# Hands-on Lab: how to monitor and manage your AWS costs

AWS Online Tech Talk
September, 2019

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AWS Cloud Economics

Do you know how much you (your company) paid the AWS bill last month?

Poll #1

What about the upcoming AWS monthly bill, do you know how much that will be?

Poll #2

# What are we going to see today

## Agenda

- Intro on AWS Cost Management
- Hands-on labs
    1. AWS Billing Dashboard
    2. AWS Cost Explorer
    3. AWS Budgets
    4. Tagging
    5. Cost and Usage Report (CUR) & Athena
- Best Practices and Q&A

## In order to maximize the impact of this session

- Have your AWS account open and ready
- Ask questions using the chat window
- Session is recorded, you can come back and review all the steps later

# AWS has been helping enterprises for 13+ years

## Achieving business value with the Cloud Value Framework

### Cost savings (TCO)

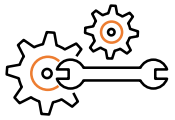
What is it?
Infrastructure cost savings/ avoidance from moving to the cloud

Example
50%+ reduction in TCO (GE)

### Staff productivity

What is it?
Efficiency improvement by function on a task-by-task basis

Example
More than 500 hours per year of server configuration time saved (Sage)



### Operational resilience

What is it?
Benefit of improving SLAs and reducing unplanned outage

Example
Critical workloads run in multiple AZs and Regions for robust DR (Expedia)

### Business agility

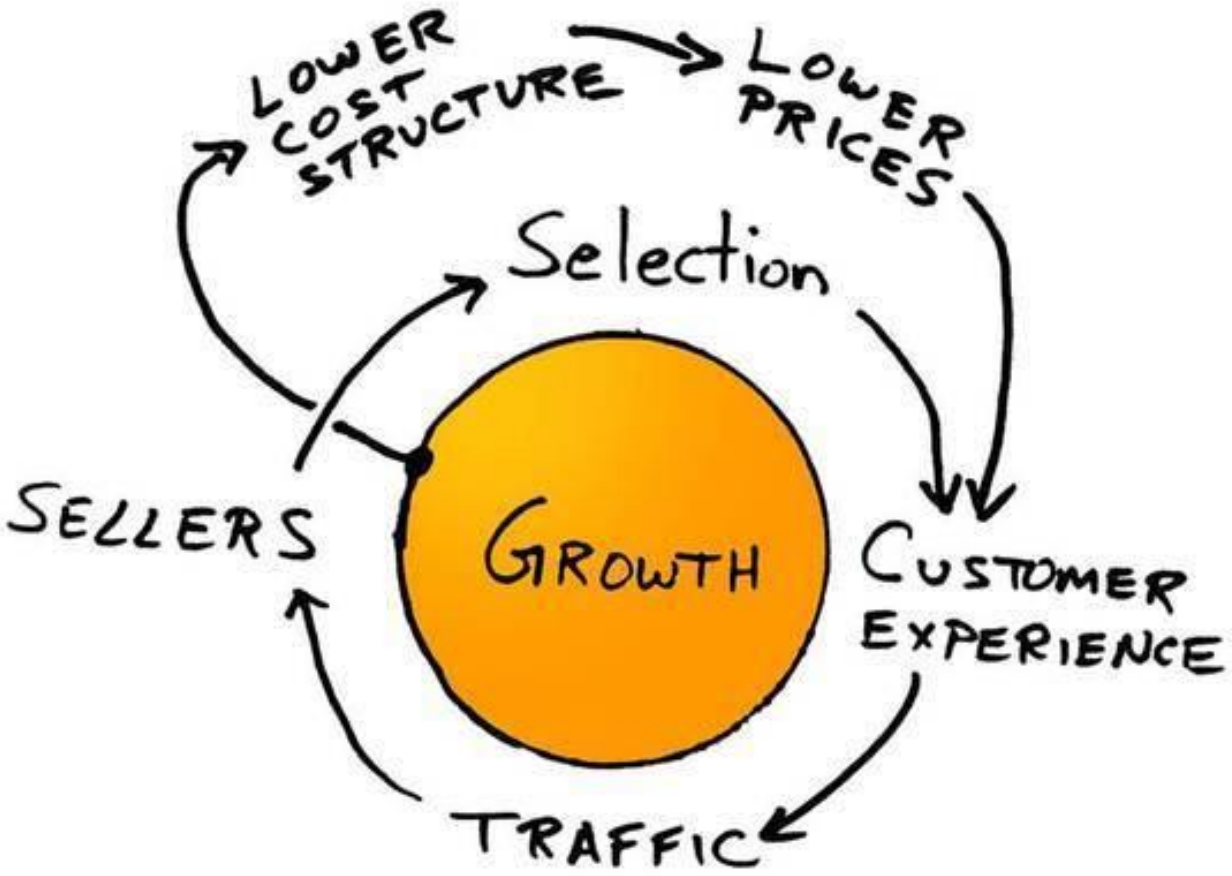
What is it?
Deploying new features/ applications faster and reducing errors

Example
Launch of new products 75% faster (Unilever)

Cost impact

Value impact

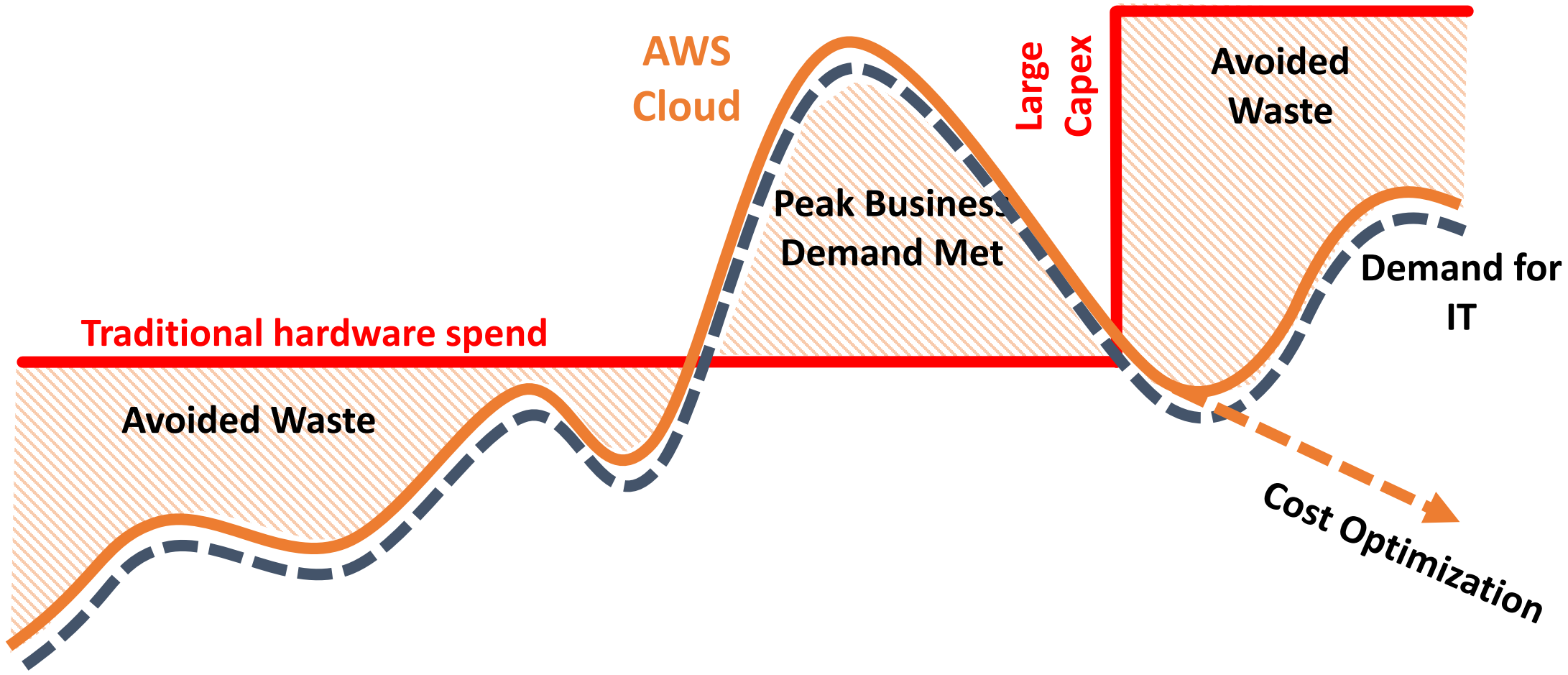
# AWS lowers prices over time




74

price reductions since 2006

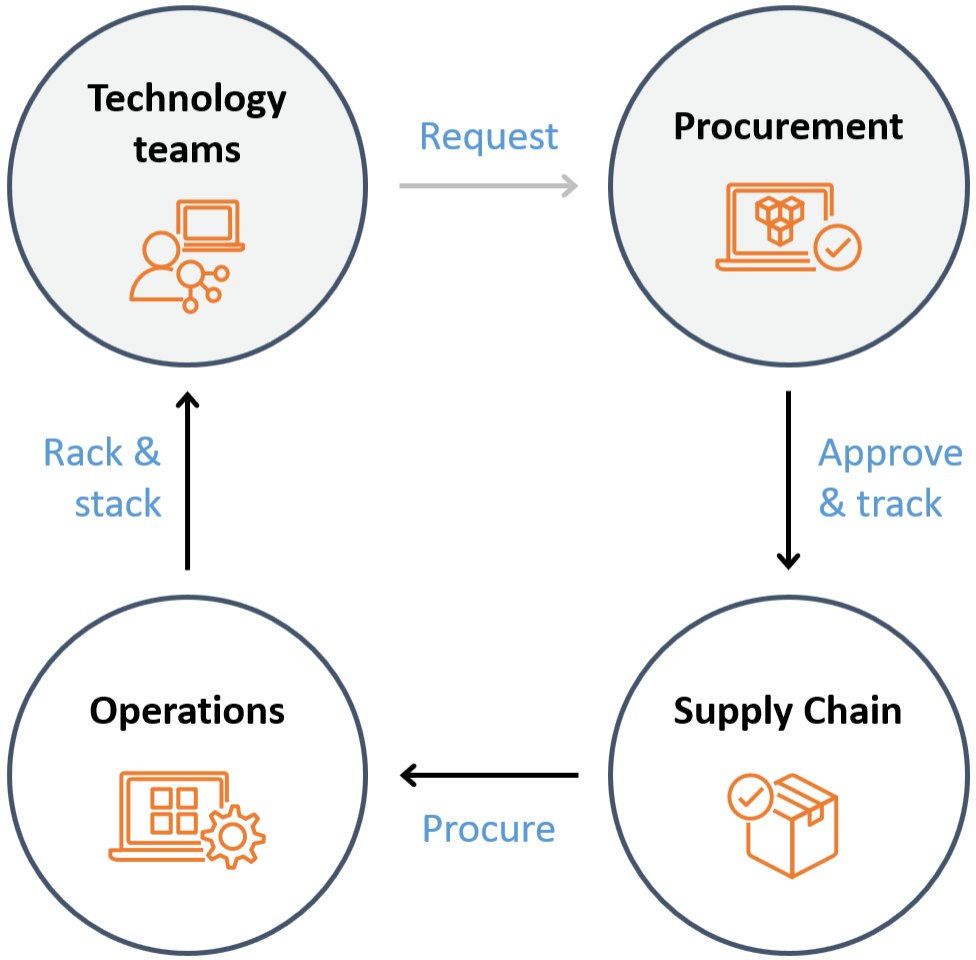
# AWS allows you to eliminate waste and match capacity and demand



Where do you sit today within your organization when it comes to AWS cost management?

Poll #3

# Traditional technology consumption




## Model

Engineers as requesters

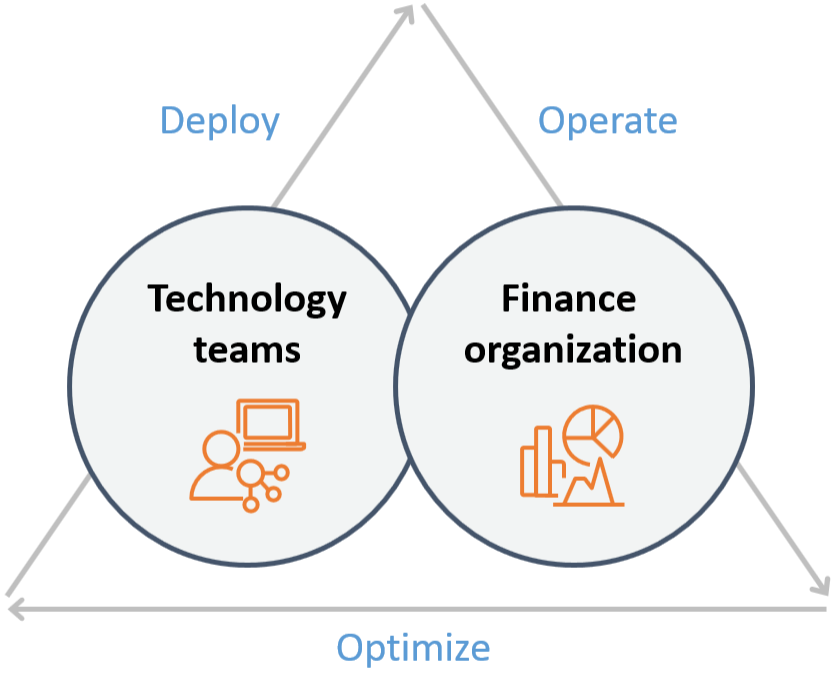
Procurement as approvers

Step function spend and capacity forecasting

**Long procurement cycles**

**High cost of failure**

# Cloud technology consumption




## Model

Engineers and Finance acting as one

Spend is dynamic and less predictable

**Procurement is instant**

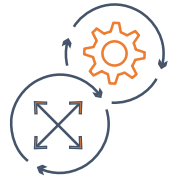
**Low cost of failure**

# Some of the root causes of cloud waste

## Learning curve associated with:

Managing access to
on-demand resources

Understanding Cloud
Pricing options



Selecting optimal services
and resource types/sizes

Predicting the cost associated with
variable usage

Awareness of resource costs

Cost governance in a continuous
manner

Good intentions never work, you need good mechanisms to make anything happen

Jeff Bezos
Founder and Chief Executive Officer
Amazon.com, Inc.

# Cloud Financial Management (CFM) Framework

## See

Account & tagging strategy

Cost reporting & monitoring

Showback & Chargeback

Efficiency/value KPIs

## Save

Cost aware architecture, design & service selection

Match capacity with demand

Choose the right pricing model

Resource governance

## Plan

Strategic fit

Business case & value articulation

POC based cost estimation

Budgeting & forecasting variable cloud spend

## Run

Partnership between Finance & Technology organizations

Invest in people, processes, governance & tools

Celebrate wins

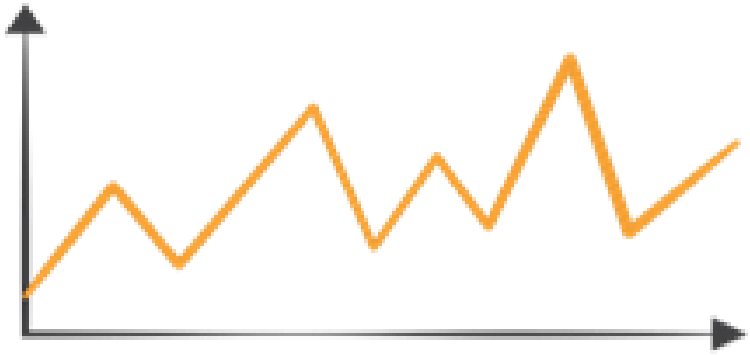
Do you have a dedicated resource today to manage AWS costs at your organization?

Poll #4

# AWS Pricing Models

## On Demand (OD)

pay per second without any commitment



Experimentation, demand still unknown

Pay only for what you use

## Reserved Instances (RI)

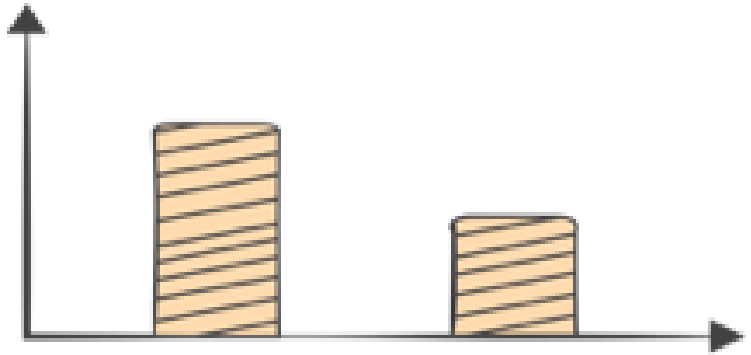
Commit to 1 or 3 years and get a significant discount

Known workloads, predictable demand

Up to 75% less vs OD

## Spot

Idle capacity, low cost and no commitment



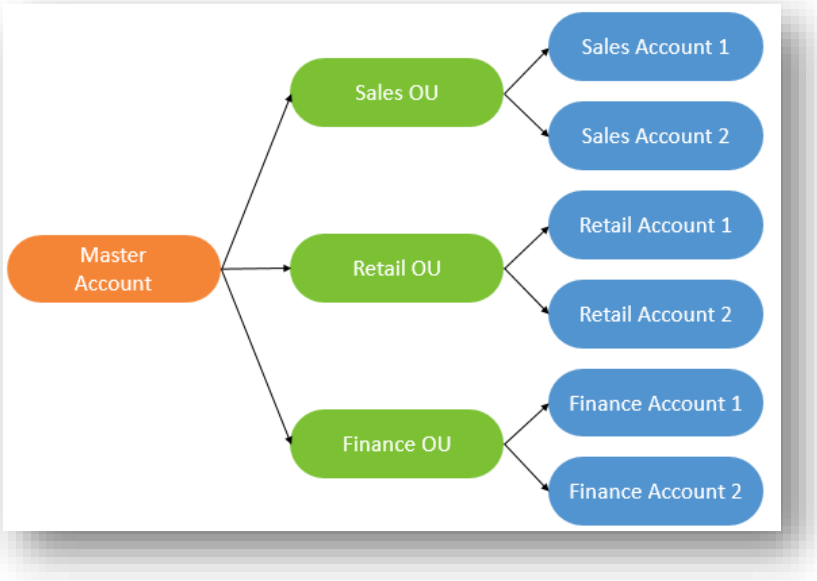
Flexible workloads, *stateless*

Approx. 90% less vs OD

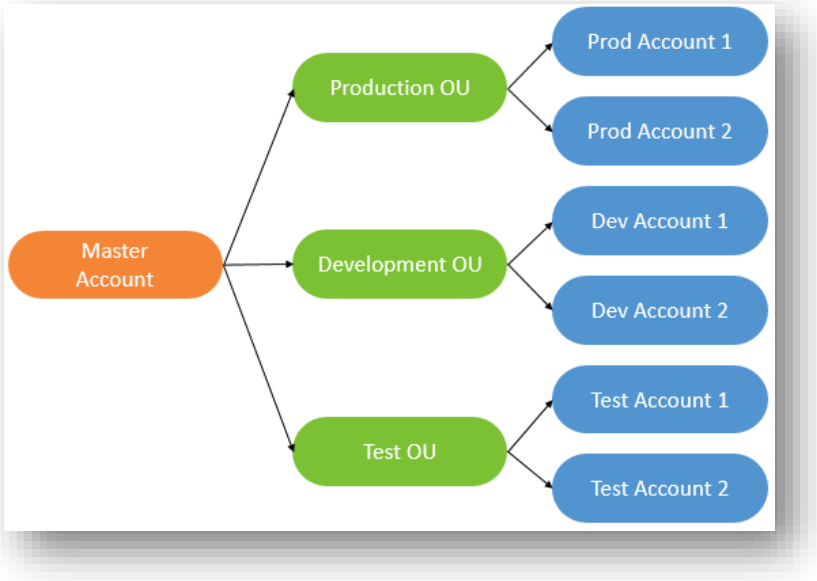
# EC2 RI Spectrum of Savings

| | Less | | More |
|---|---|---|---|
| **Payment Option** | No Upfront | Partial Upfront | All Upfront |
| **Duration (Years)** | 1 | | 3 |
| **Operating System** | Non-Linux | | Linux/Unix |
| **Instance Type** | Older Generations | | Newer Generations |
| **Type** | Convertible | | Standard |

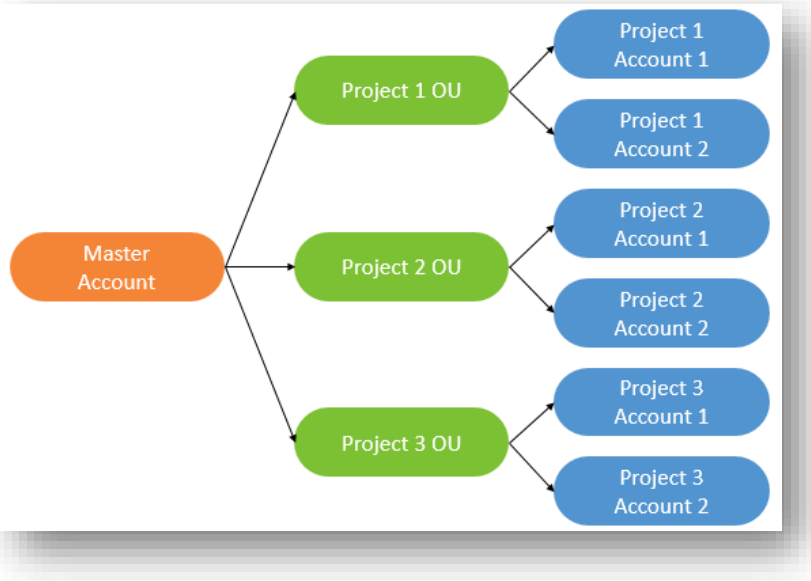
# AWS Organizations: Consolidation Strategies




Business Unit

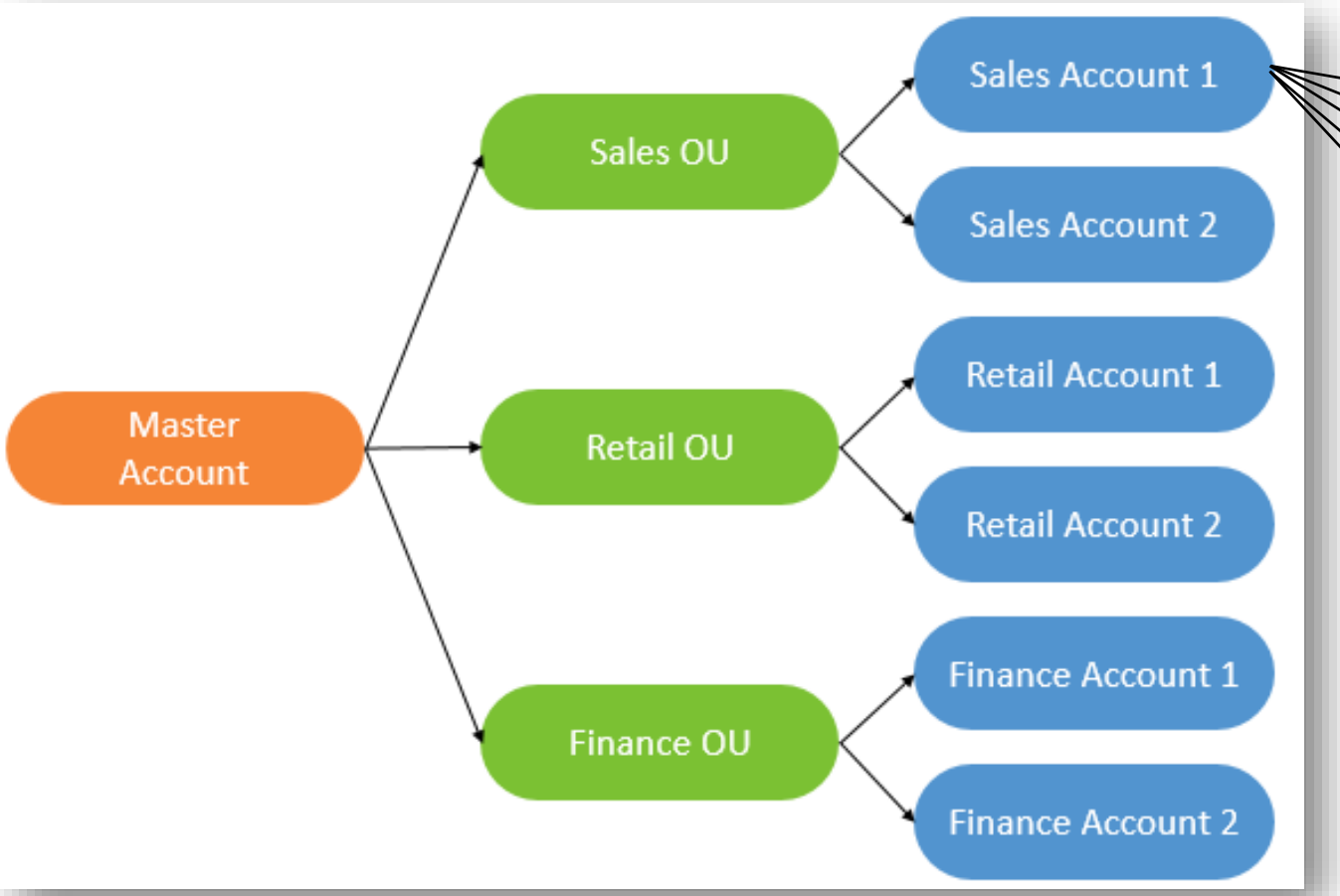



Environment




Project

# AWS Organizations: Consolidation Strategies




**Cost allocation tags**

- Environment
- Project
- Team
- Application ID
- Cost Center

TAGS provide a more granular view of your organization's consumption pattern

# Using tags for visibility and chargeback

| Stakeholder | Tag Name | Example | Description | Mandatory | Accounts |
|---|---|---|---|---|---|
| Finance | Cost Center | 4374 | Cost center responsible for those resources | Yes | All |
| Finance and IT | Environment | Dev | Type of environment | Yes | All |
| IT | Owner | Ricardo | Person responsible for those resources | Yes | All |
| IT | Contact | 1425365xxxx | Contact details of the person responsible for those resources | No | All |
| Finance | Project | Aurora | Project name | No | Only PROD |
| IT | Date_Expiration | Feb 2020 | Expected date to finish this project | No | All |
| Security and IT | Support | Team Alfa | Support team responsible for this resources | Yes | Only PROD |

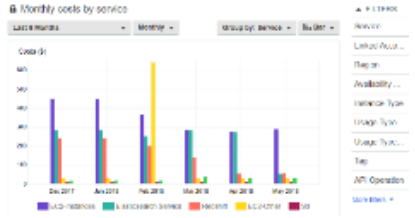
https://aws.amazon.com/answers/account-management/aws-tagging-strategies/

# 1) Getting to know AWS Billing Console

# Pick the tool that provides the visibility you need

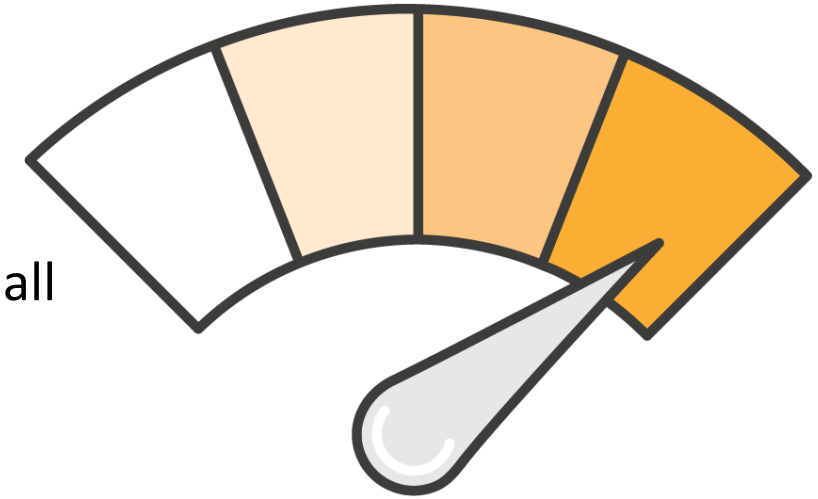
1. Monthly AWS Invoice

2. AWS Billing console



3. AWS Cost Explorer and AWS Budgets

4. AWS Billing File Analysis, DIY dashboards, and 3rd party tools



Simple, Static, Small environment

Complex, Dynamic, Large environment

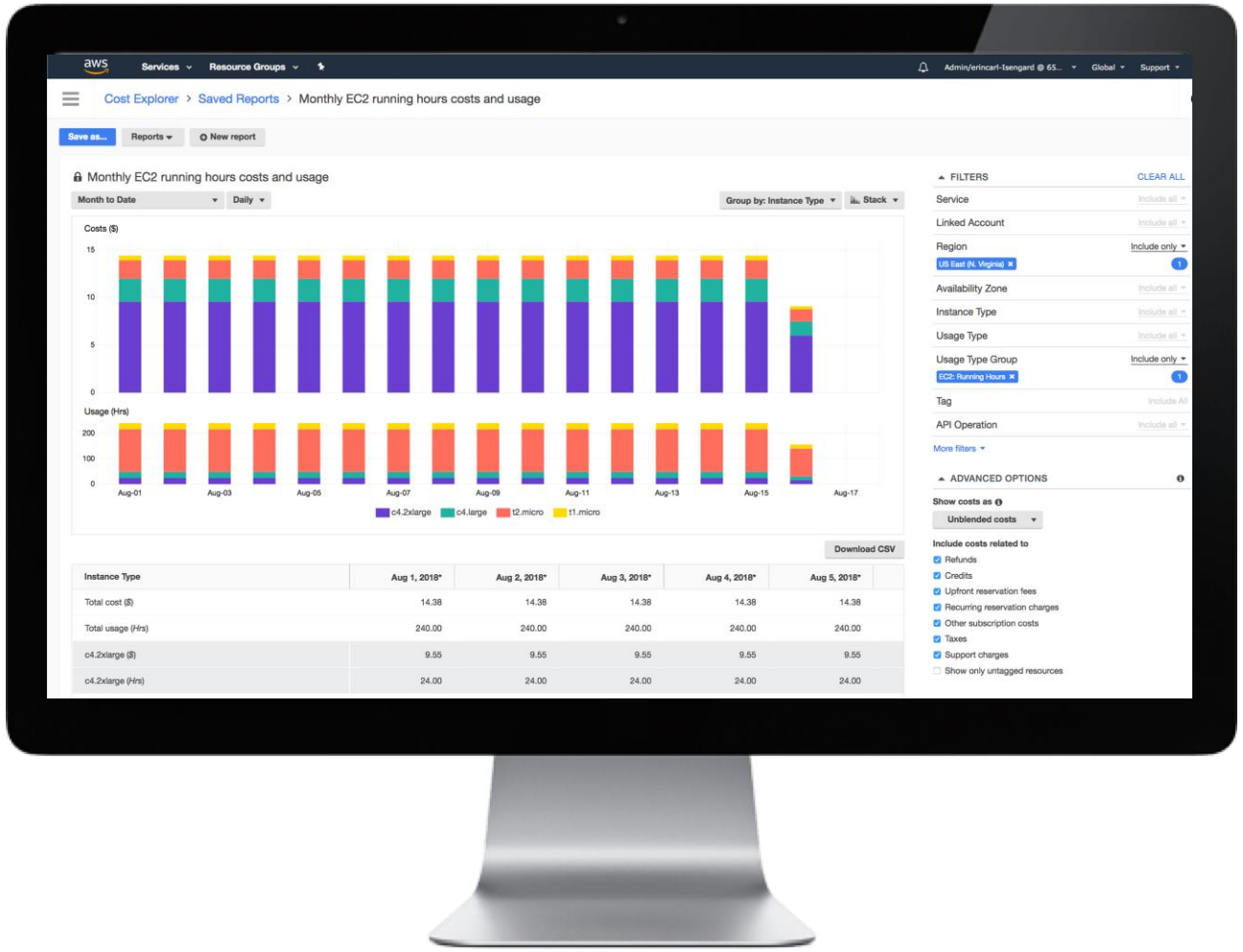
# Demo

# Pick the tool that provides the visibility you need

| | Billing Dashboard/Bills | AWS Cost Explorer | Cost and Usage Report (CUR) |
|---|---|---|---|
| Data Field | • AWS Account ID<br>• Service (EC2)<br>• Usage Type (BoxUsage:t3.large)<br>• Operation (RunInstance)<br>• Item Description (OS & pricing)<br>• Usage Quantity<br>• Cost | All fields from Bills file +<br>• User Defined Tags<br>• API Operation<br>• Region/AZ<br>• Platform (OS)<br>• Purchase Option<br>• Tenancy | All fields from Bills file +<br>• Resource-id |
| Period | • Monthly | • Monthly (Last 12M)<br>• Daily | • Hourly<br>• Daily |
| Output | • PDF and CSV | • Billing Dashboard UI<br>• CSV<br>• Cost Explorer API | • S3 |
| Use for | • Simple monthly reports | • Daily/Weekly cost tracking<br>• Leverage Cost Awareness<br>• Trend and Budget analysis | • Hourly/Daily reporting<br>• Detailed Chargeback & Showback |

# 2) AWS Cost Explorer

# Getting to know AWS Cost Explorer




AWS Cost Explorer allows your organization to have visibility into your consumption pattern, such as mapping the most commonly used services and identifying unexpected anomalies or expenses.

- Monthly or daily cost, per service, linked account, tags, region and etc.
- Hours used for EC2 by type of instance, linked account, tags and price model
- Reports for Reserved Instance Management: Coverage and Usage

All of these features can also be accessed through the Cost Explorer API.

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aws Services Resource Groups Admin/erincarl-Isengard @ 65... Global Support

Cost Explorer > Saved Reports > Monthly EC2 running hours costs and usage

Save as... Reports New report

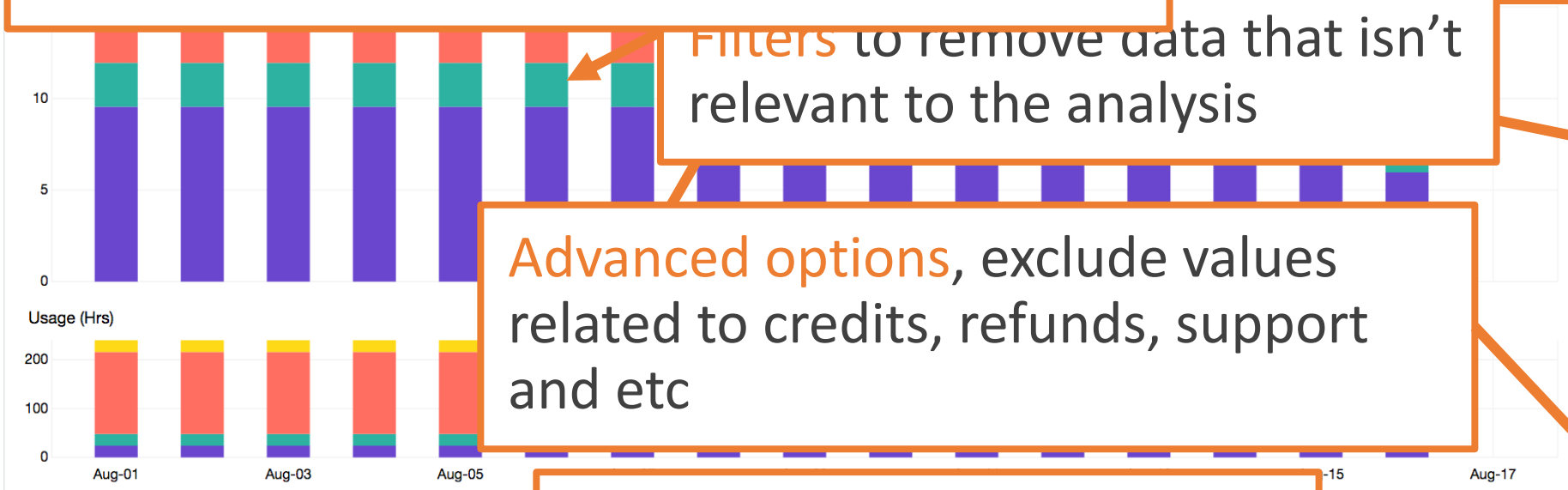
Group by: instance type, linked account, purchase model, region, service…

…ped per instance type and …ottom)

Filters to remove data that isn't relevant to the analysis

Advanced options, exclude values related to credits, refunds, support and etc

You can also export to csv




CLEAR ALL

Include all

Include all

Include only

US East (N. Virginia) 1

Availability Zone Include all

Instance Type Include all

Usage Type Include all

Usage Type Group Include only

EC2: Running Hours 1

Tag Include A

API Operation Include all

More filters

ADVANCED OPTIONS

Show costs as

Unblended costs

Include costs related to

- [x] Refunds
- [x] Credits
- [x] Upfront reservation fees
- [x] Recurring reservation charges
- [x] Other subscription costs
- [x] Taxes
- [x] Support charges
- [ ] Show only untagged resources

Download CSV

| Instance Type | Aug 1, 2018* | Aug 2, 2018* | Aug 3, 2018* | Aug 4, 2018* | Aug 5, 2018* |
|---|---|---|---|---|---|
| Total cost ($) | 14.38 | 14.38 | 14.38 | 14.38 | 14.38 |
| Total usage (*Hrs*) | 240.00 | 240.00 | 240.00 | 240.00 | 240.00 |

All that can also be accessed through the Cost Explorer API.

# Demo

# AWS Cost Explorer

## Comprehensive dashboards

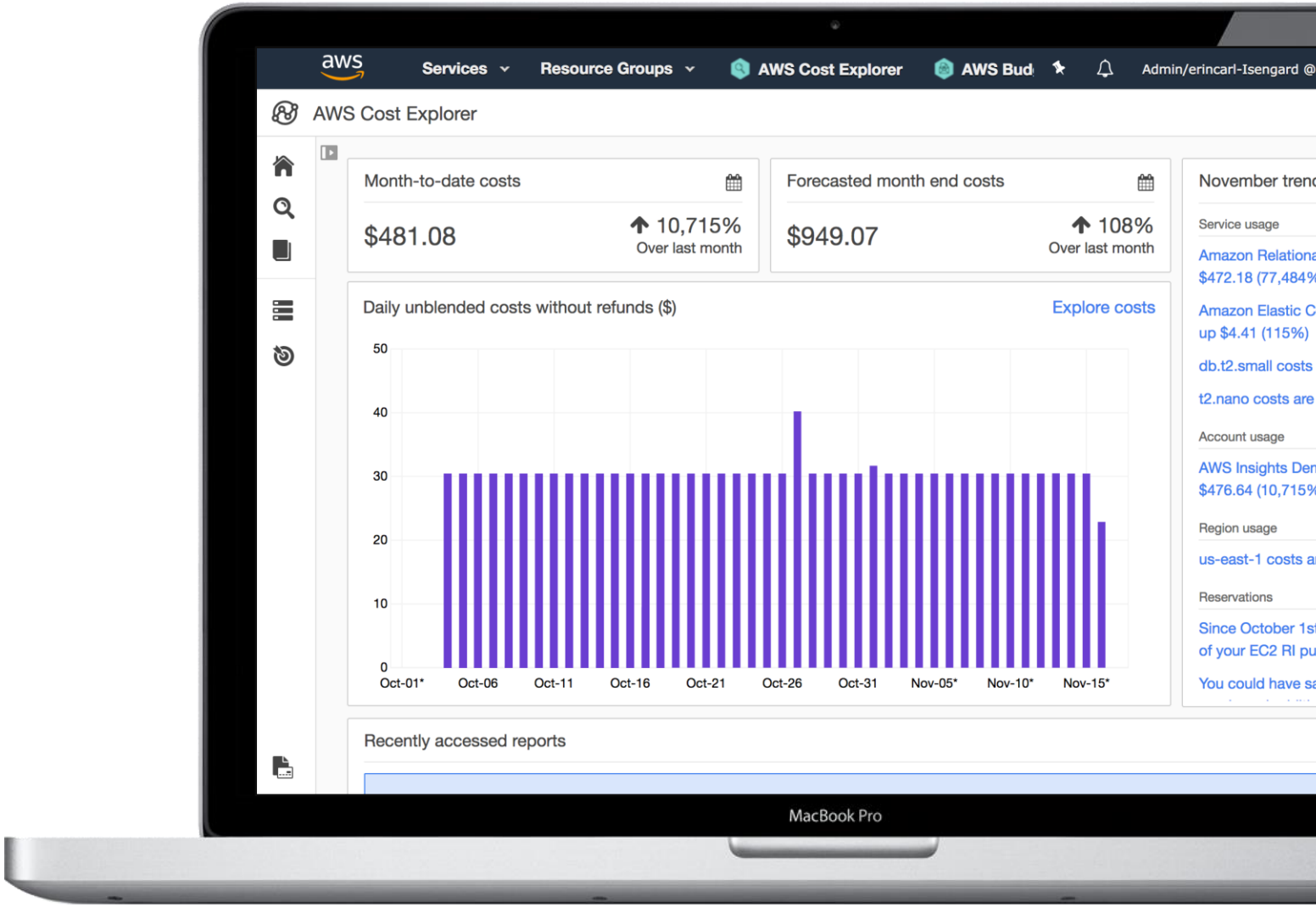
Gain a summary view of key cost details, including month-to-date costs, month-end forecasted costs, and saved reports

## Automated trend analysis

Identifies anomalous cost and usage events, across your account(s), based on historical patterns

## Optimized user experience

Users of all levels of expertise in your organization can quickly onboard and feel confident using Cost Explorer to address their cost management needs



# AWS Cost Explorer

## Plan for future spending

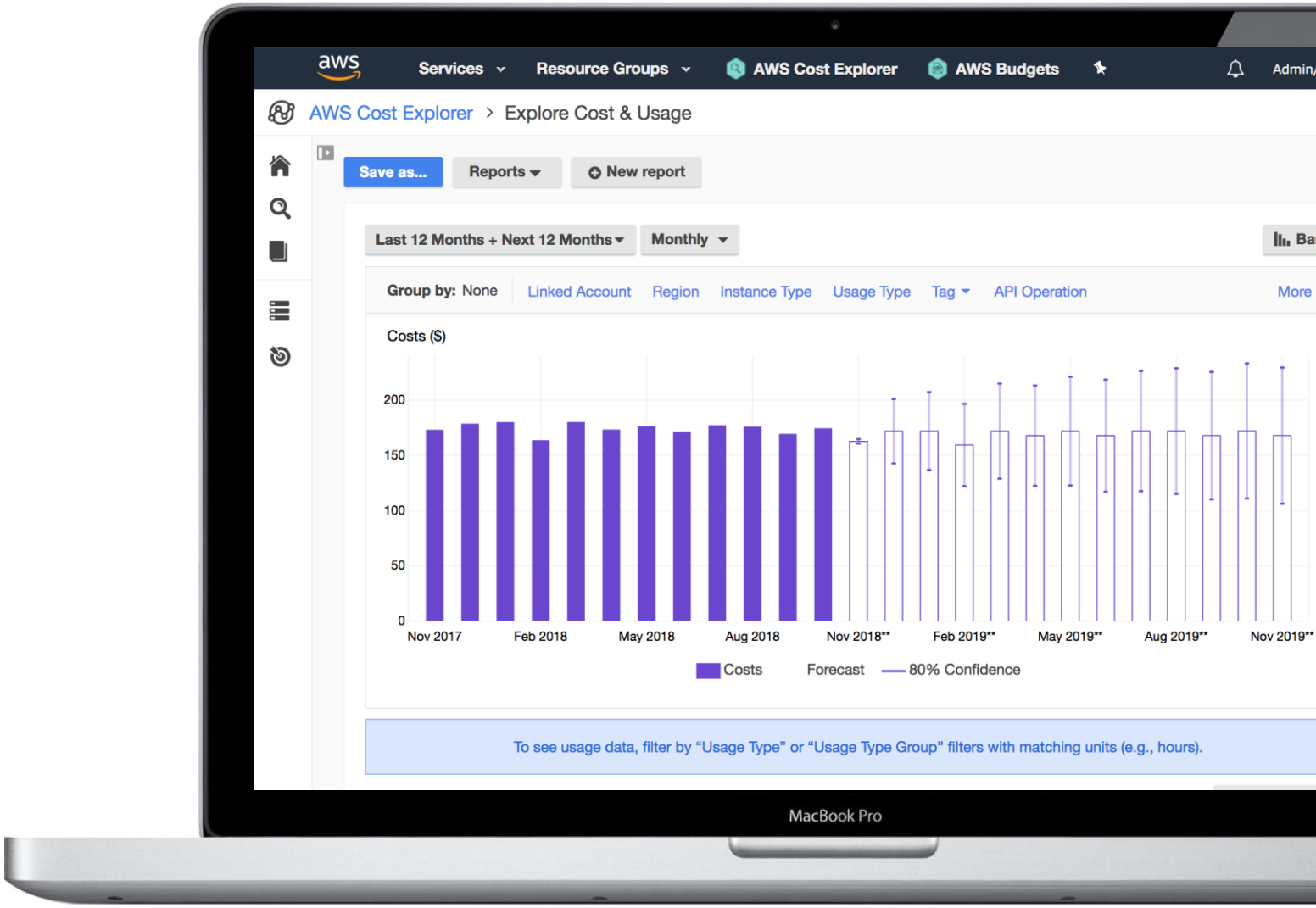
Increased forecasting accuracy due to new machine learning- and rules-based models, allowing you to plan ahead with more confidence

## Customize your forecasts

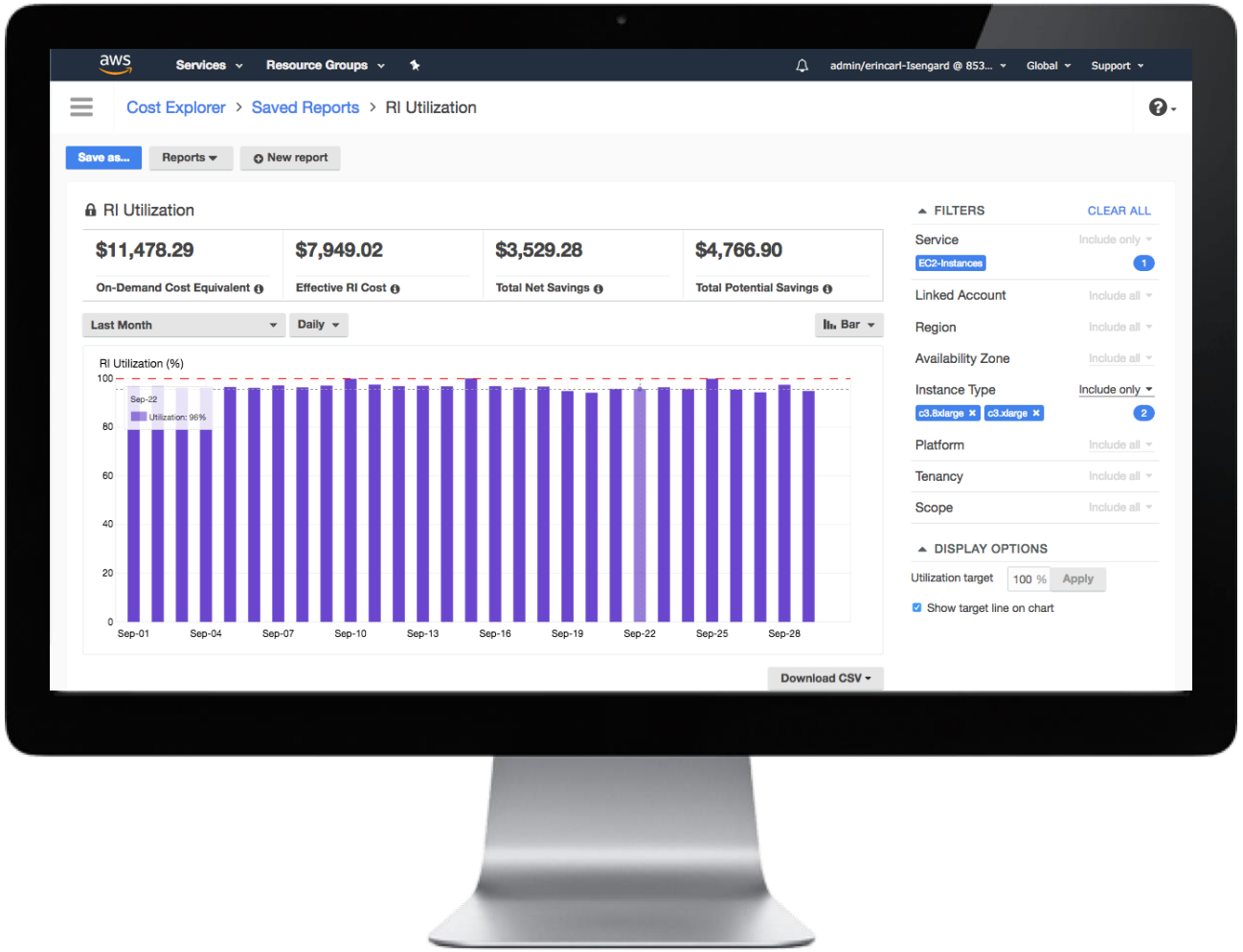
Use Cost Explorer's filtering capabilities to forecast costs along specific usage dimensions

## Programmatic access

Forecasting functionality is also available via the Cost Explorer API



# AWS Cost Explorer RI Utilization




**Reserved Instances Report**

- RI Coverage Report - How Many EC2 Hours Are Covered by RI vs. Spot and On Demand
- Report on utilization of existing RIs, including savings achieved – what % of hours used and how much did it represent in savings (OD cost minus RI cost)
- Reports with RI Amortization
- Available for Amazon EC2, Amazon RDS, Amazon Redshift, Amazon ElastiCache, and Amazon Elasticsearch bookings

All of these features can also be accessed through the Cost Explorer API.

# Demo

Is your organization leveraging EC2 Reserved Instances today?

Poll #5

# AWS Cost Explorer RI Recommendations

## Get customized Reservation Recommendations

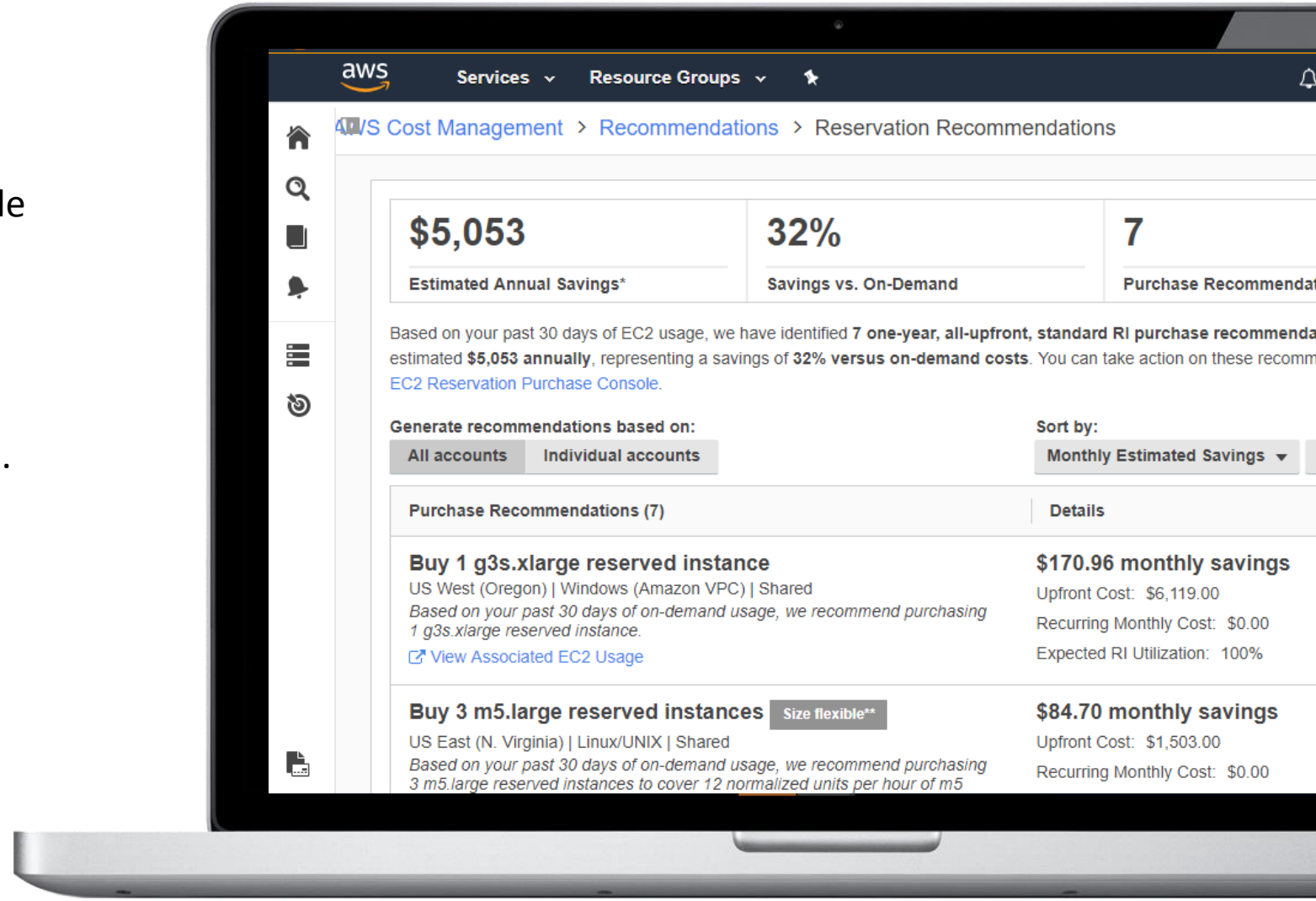
Understand available savings, expected utilization, and cost commitment from a single place

## Available across five AWS services

EC2, RDS, Redshift, ElastiCache, ElasticSearch.

## Define the best recommendation parameters for you

Pick your desired payment option, term, and more.



# AWS Cost Explorer Resource Optimization

## Address the challenges of identifying optimization opportunities at scale

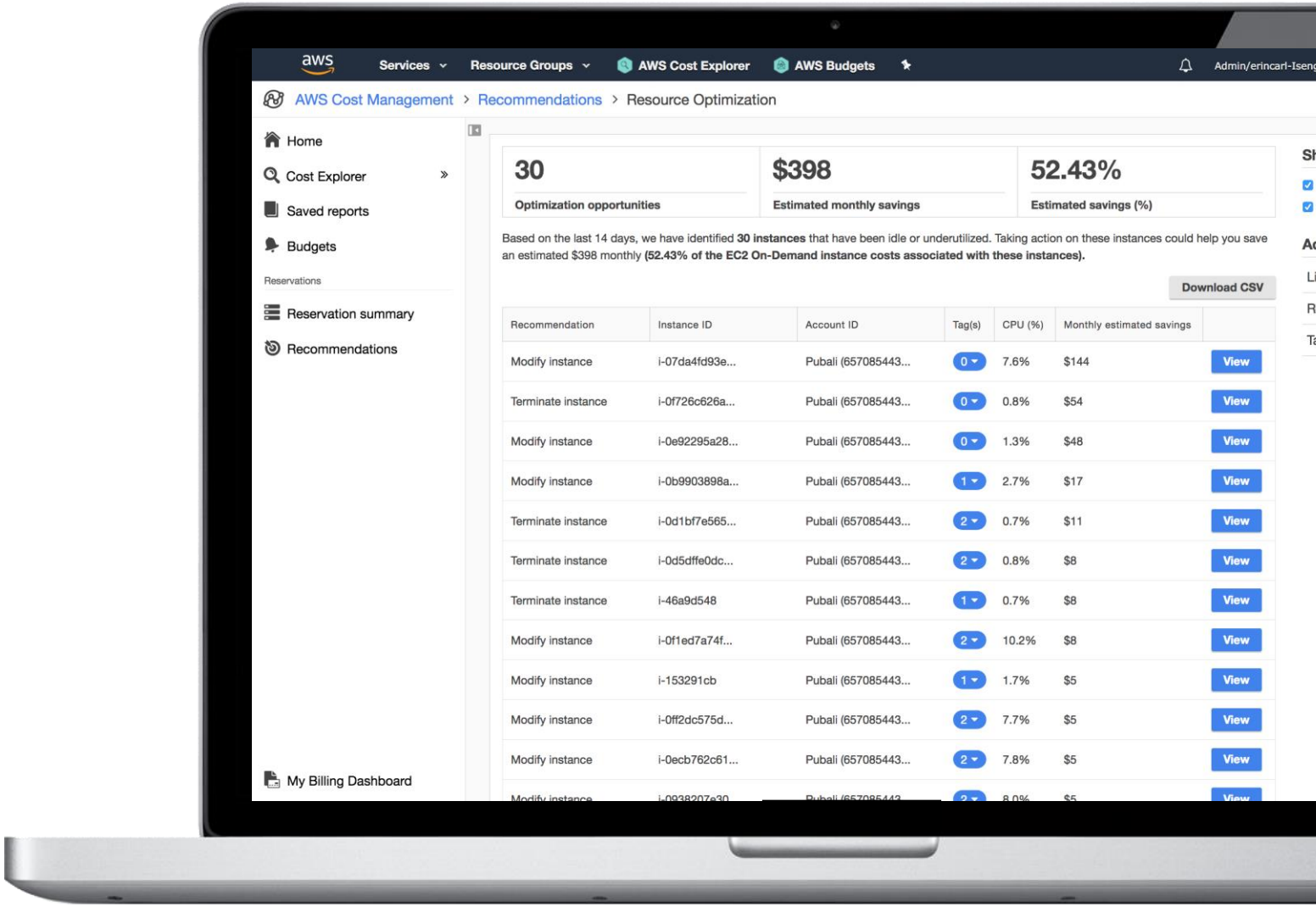
Get customized Amazon EC2 Rightsizing Recommendations for free

## Single view across your regions and accounts

Exhaustive view of your opportunities from one place

## Filter your recommendations

Based on Cost Allocation Tag, Region, or Linked Account.



# AWS Cost Explorer Resource Optimization

## Identify your idle and underutilized instances

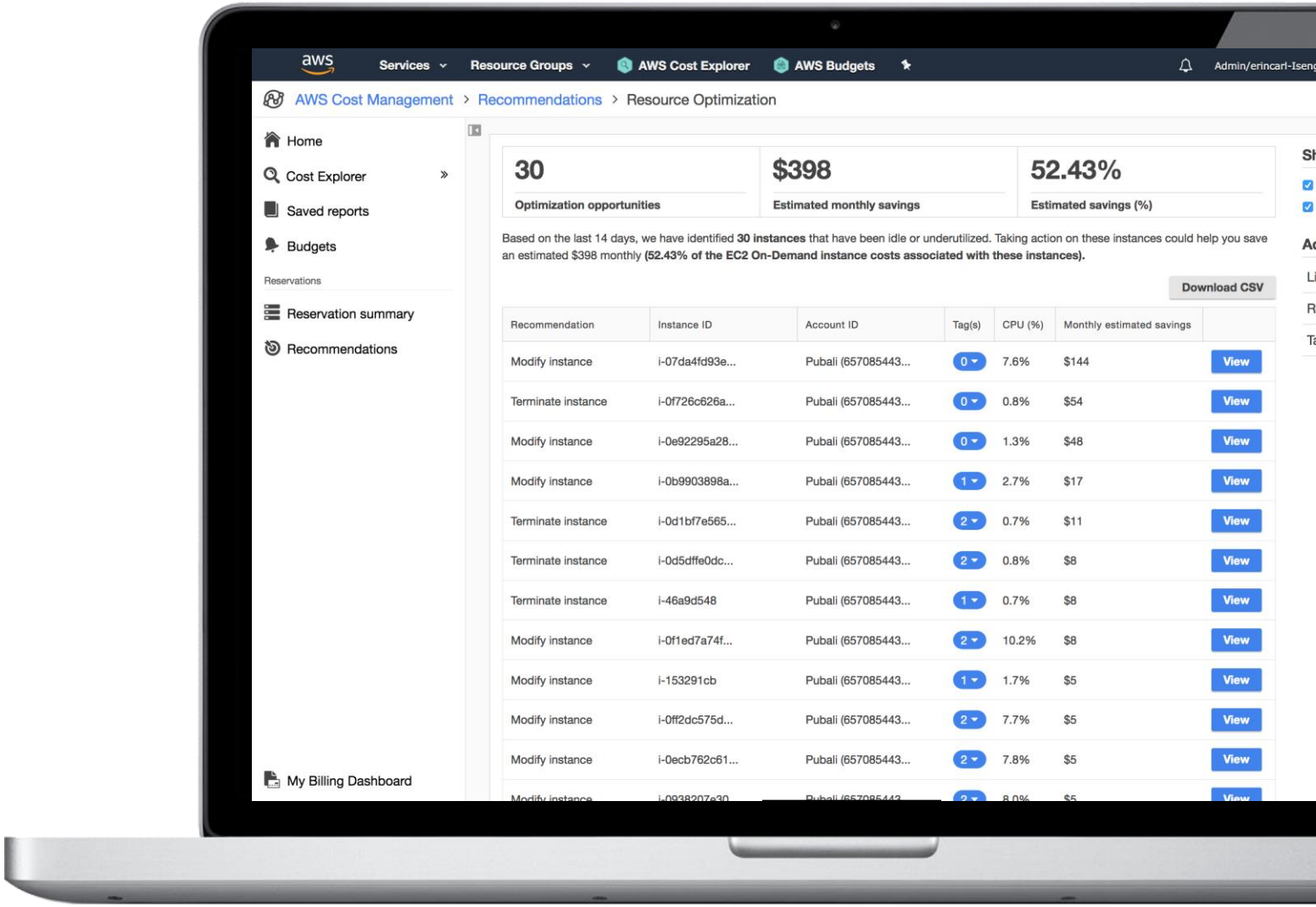
With the option to enhance those recommendations due to integration with the CloudWatch agent.

## Receive actionable recommendations

Know the recommended action to downsize or terminate on an instance by instance basis

## Quantify your potential savings

Understand how much you can save based on your recommended action, and how your reservations impact savings.



# Demo

# What does success looks like for your organization?
# Link consumption with value created

## Cost based (efficiency)

$ Average daily spend
$ Monthly forecast vs actual
$ Untagged resources
% Turned off instances
% RI coverage and utilization
$ Saved
# Underutilized resources
…

## Value based (business outcomes)

$ per User or Transaction
$ per Impression or Click
$ per Request
$ per Application or Business Unit
$ per Revenue
$ Per Developer
# hours per $ invested
…

# Customer A | Executive Summary

EXAMPLE

Month-to-date usage Highlights

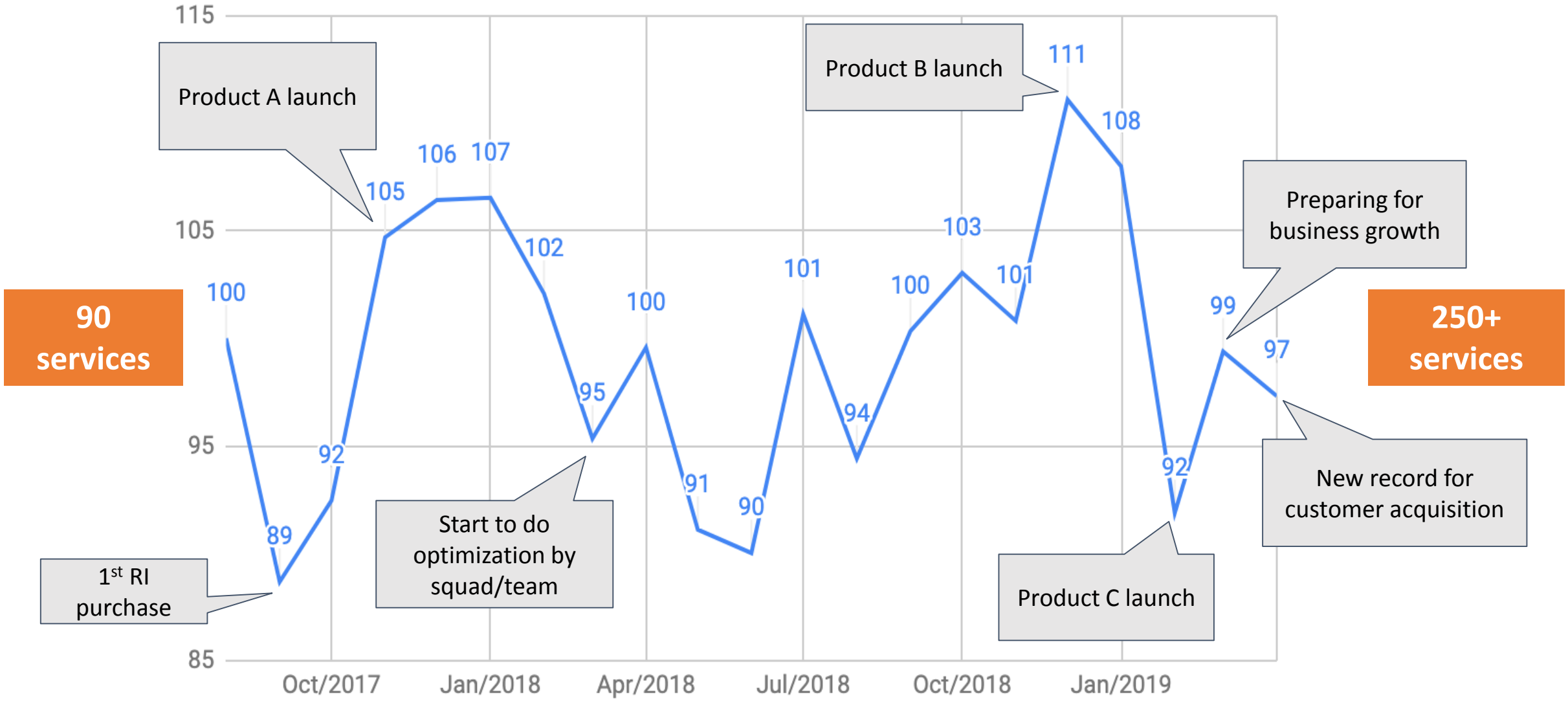
## Optimization Level

[low] **13%** EC2 Resources covered by RI
[ok] **95%** EC2 RI hours utilized – saving approx. **$10k/mo**
[low] **11%** RDS Resources covered by RI
[ok] **100%** RDS RI hours utilized – saving approx. **$2k/mo**
[high] **65%** EC2 On Demand hours from previous generations
[low] **3%** Spot coverage

## Opportunities to save

**$5k/mo** turn off unattached EBS and ELBs with no backend instance
**$12k/mo** reserve capacity for RDS and ElastiCache (1Y Partial Upfront)
**$3k/mo** update EC2 On Demand instances to newer generations
**$17k/mo** downsize EC2 instances that are underutilized & turn off idle instances
**$25k/mo** reserve capacity for EC2 (3Y Partial Upfront CVT)

# Cost per user evolution: after growing 3x userbase and launching +150 new services cost per user remained stable



# 3) AWS Budgets

# AWS Budgets

## Create custom budgets

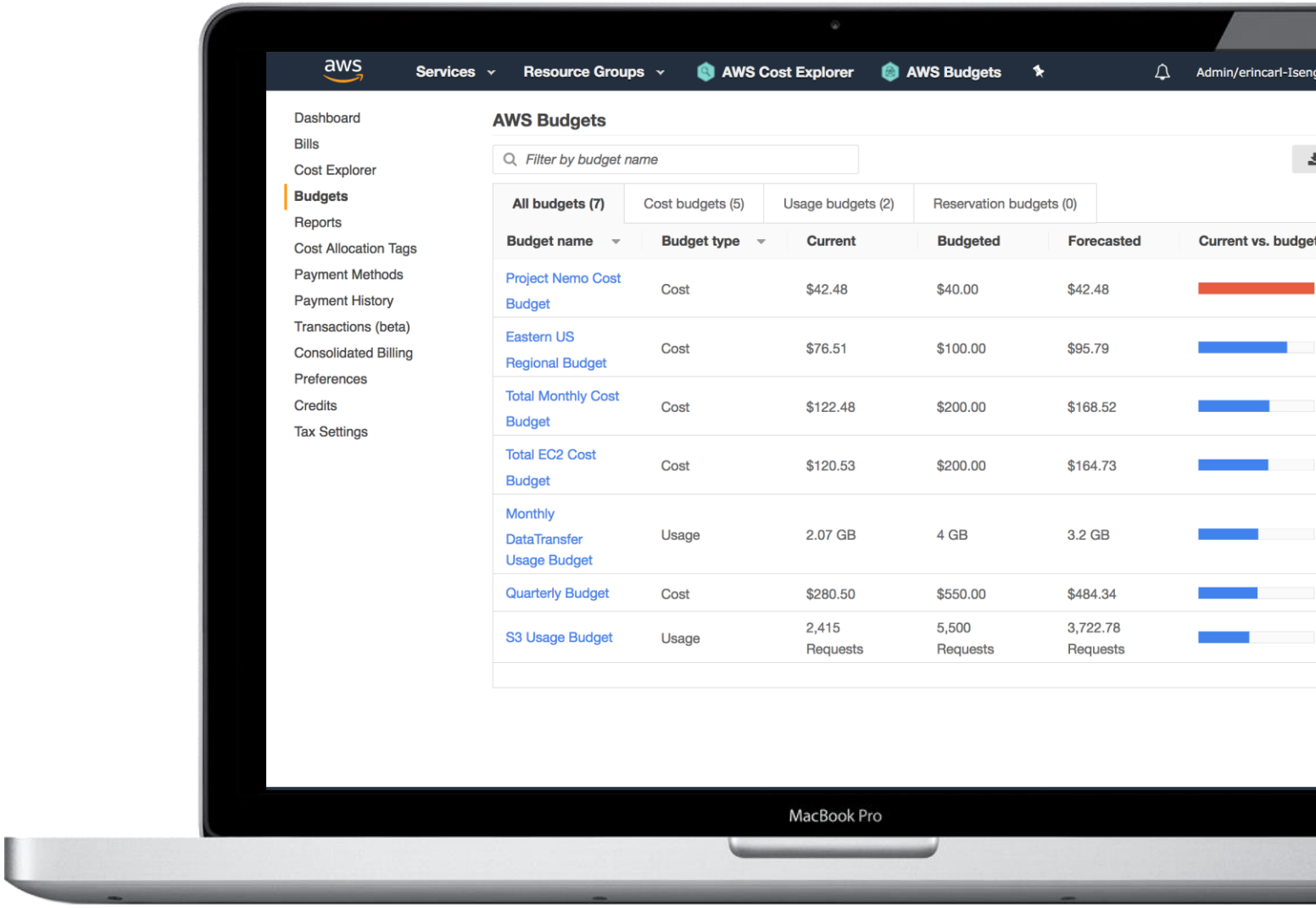
Set custom cost, usage, and reservation budgets and receive alerts when you exceed (or are forecasted to exceed) your alert thresholds.

## Cost Explorer integration

AWS Budgets is now integrated with Cost Explorer, providing contextually-relevant data to help you set budgets

## Centralized management

Simplified workflows make it easier to create and manage budgets and monitor them from the Budgets Dashboard



# Demo

# AWS Budget Email Alerts Example

AWS Budget Notification
AWS Account [redacted]*0642*

September 02, 2019

Dear AWS Customer,

You requested that we alert you when the **cost** associated with your *Monthly EC2 Budget for Project Beta* budget **exceeds $31.50** for the current month. The **cost** associated with this budget is **$33.35**. You can find additional details below and by accessing the AWS Budgets dashboard.

| Budget Name | Budget Type | Budgeted Amount | Alert Type | Alert Threshold | FORECASTED Amount |
|---|---|---|---|---|---|
| Monthly EC2 Budget for Project Beta | Cost | $35.00 | FORECASTED | > $31.50 | $33.35 |

Go to the AWS Budgets dashboard

# AWS Budget Email Alerts Example

Reserved Instance Alerts
AWS Account [redacted]*0642*

Dear AWS Customer,

You requested that we alert you when the daily **RI Utilization** associated with your *EC2 RI Utilization* budget falls **below 90.0%**. On September 19, 2019, the daily utilization associated with your Amazon EC2 reservations was **9.524%**. You can find additional details below and by accessing the AWS Budgets dashboard.

| Budget Name | Budget Type | Budgeted Amount % | Utilization Threshold % | Actual Utilization % |
|---|---|---|---|---|
| EC2 RI Utilization | RI Utilization | 100.00% | 90.0% | 9.524% |

Go to the AWS Budgets dashboard

Your 3 most under-utilized Amazon EC2 reservations, in terms of unused hours, are summarized below. You can find additional information in AWS Cost Explorer's RI Utilization reports.

| Subscription Id | Instance Type | Availability Zone | Current Utilization % | RI Hours Purchased | RI Hours Unused | Cost for Unused RI Hours |
|---|---|---|---|---|---|---|
| [redacted] | t3.nano | | 5.26% | 456.0 | 432.0 | 1.12 |
| [redacted] | t2.nano | | 0.00% | 24.0 | 24.0 | 0.20 |
| [redacted] | t3.nano | | 100.00% | 24.0 | 0.0 | 0.00 |

Go to AWS RI Utilization reports

# AWS Budgets

## Budget Reports

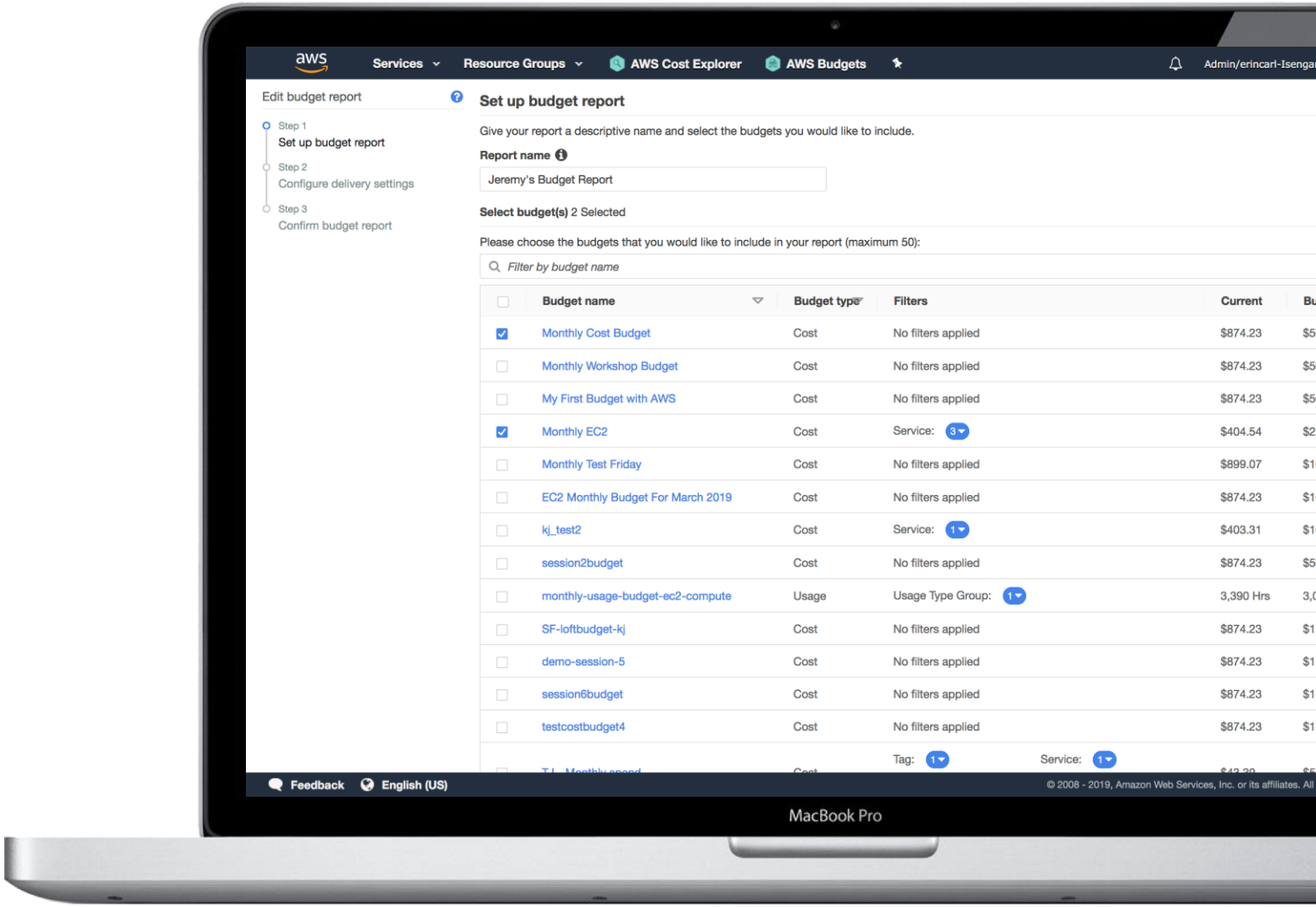
Send a daily, weekly or monthly scheduled email detailing the performance of your budgets

## Actual vs. Forecasted

Review your monthly, quarterly, or annual cost and usage across accounts.

## Increase Awareness

Deliver your reports to non-AWS stakeholders that still need visibility on cost, usage, coverage, and utilization performance.



# AWS Budgets

## Budget monitoring

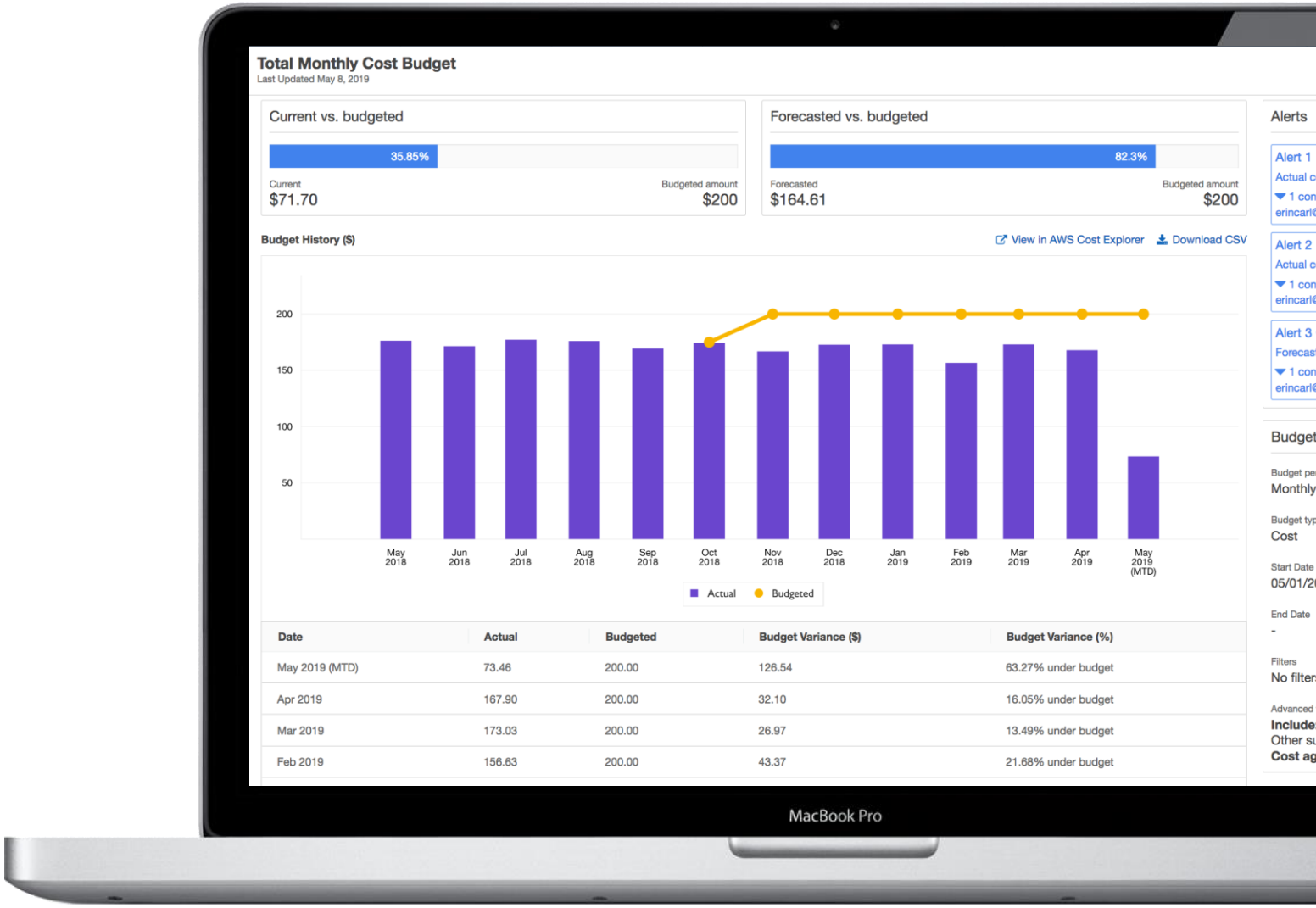
Using the Budget Details page, you can dive deeper into individual budgets and their performance

## Historical Budget Performance

Access a visualization of your historical spend and how it compares to the budget that you set (variance analysis)

## AWS Chatbot Integration

Receive your budget alerts in your desired Slack channel or Amazon Chime room.



# AWS Budgets

## Embed AWS Budgets into your account automation processes

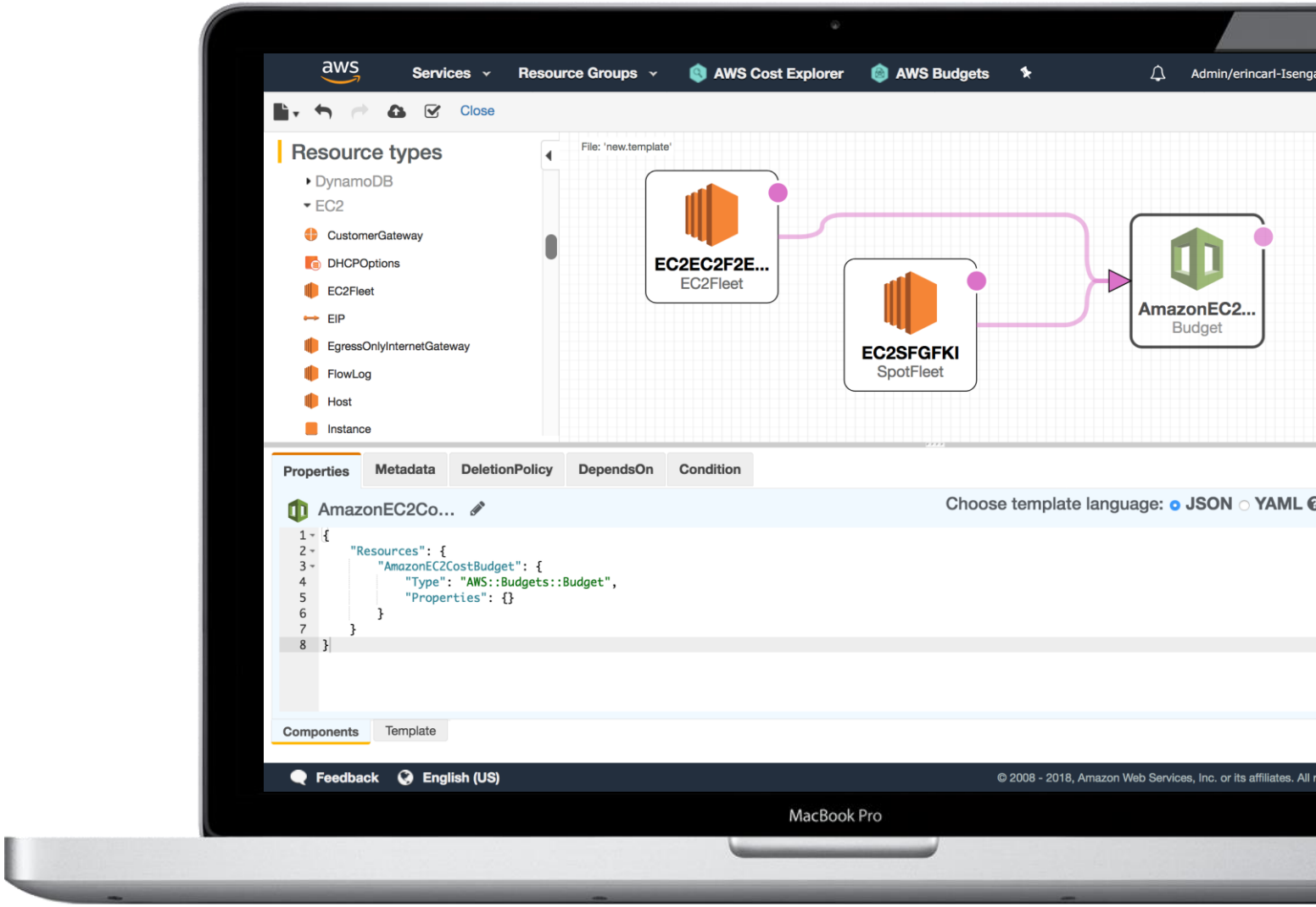
Use AWS Budgets' integration with AWS CloudFormation to automatically create budgets when provisioning resources

## Simplify cost tracking across your accounts

Automatically create budgets for each account you provision using CloudFormation Stacks and StackSets

## Programmatic Access

Access all budgets functionality via the AWS Budgets API



# 4) Tagging Strategies

# Tagging Restrictions

- For each resource, each tag key must be unique
- Max Key length = 128 Unicode characters UTF-8
- Max Value length = 256 Unicode characters in UTF-8
- Letters, Numbers, Spaces, + - =. _: / @
- Tag keys and values are case sensitive
- Don’t use the aws: prefix (reserved for AWS use)

# Demo

# Tag Governance

| Proactive Enforcement | Reactive Enforcement | Reporting & Alerting |
|---|---|---|
| • Infrastructure as Code (AKA Deployment Automation - CloudFormation, Terraform, etc.) | • AWS Config Rules<br>  • Tag compliance rule | • AWS Resource Groups (UI & API)<br>• CloudWatch (alert on tag change)<br>• IAM based tag read/write controls |
| • IAM Policies restricting resource provisioning based on tag requirements (EC2 & EBS) | • Tag Propagation Mechanism<br>  • EC2 -> EBS -> Snapshots | • AWS Config Dashboard (Multi-Account, Multi-Region) |
| • Autotagging provisioned resources (CloudTrail + CloudWatch + Lambda solution) | • Third Party Tooling Options<br>  • Cloud Custodian & Gorilla Stack<br>  • CloudHealth Policies/Perspectives<br>  • Cloudability Tagging | • Home grown tooling (i.e. AWS SDK via Python boto3) |
| • ITSM style upfront tagging via AWS Service Catalog (TagOptions Lib) | • Gamification (KPI: Tag Coverage Rate)<br>• Governance: Tag, Shutdown and Terminate | • 3rd Party Tools |

# 5) Setting up CUR/Athena

Are you using any 3rd party tools to manage AWS costs?

Poll #6

# Cost and Usage Report (CUR)

- Cost and Usage Report
- The most fine grained data source for cost and usage data
- Detailed billing artifact (stored in an Amazon S3 bucket)
- CSV, Apache Parquet Formats (compressed columnar)
- Updates occur continuously ~3X a day (hourly/daily billing granularity)

# CUR Features

- On-Demand, Spot & RI pricing information
- Comprehensive RI metadata
  - Amortized RI costs
- Enables billing data ingestion @ scale with **Athena** integration
  - Run SQL queries (in Athena) against CUR
  - Daily CUR updates automatically updated into Athena table

# Demo

# Example: CUR Building Blocks

`lineItem/LineItemType`

- '**Fee**': upfront RI cost
- '**RIFee**': monthly committed RI cost
- '**Usage**': resource charged at On-Demand rate
- '**DiscountedUsage**': resource charged at discounted rate due to RI

# Example: CUR Building Blocks

`reservation/ReservationARN`

- Column where unique RI Amazon Resource Name (ARN) is stored
- Appears on rows where **LineItemType=(Fee, RIFee and DiscountedUsage)**
  - The ID to use to track the consumption of the RI by AWS resource

`lineItem/LineItemDescription`

- Text description of the charge (use to confirm RI discount is being applied)

# Cloud Financial Management (CFM) Framework

## See

Account & tagging strategy

Cost reporting & monitoring

Showback & Chargeback

Efficiency/value KPIs

## Save

Cost aware architecture, design & service selection

Match capacity with demand

Choose the right pricing model

Resource governance

## Plan

Strategic fit

Business case & value articulation

POC based cost estimation

Budgeting & forecasting variable cloud spend

## Run

Partnership between Finance & Technology organizations

Invest in people, processes, governance & tools

Celebrate wins

# Best practices

Identify owners for cloud financial management activities

Start with cost transparency (cost allocation tags), make sure teams who are using the platform are aware of how much they are spending

Improve cost predictability with AWS Budgets and forecasting

Leverage tools (AWS Cost Explorer) to analyze and execute cost optimization activities

Define what success looks for your organization (metrics) and build mechanisms to recognize good behavior

# Resources to get you started

## AWS Cost Optimization

aws.amazon.com/pricing/cost-optimization/

## AWS Cost Management

aws.amazon.com/blogs/aws-cost-management/

## AWS Well Architect Cost Opt Whitepaper

d1.awsstatic.com/whitepapers/architecture/AWS-Cost-Optimization-Pillar.pdf

## Laying the foundation for Cost Opt Whitepaper

d1.awsstatic.com/whitepapers/cost-optimization-laying-the-foundation.pdf

## Cost Optimization Well Architect Labs

awscostlabs.com

## Case studies and research

aws.amazon.com/solutions/case-studies

## FinOps Foundation

finops.org

## AWS Cost Management Tools Partners

aws.amazon.com/products/management-tools/partner-solutions/

If you want something to happen
you need to make it easy

# Thank you

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AWS Cloud Economics

“We don’t make money when we sell things. We make money when we help customers make purchase decisions.”

**Jeff Bezos**

**Founder and Chief Executive Officer**

**Amazon.com, Inc.**

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