloud-config
bootcmd:
[...]
AZ_NAME=`ec2metadata --availability-zone | sed -e 's/^.*-[0-9]//'`;
INSTANCE_ID=`ec2metadata --instance-id | sed -e 's/^i-//'`;
AWS_HOSTNAME=$HOSTNAME_PREFIX'-'$AZ_NAME'-'$INSTANCE_ID;
echo $AWS_HOSTNAME > /etc/hostname;
hostname -F /etc/hostname;
aws ec2 create-tags --resources `ec2metadata --instance-id` --tags
Key=Name,Value=$AWS_HOSTNAME --region us-east-1
```

Leverage user data and cloud-init or cfn-init (for AWS CloudFormation)

You can use the script to also name your servers in an automated fashion

Service discovery

- Use tools like Consul, Netflix Eureka
- Or build your own:
  - Scheduled AWS Lambda function (using tags)
  - Put A-Records in Route53 private zones

Deployment via cloud-init at instance launch

Using or mimicking AWS CodeDeploy
User data and AWS CLI:

```
#cloud-config
bootcmd:
  - aws s3 cp s3://<deploy-scripts-bucket>/init/rtb.sh - | bash
```

RTB.sh:

- Get code from S3-bucket
- Copy to local EBS volume
- Start via systemd

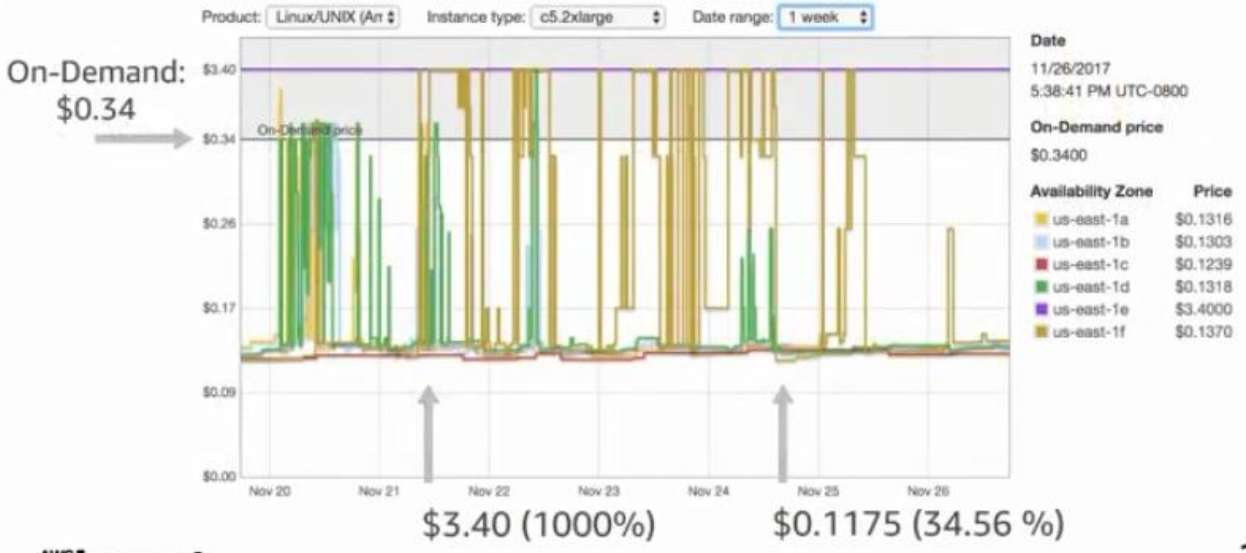
Cost optimization with Auto Scaling

- Per second billing! New
  - You can **scale down faster** now
  - Focus on **performance**, less on cost
- Optimize cost through **dynamic** scale-in and scale-out
- Leverage **scheduled scaling events** to anticipate load changes
- Use Spot Instances

Use Spot Instances

- Price based on **supply/demand**
- You choose your **maximum** price/hour
- Your instance is started if the Spot price is **lower**
- Your instance is **terminated** if the Spot price is higher, with **two-minutes'** notice
- But: You can now choose "**stop**" instead of "terminate" New
- And: You did **plan for fault tolerance**, didn't you?

Spot Instance example

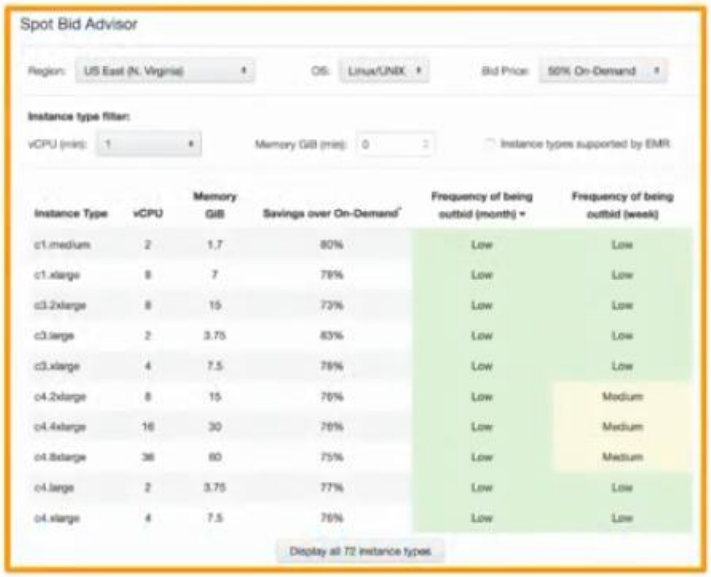


Spot Instance use cases

- Stateless Web/app server fleets
- Amazon EMR
- Continuous integration (CI)
- High performance computing (HPC)
- Grid computing
- Media rendering/transcoding

https://aws.amazon.com/ec2/spot

Spot Bid Advisor



Spot Instances recap

- **Dynamic** pricing
- Opportunity to **save** 80% to 90% cost
  - But be careful
- Different prices **per AZ**
- Leverage **Auto Scaling**!
  - One group with Spot Instances
  - One group with On-Demand
  - Get the best of both worlds

- Spot Fleet – Manage thousands of Spot Instances with one API call

"But my applications are too small even for the smallest instance!"

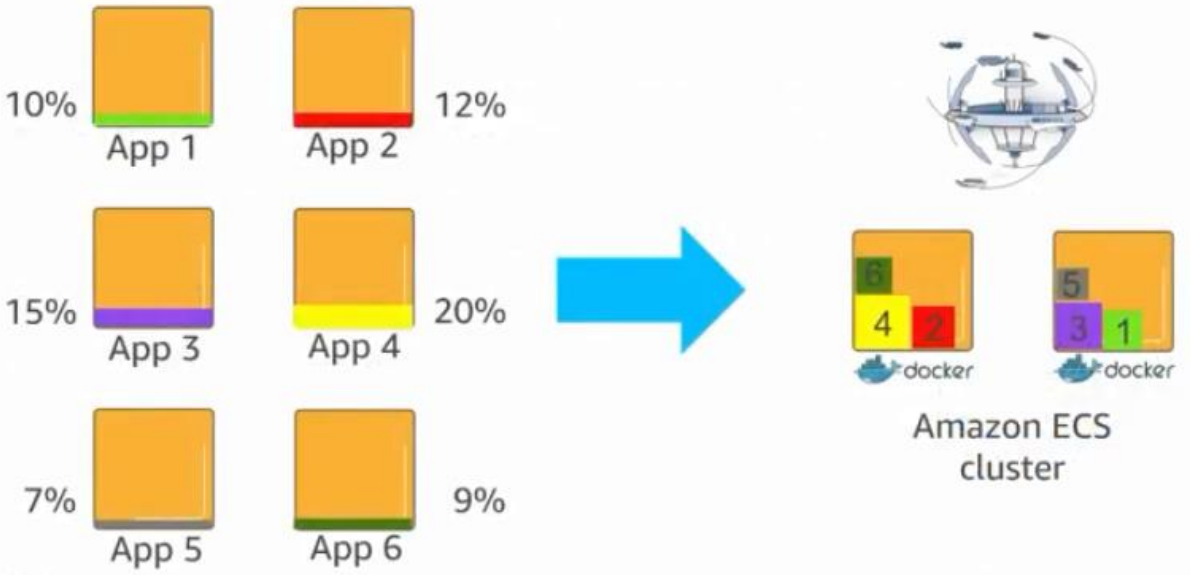
Amazon EC2 Container Service

- Easily manage docker containers
- Flexible container placement
- Designed for use with other AWS services
- Extensible
- Performance at scale
- Secure

aws re:Invent

aws

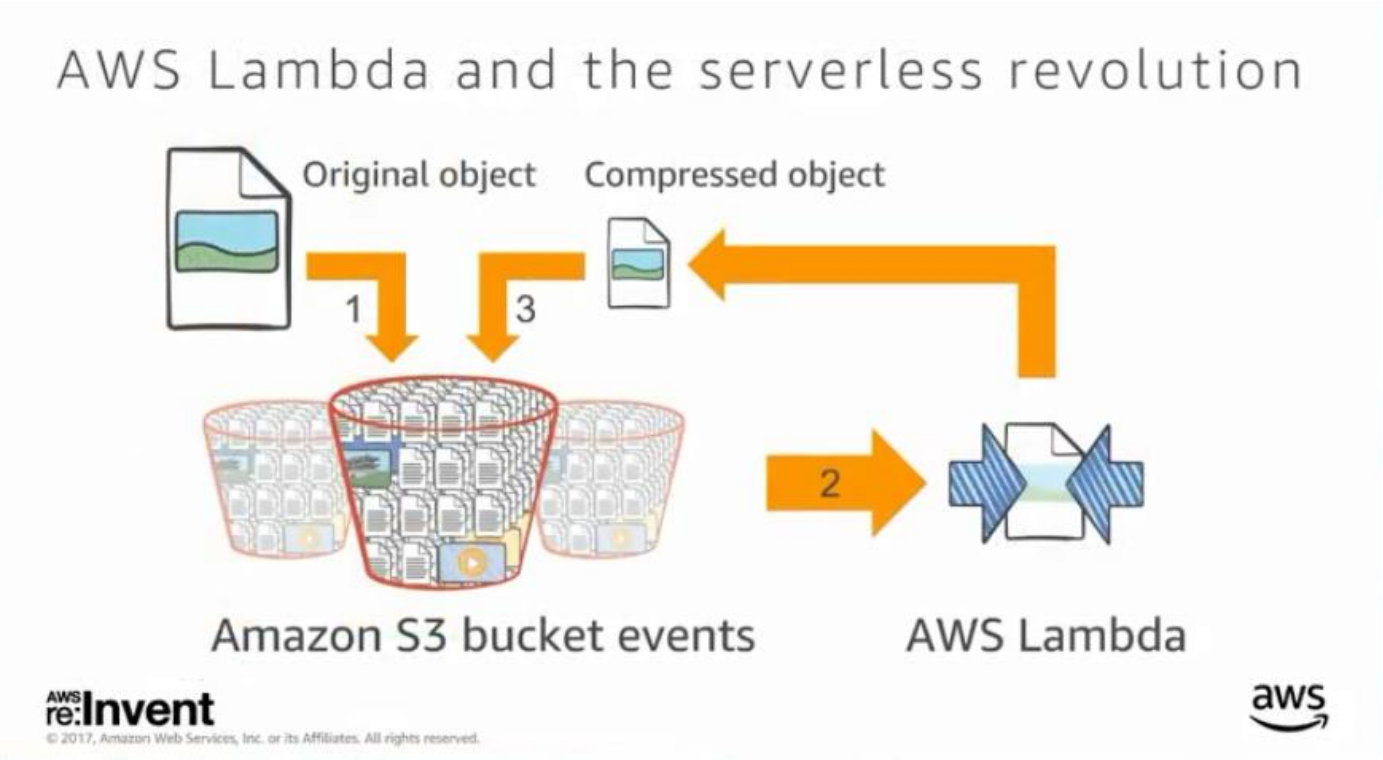
Consolidate with Amazon ECS

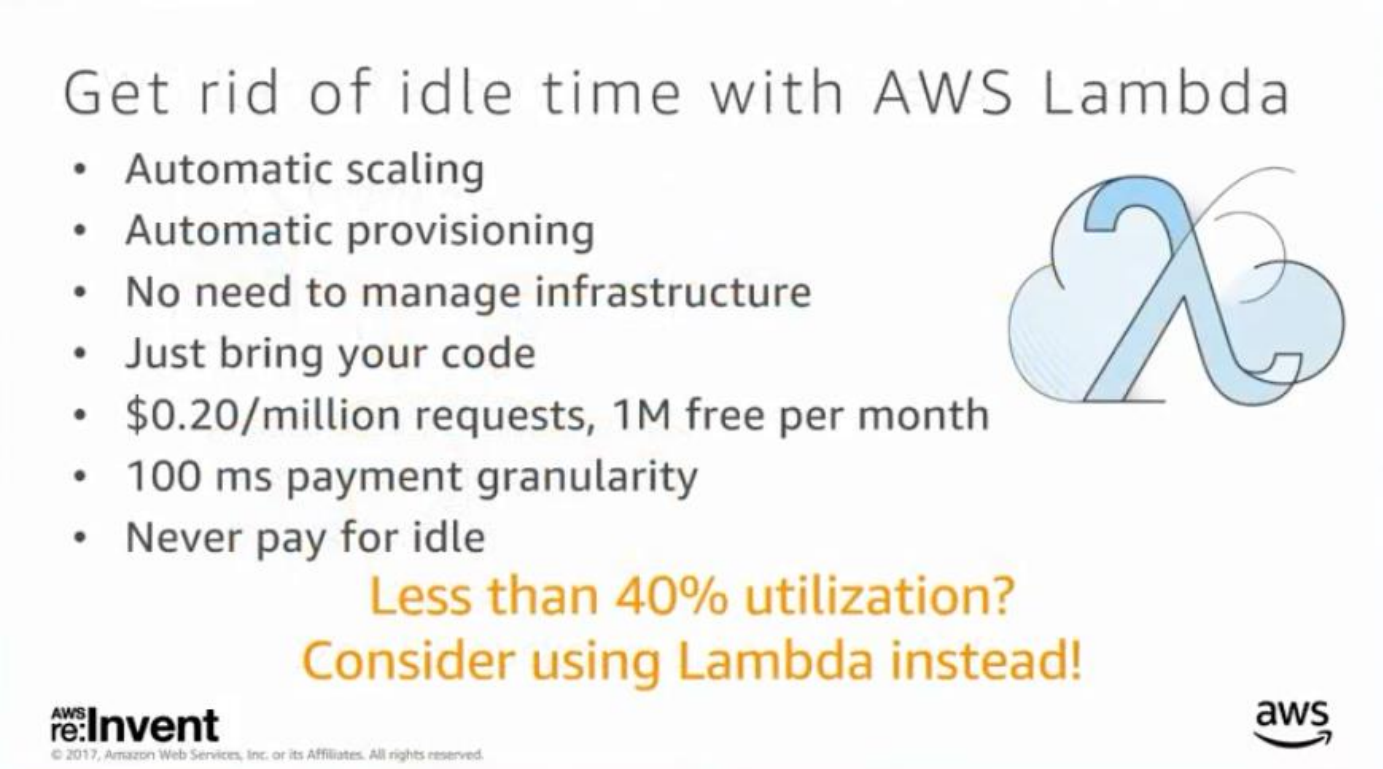


aws re:Invent

aws

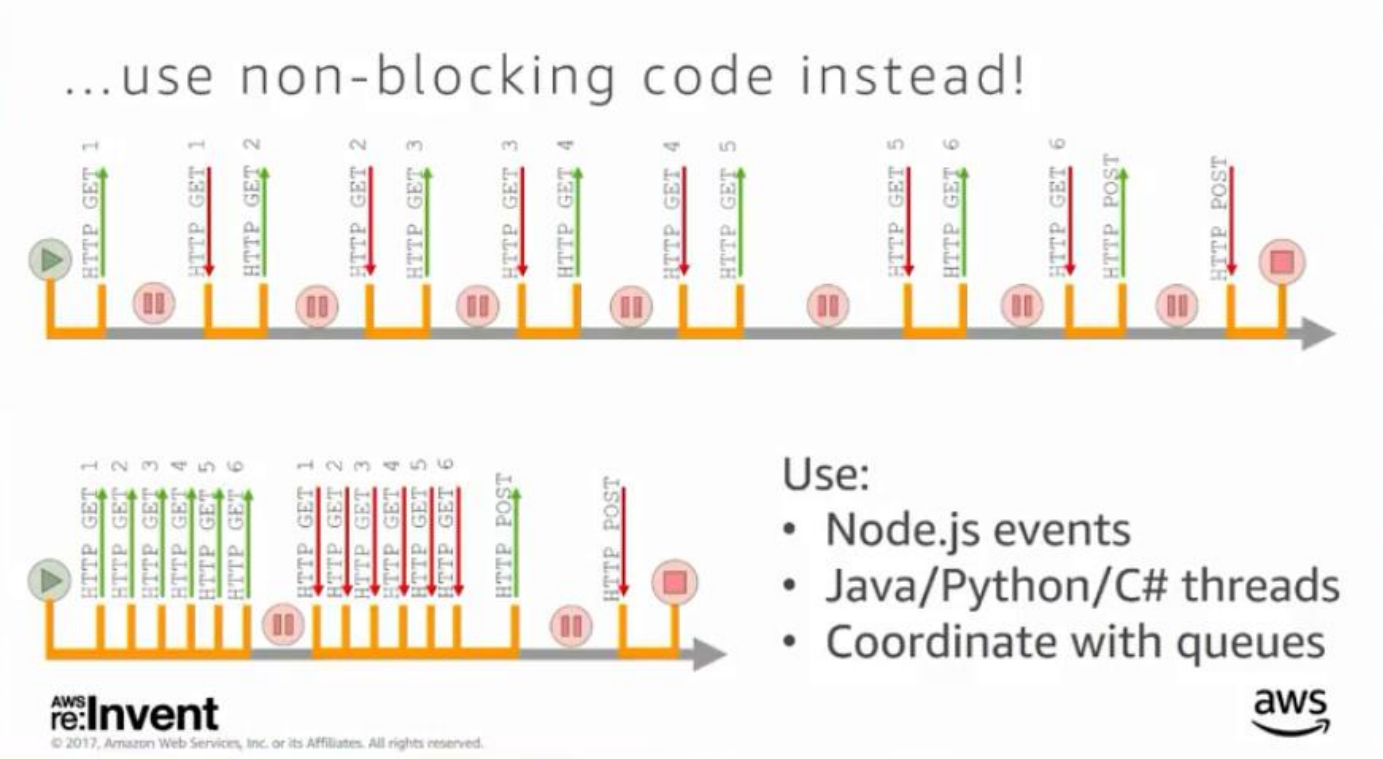
When you have lots of small apps doing very shot tasks, you need to leverage the ECS service. Try and find those single EC2 instances you are running that are doing some dumb simpler jobs but are still idling at 10% usage, then consolidate them all into a smaller number of instances running in ECS.



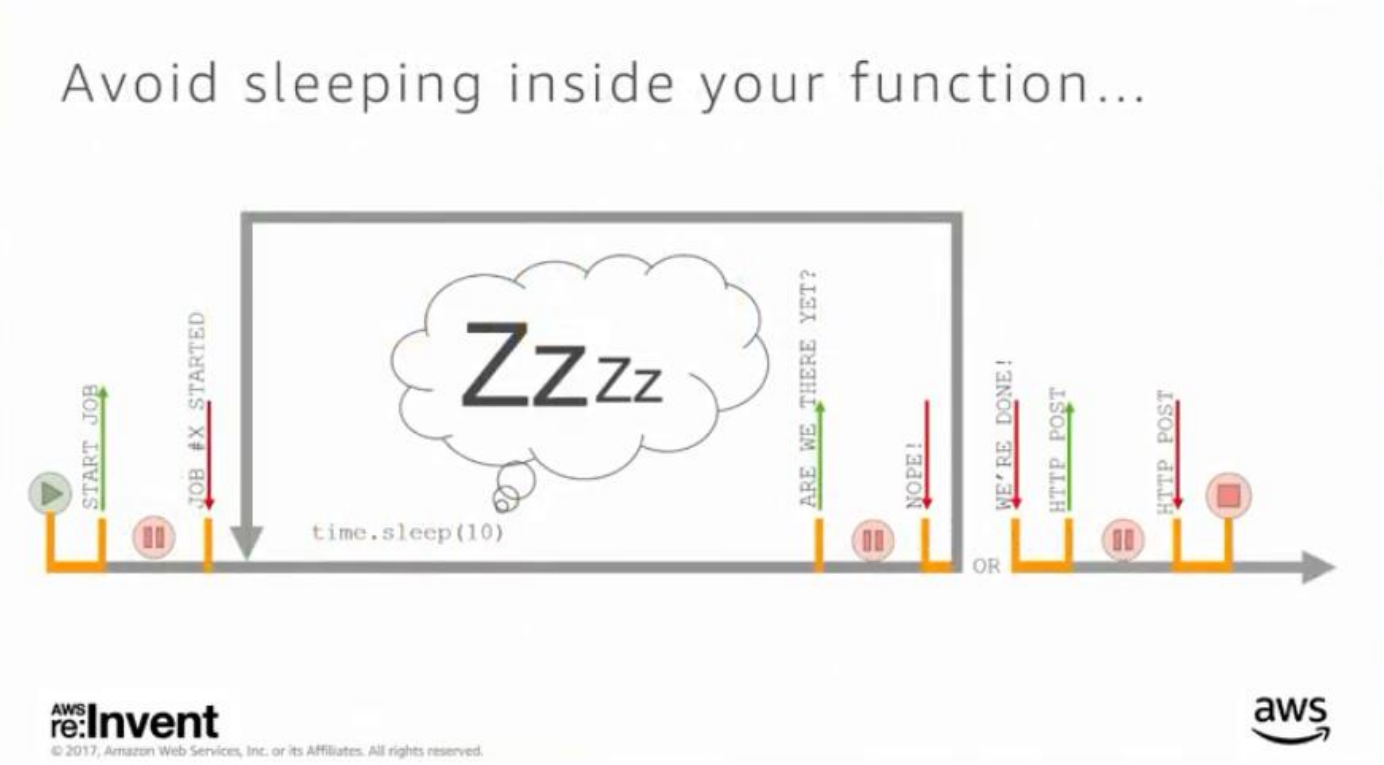


If your existing EC2 application is running lesser than 40% utilization, you will save money by porting that application to use lambda instead.

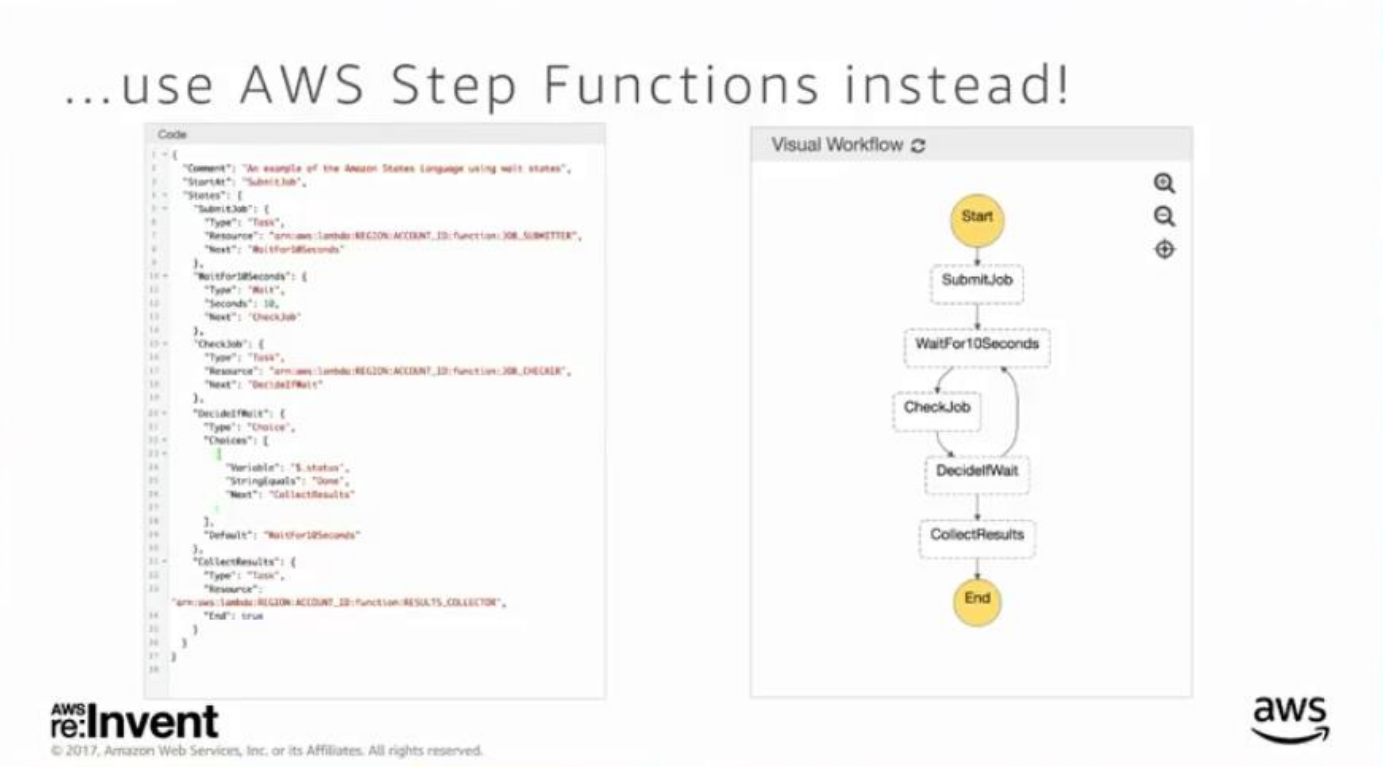
You also need to keep track of how much of your lambda function capacity is being used for computing and how much is being used for waiting? The grey areas are all waiting areas that you are paying for. You need to optimize this by parallelize your API calls



You can now be done earlier with less waiting. You simply coordinate the API calls using threads and queues when available for multithreading

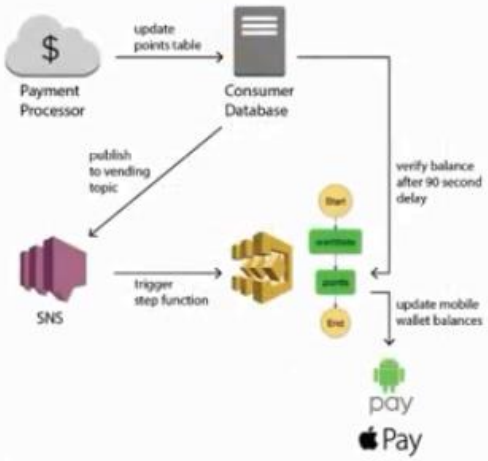


You need to remove time.sleep() functions and instead use AWS Step Functions



Step functions allows you to place control logic in the cloud as a step function workflow where you can submit your job at the beginning of the workflow as a step, then you can implement a simple looping logic that will poll for the job to be completed, and if it is not completed it should do the waiting for you because waiting in step functions is for free. You don't pay for wait cycles in step functions, you can wait for seconds, hours, days, weeks, and even up to a year. You can simply decompose your lambda function into 2 simple lambdas to submit the job and another lambda that collects the results and processes it, you can save a lot of money

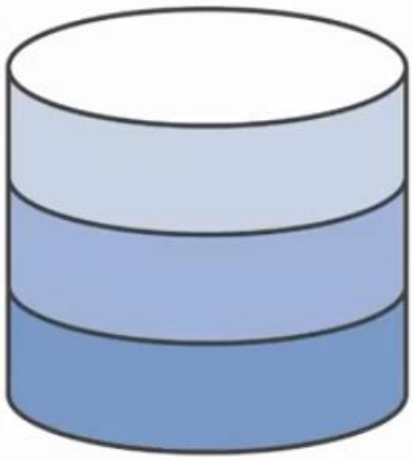
Coca-Cola saved 90s Lambda time...
...for each bottle sold!

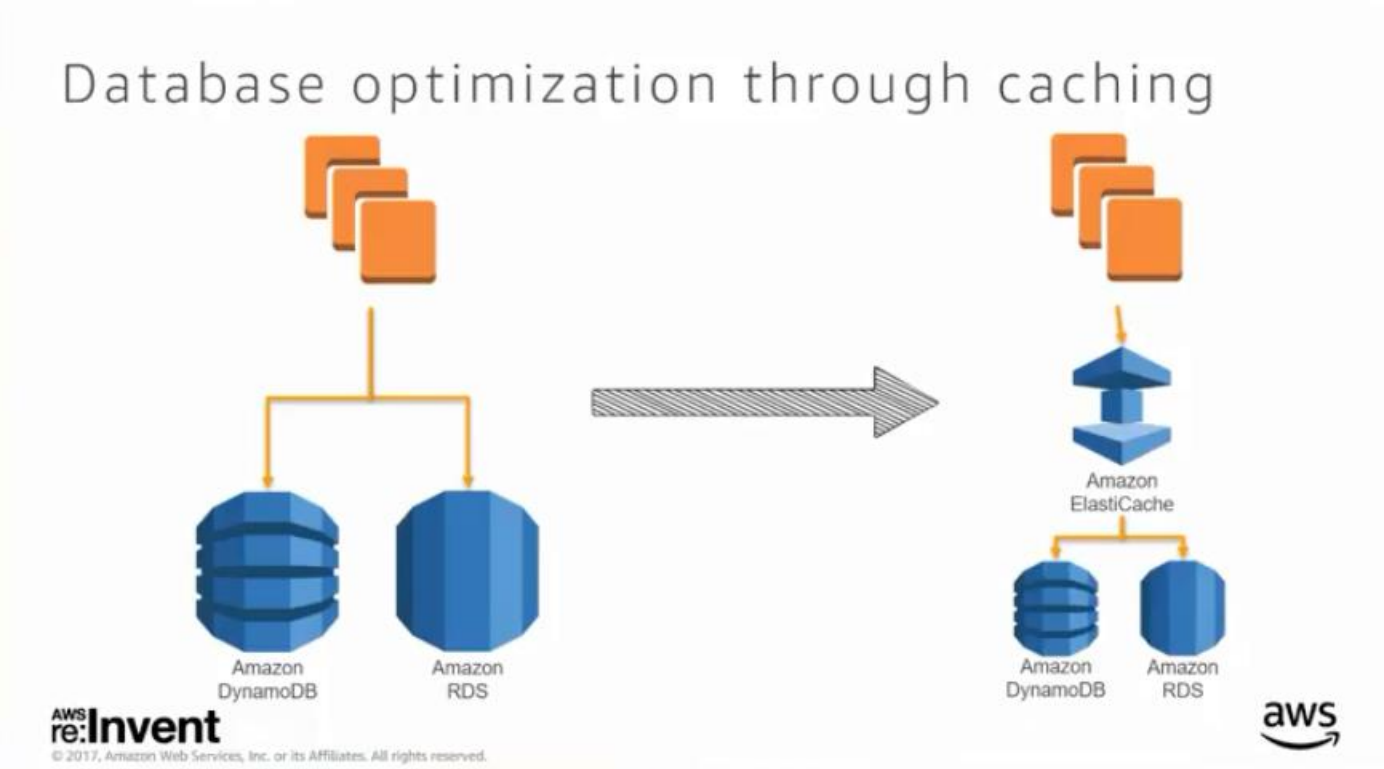


https://aws.amazon.com/blogs/aws/things-go-better-with-step-functions/

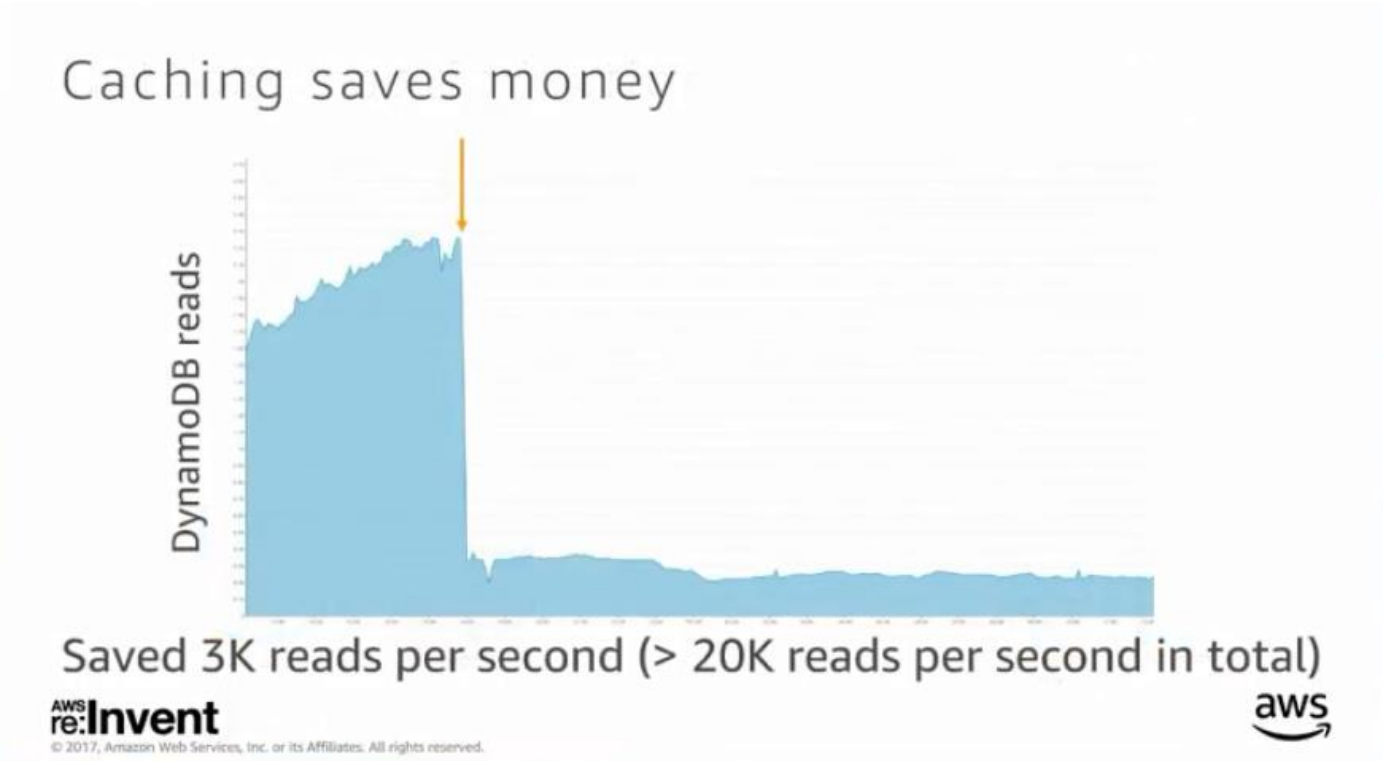
Coca cola has a system where when you buy a bottle from any of their vending machines, they will update your loyalty points account for you. Since the update of points functionality needs to wait for 90 seconds, they are using step functions for this and not having to wait in their lambda functions.

Optimizing database utilization

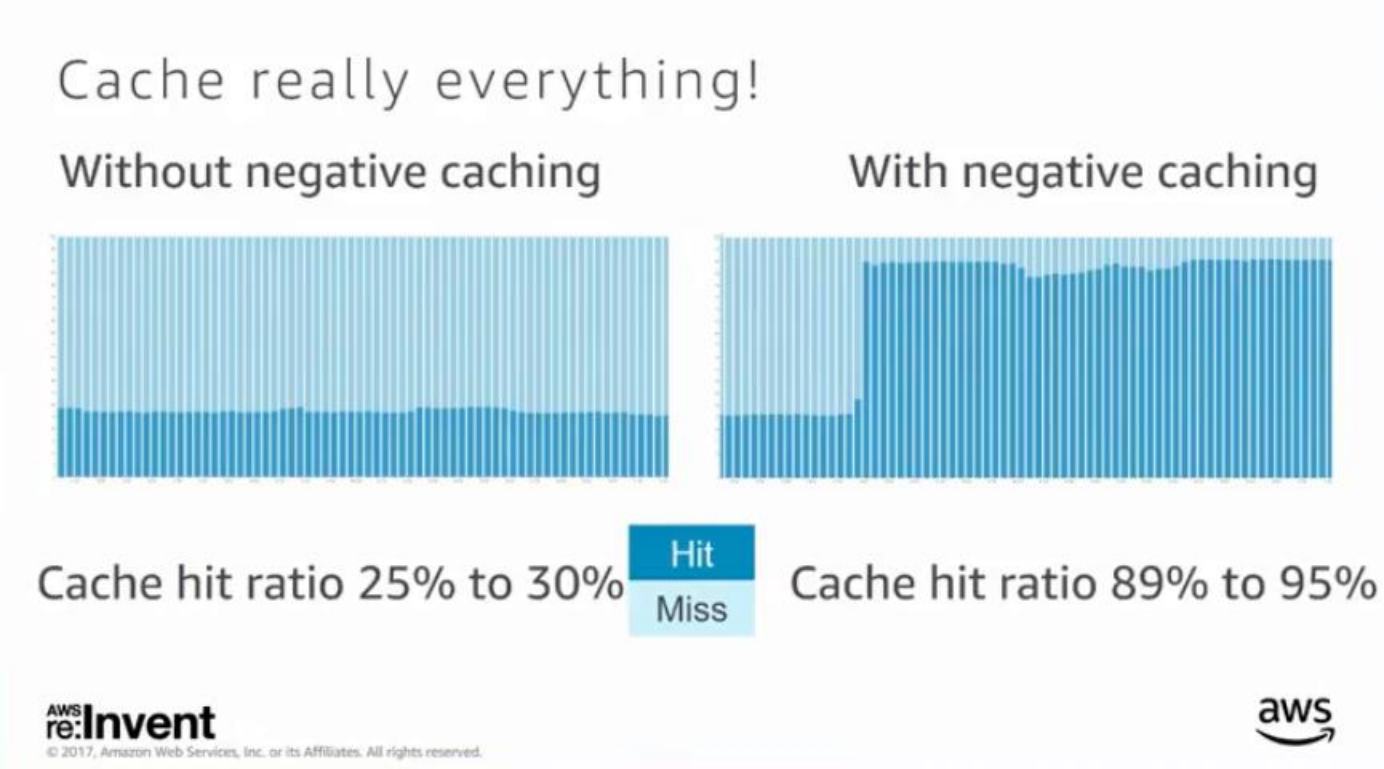




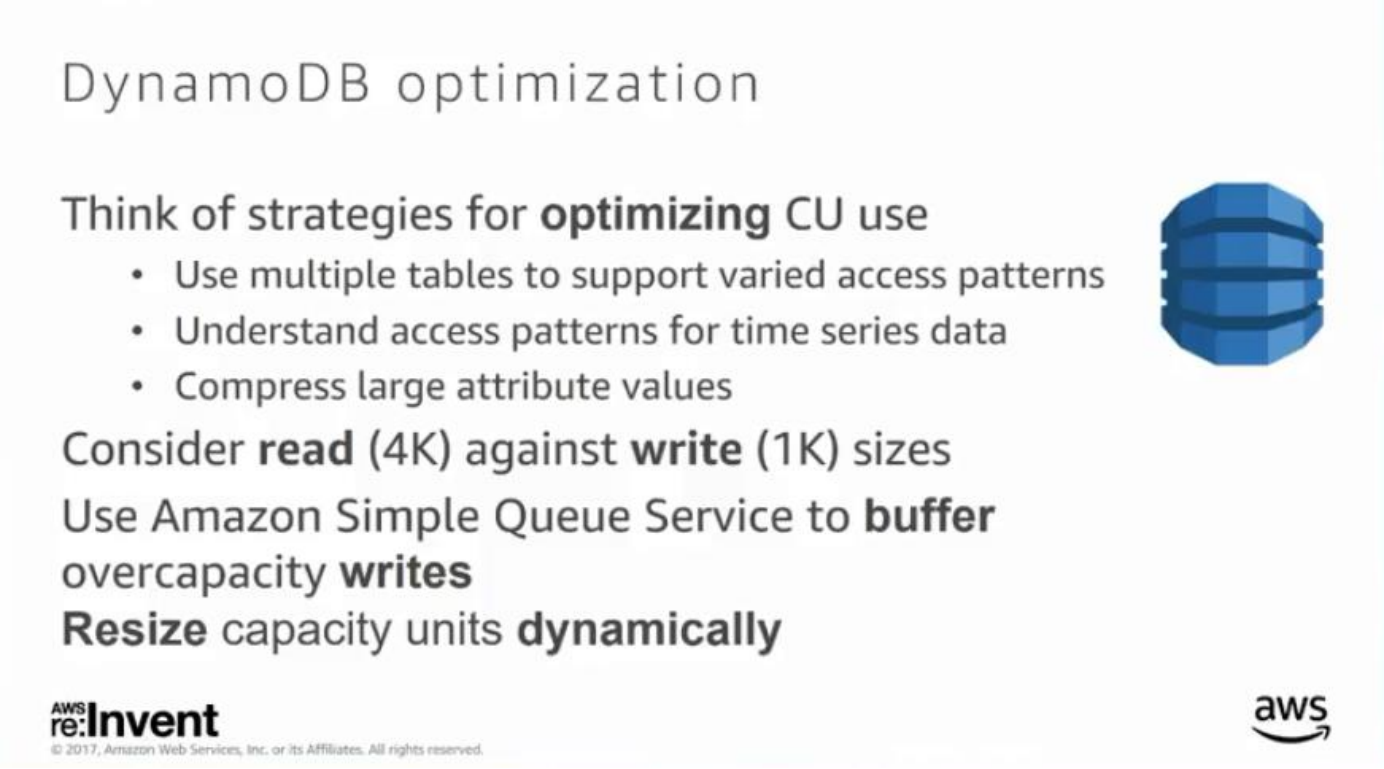
Caching helps nearly all the time with your database.



By using a single Redis node for cache, we can reduce the needed DynamoDB read capacity that we need to provision



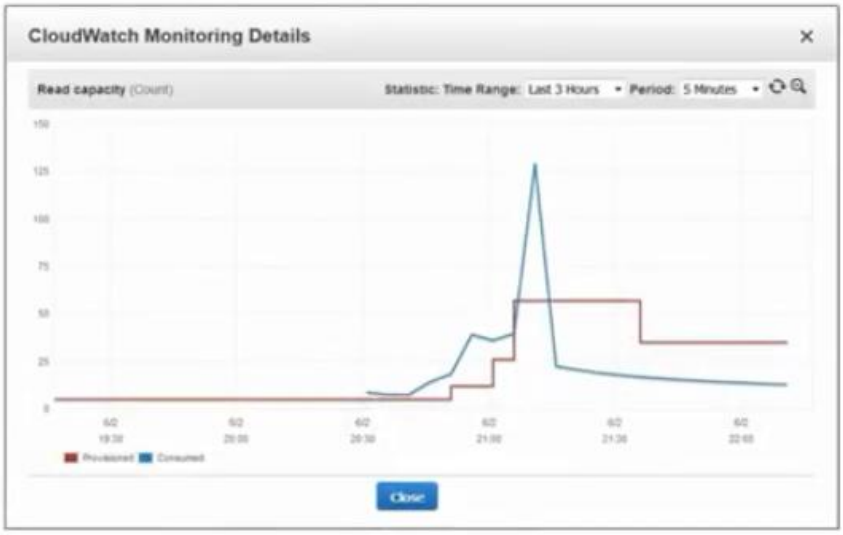
Negative cache means we are saving the fact that there is no result for a certain query also to the Redis node instead of querying for it every time the query is made and we will still not get anything result

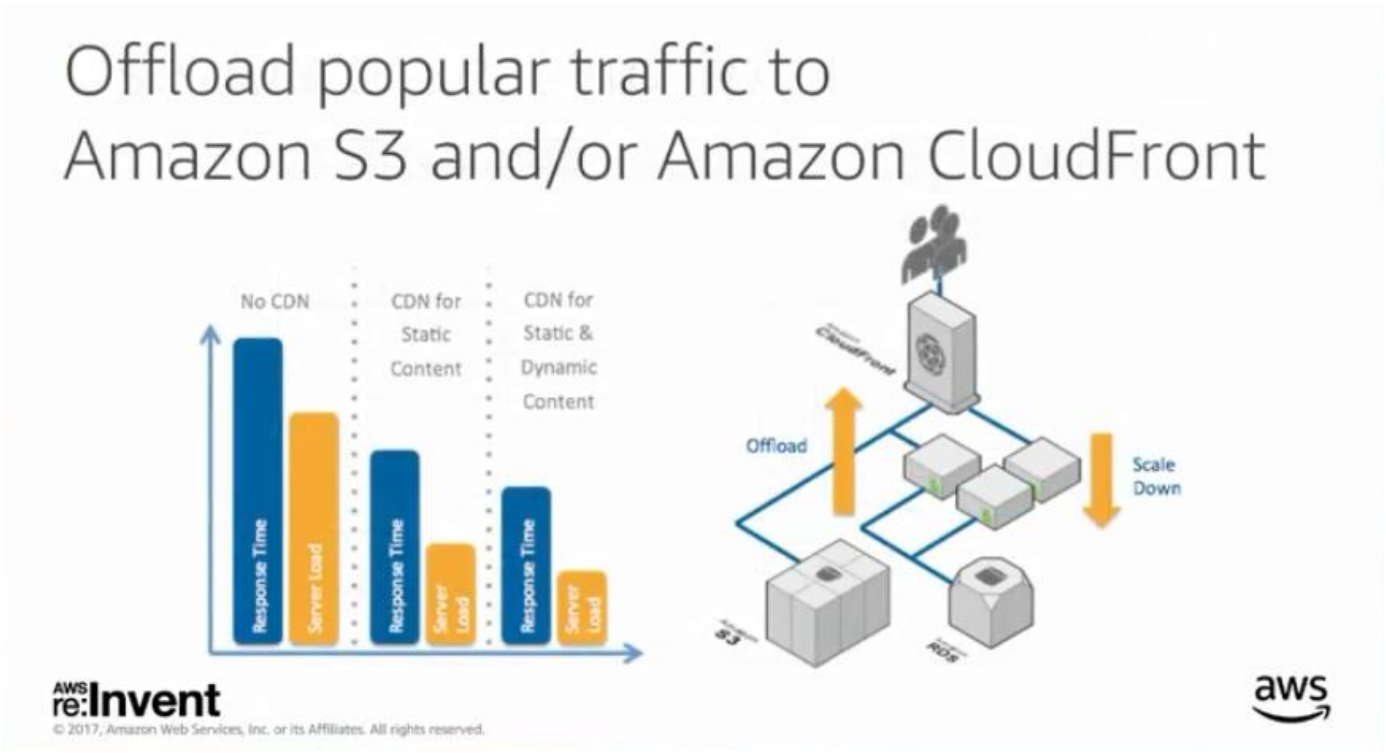


We also can optimize a lot of things in DynamoDB like the capacity usage for both reads and writes.

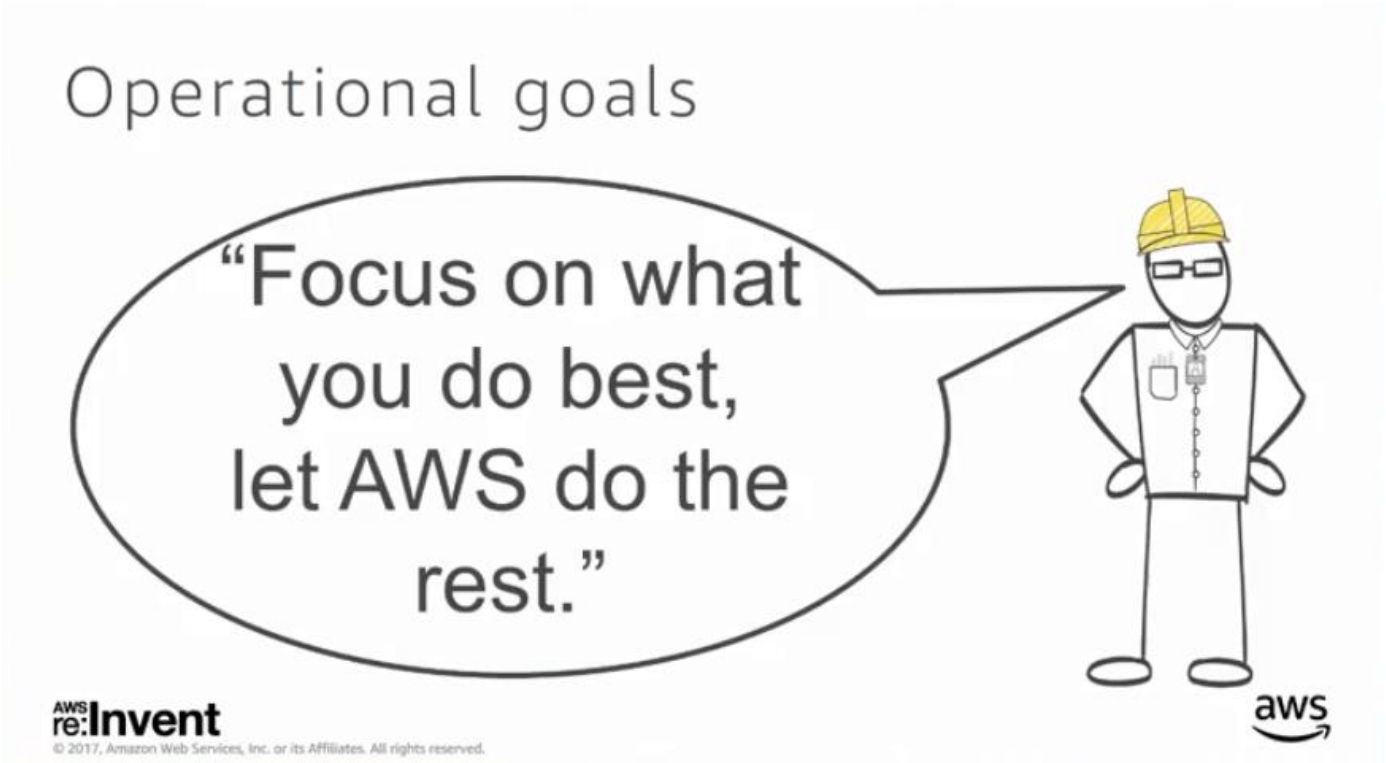
Use Auto Scaling for DynamoDB

Use Auto Scaling for DynamoDB





You can use CloudFront with a very small TTL like a TTL of 0.5 secs and you will still see some improvements



Leverage existing services

- Use Amazon RDS, DynamoDB, ElastiCache for Redis or Amazon Redshift
  - Instead of running your own database
- Amazon Elasticsearch Service
  - Instead of running your own cluster
- Amazon SQS
- Amazon Kinesis, Amazon Kinesis Firehose, Amazon Simple Notification Service, and more …

AWS can help you with any service

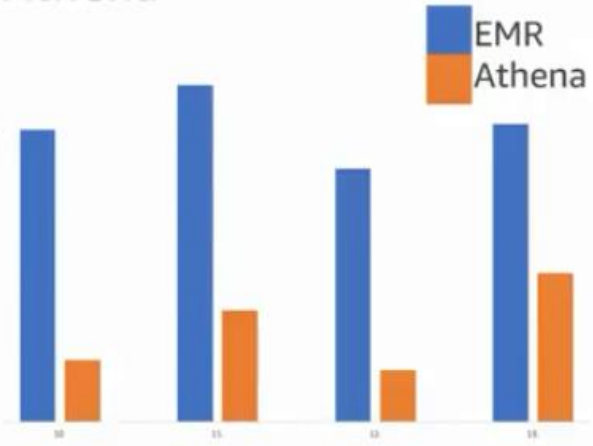
Amazon EMR to Amazon Athena migration

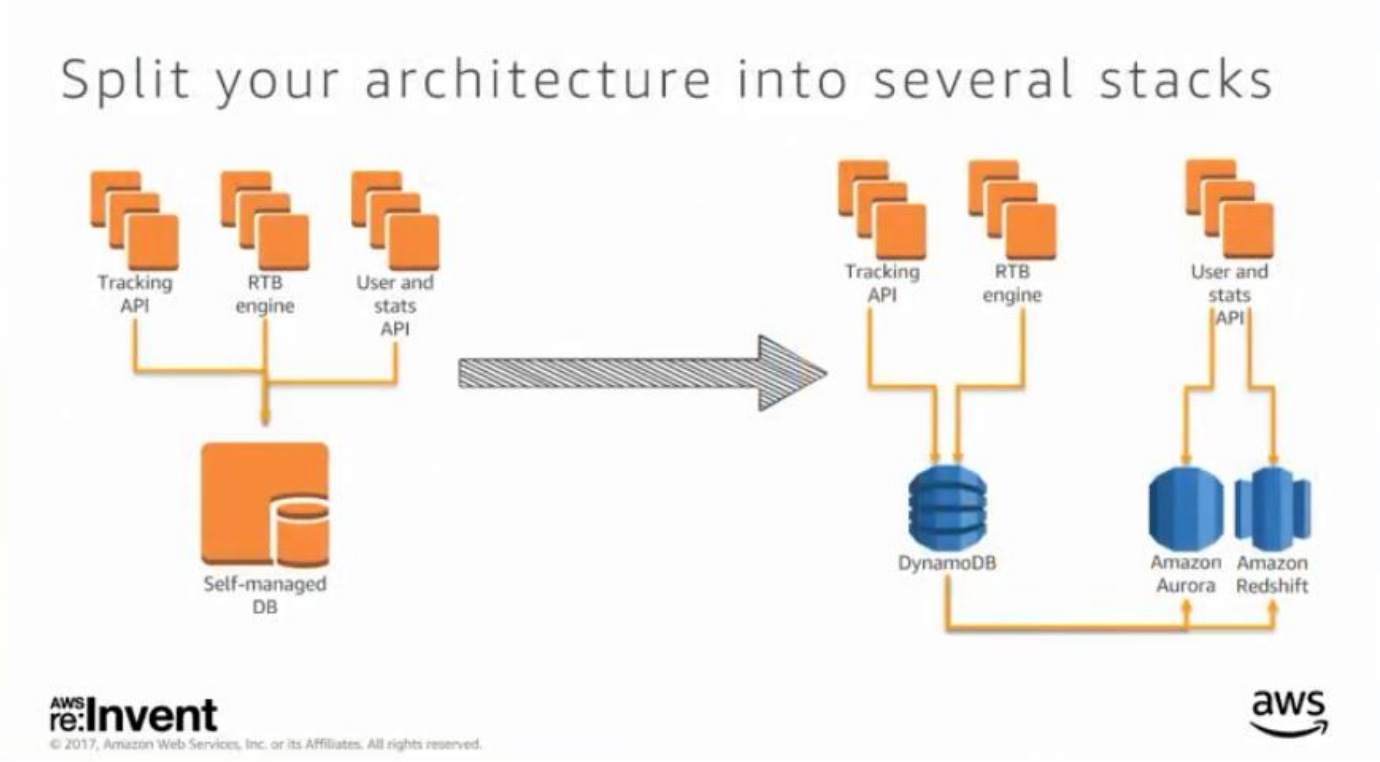
Our costs down by > 50% with Athena

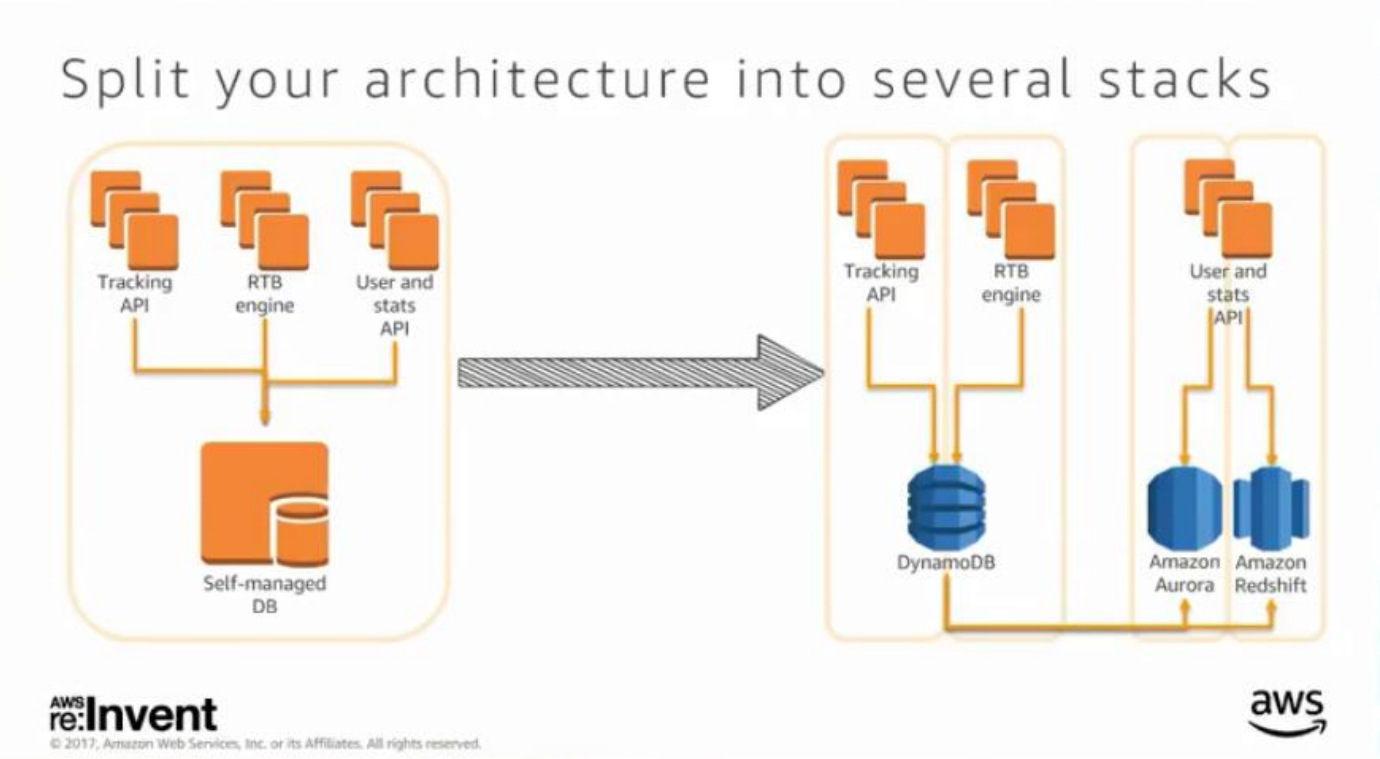
Startup phase of EMR is crucial

Architecture simplicity

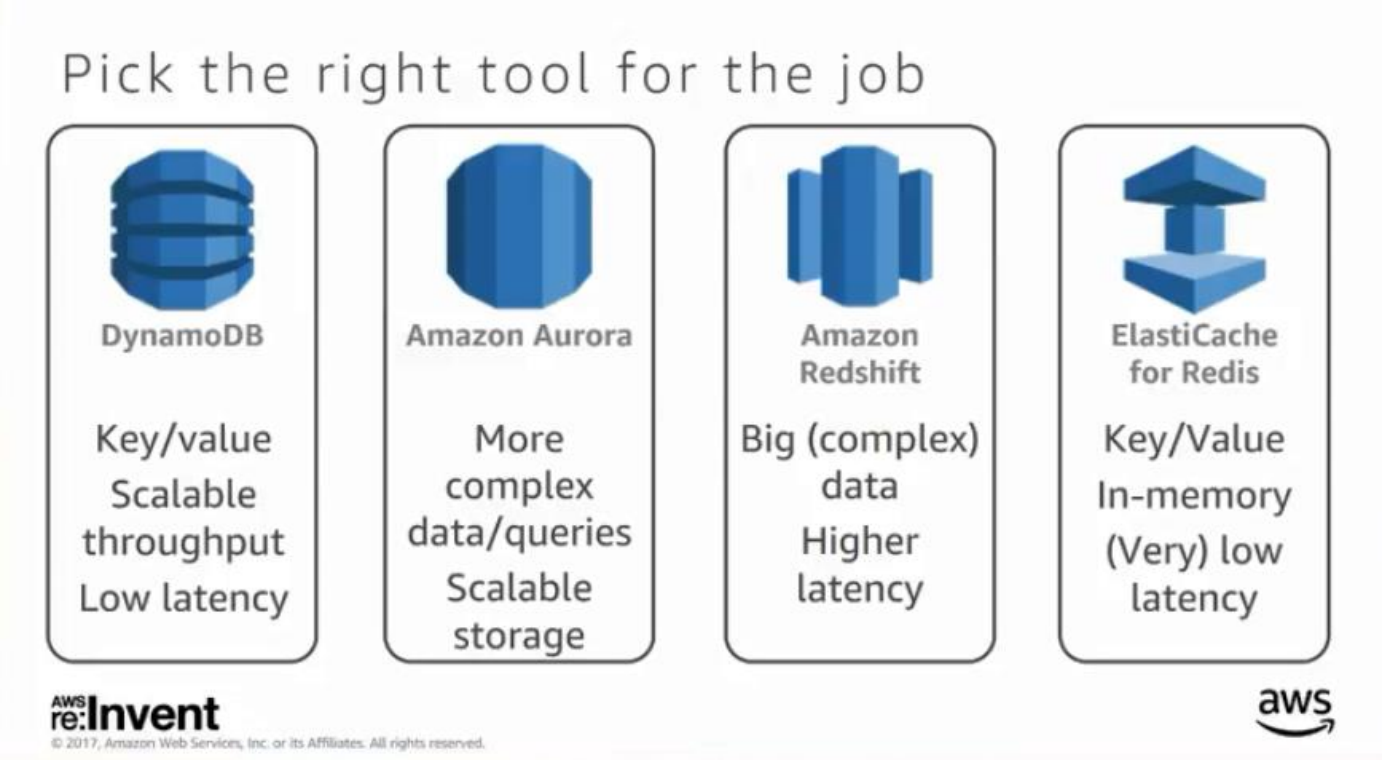
Less operations overhead



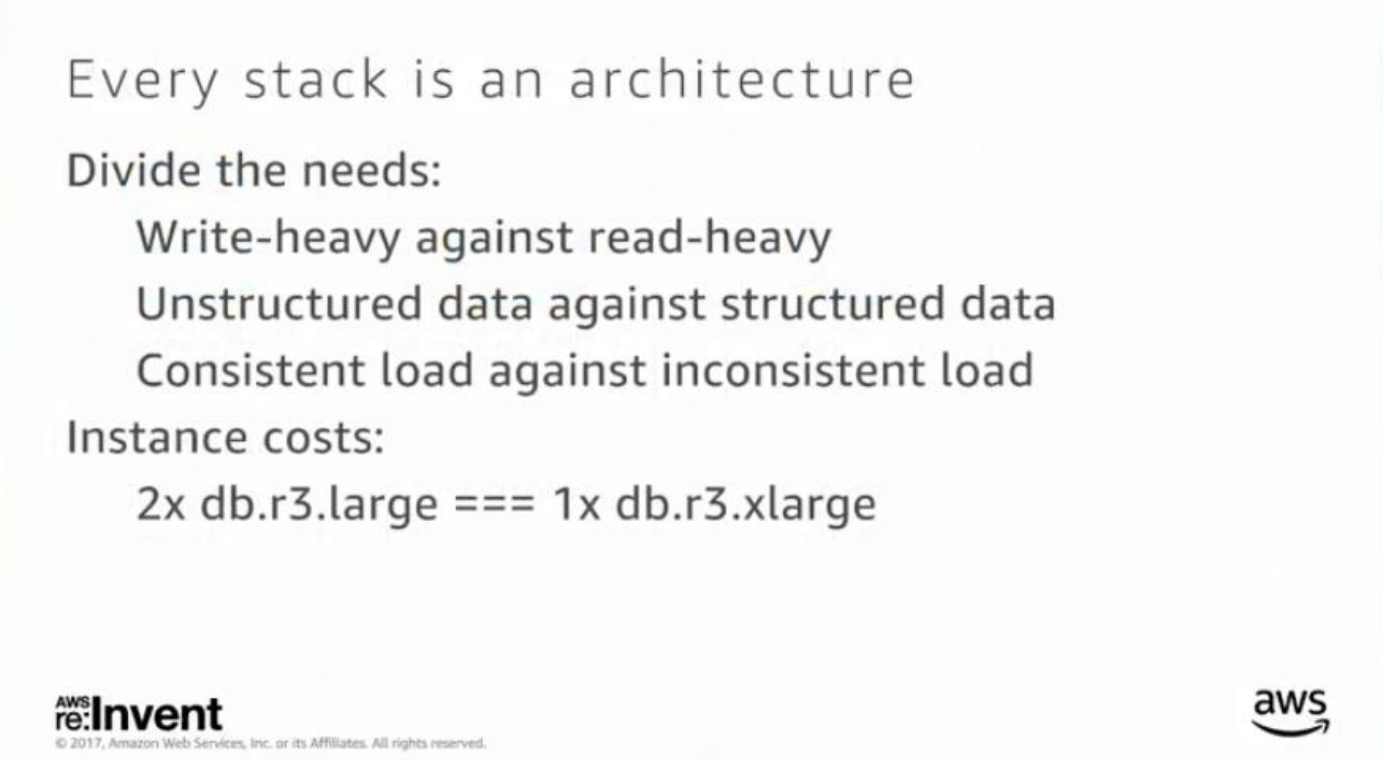




Our application architecture is now divided up into different stacks and the stacks now include the specific database it needs.



The challenge in now to find the best service for the specific job we have.



Advantages

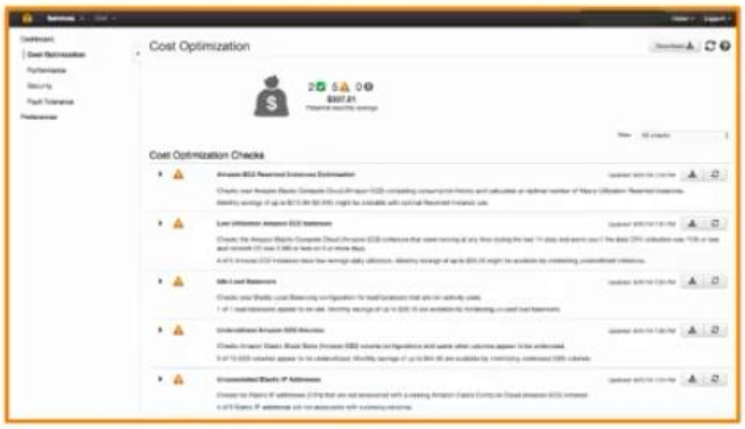
- No undifferentiated heavy lifting (= saves money and work)
- AWS operates the DB infrastructure for us
- Simple and more granular scale out
- No interference between different functionalities/systems
- Issue pinpointing and team responsibility easier

Let's recap

1. Use AWS TCO/cost/billing tools
2. Use Reserved Instances
3. Avoid idle instances through automation
4. Use Spot Instances
5. Optimize database utilization
6. Pick the right tool for the job
7. Offload your architecture

AWS Trusted Advisor

aws.amazon.com/premiumsupport/trustedadvisor/



Included with business or enterprise support

But wait! There's more...

https://youtu.be/SG1DsYgeGEk
AWS re:Invent 2015
ARC302 Running Lean Architectures:
Optimizing for Cost Efficiency

https://youtu.be/pFpv6FsCVfY
AWS re:Invent 2016
ARC313 Running Lean Architectures:
Optimizing for Cost Efficiency


AWS re:Invent
Thank you!
markus@teaminternet.com | @osterjour
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