PERFORMANCE OPTIMIZATION

SCALING, HORIZONTAL AND VERTICAL

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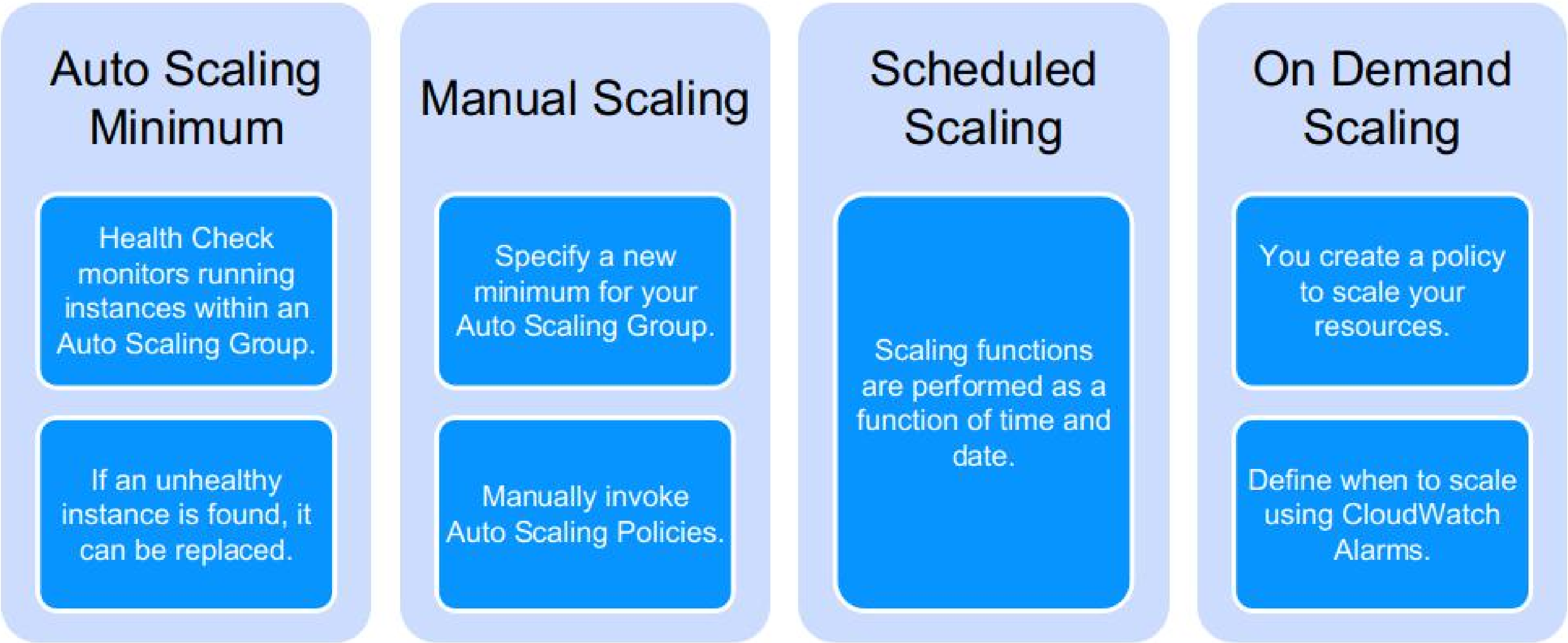
SCALING, HORIZONTAL AND VERTICAL

SCALING PLANS



Auto Scaling Minimum

Health Check monitors running instances within an Auto Scaling Group.

If an unhealthy instance is found, it can be replaced.

Manual Scaling

Specify a new minimum for your Auto Scaling Group.

Manually invoke Auto Scaling Policies.

Scheduled Scaling

Scaling functions are performed as a function of time and date.

On Demand Scaling

You create a policy to scale your resources.

Define when to scale using CloudWatch Alarms.

For more, look here

RDMA

RDMA stands for Remote Direct Memory Access

Zero-copy networking

- by enabling the network adapter to transfer data from the wire directly to application memory or
- from application memory directly to the wire

Wiki on RDMA

RDMA ON AZURE

Most of the HPC VM sizes (HBv2, HB, HC, H16r, H16mr, A8 and A9) feature a network interface for remote direct memory access (RDMA) connectivity

OS

- Linux and Windows

Infiniband, drivers

MPI (Message Passing Interface)

RDMA network address space

- The RDMA network in Azure reserves the address space 172.16.0.0/16. To run MPI applications on instances deployed in an Azure virtual network, make sure that the virtual network address space does not overlap the RDMA network.

OPTIMIZING PERFORMANCE ON BIGQUERY

Four Key Elements of Work

- **I/O** — How many bytes did you read?
- **Shuffle** — How many bytes did you pass to the next stage?
    - Grouping — How many bytes do you pass to each group?
- **Materialization** — How many bytes did you write to storage?
- **CPU work** — User-defined functions (UDFs), functions

AVOID INPUT / OUTPUT WASTEFULNESS

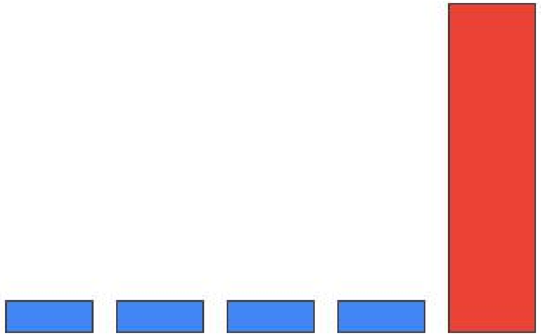
Advice for BigQuery, your situation may be different

- Do not SELECT *, use only the columns you need
- Filter using WHERE as early as possible in your queries
- Do not use ORDER BY without a LIMIT

DATA SKEW

Data skew in BigQuery

- But applicable to many areas or data handling, e.g. Spark
- Filter your dataset as early as possible (this avoids overloading workers on JOINs)
- BigQuery will automatically attempt to reshuffle workers that are overloaded with data
  - You may have to it yourself in other situations

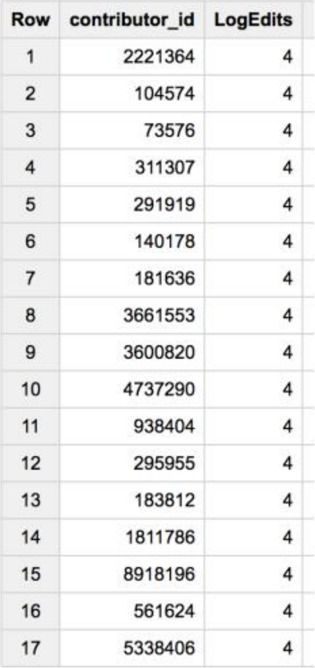


Skewed Data creates an imbalance between BigQuery worker slots (uneven data partition sizes)

CAREFUL USE OF GROUP BY

Again, BigQuery but applicable in many SQL situations

- Best when the number of distinct groups is small (fewer shuffles of data).
- Grouping by a high-cardinality unique ID is a bad idea.



Row	contributor_id	LogEdits
1	2221364	4
2	104574	4
3	73576	4
4	311307	4
5	291919	4
6	140178	4
7	181636	4
8	3661553	4
9	3600820	4
10	4737290	4
11	938404	4
12	295955	4
13	183812	4
14	1811786	4
15	8918196	4
16	561624	4
17	5338406	4

← Do not Group on an ID

DEBUGGING, MONITORING, PERFORMANCE TUNING

Stackdriver is a Google tool

However, it is cross-cloud

- and a good tool to explain the issues

October 2020, rebranded as Google Cloud Operations

Important : please take the following slides as an approach example even if you do not use the Google cloud

WHAT STACKDRIVER DOES

Combines metrics, logs, and metadata

- On Google Cloud Platform (GCP)
- On Amazon Web Services
- on-premises infrastructure
- or a hybrid cloud

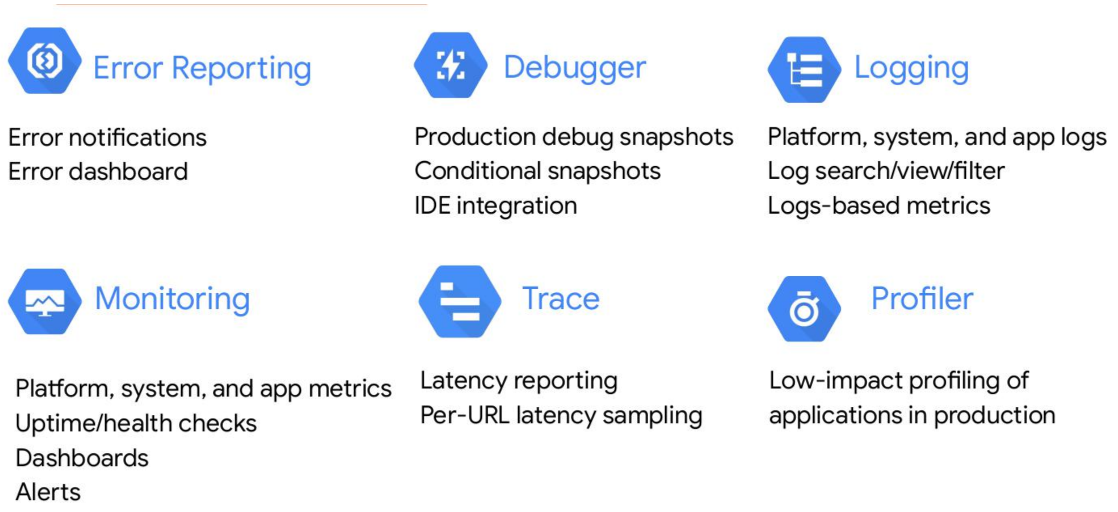
Allows to

- understand service behaviors and issues
- from a single comprehensive view of your environment
- take action if needed

GOOGLE STACKDRIVER

A multicloud service

An example to discuss the issues



Error Reporting

Error notifications
Error dashboard

Debugger

Production debug snapshots
Conditional snapshots
IDE integration

Logging

Platform, system, and app logs
Log search/view/filter
Logs-based metrics

Monitoring

Platform, system, and app metrics
Uptime/health checks
Dashboards
Alerts

Trace

Latency reporting
Per-URL latency sampling

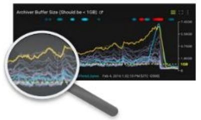
Profiler

Low-impact profiling of
applications in production

INCREASE APPLICATION RELIABILITY

Monitor GCP, AWS, and Multi-Cloud Environments

Get the insight that you need with minimal configuration. Monitor hosted services and cloud architectures.



Identify Trends, Prevent Issues

Visualize trends via flexible charts and dashboards. Identify risks using scoring, anomaly detection, and prediction.

Reduce Monitoring Overhead

Spend less time correlating metrics, alerts, and logs across disparate systems. Don't worry about scaling tools.

Improve Signal-to-Noise

Reduce false positives and alert fatigue with advanced alerting designed for modern distributed systems.

Fix Problems Faster

Uptime and health checks notify you quickly when endpoints become inaccessible to your users. Drill down from alerts to dashboards to logs and traces to get to the root cause quickly.

PERFORMANCE MANAGEMENT TOOLS

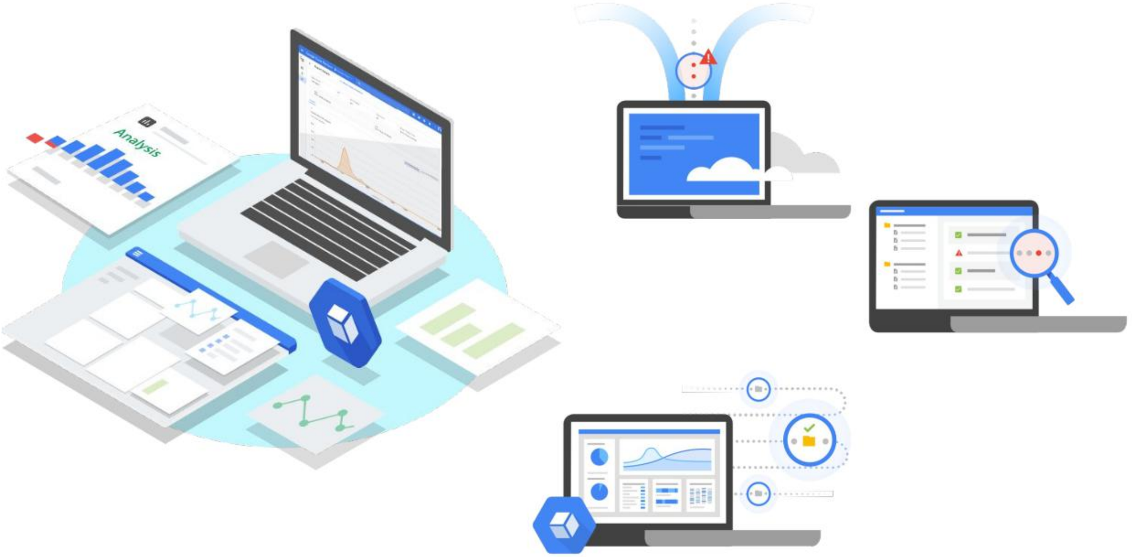
Stackdriver Trace

Stackdriver Debugger

Stackdriver Profiler

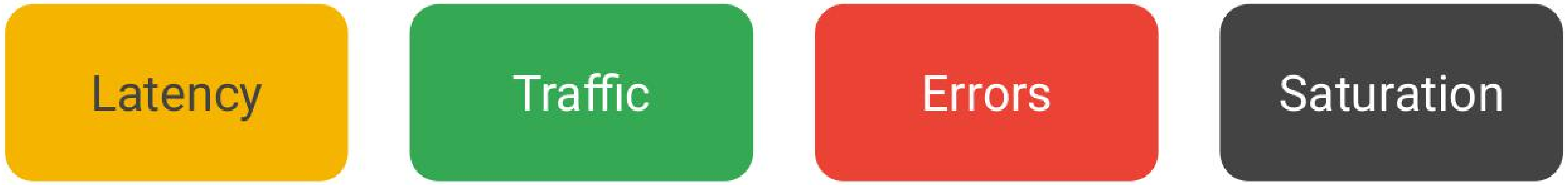
STACKDRIVER TRACE

Distributed tracing



STACKDRIVER PROFILER

FOUR GOLDEN SIGNALS



Latency

Traffic

Errors

Saturation

PRESENTATION ON E-CAS

E-CAS public

AWS CLOUDWATCH

A monitoring service for AWS cloud resources and the applications you run on AWS

Visibility into resource utilization, operational performance, and overall demand patterns

Custom application-specific metrics of your own

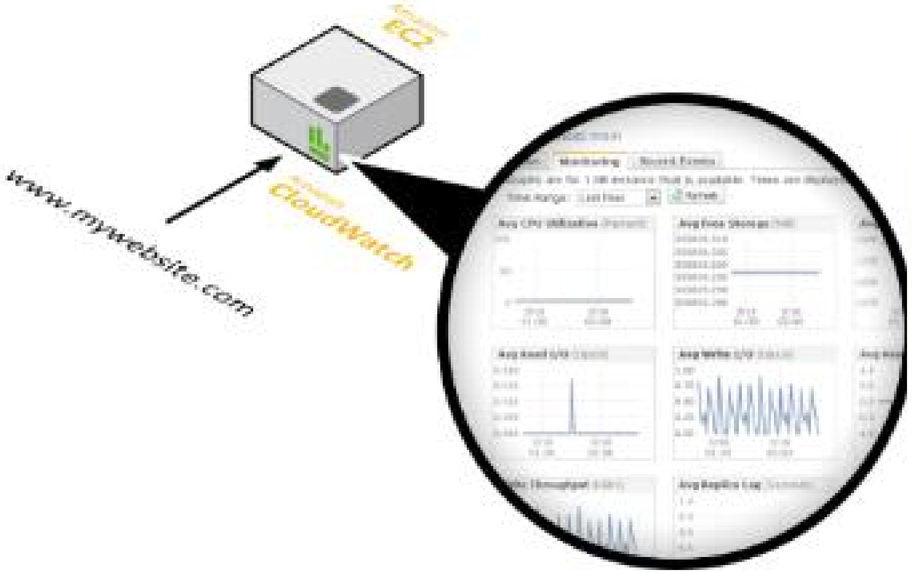
Accessible via AWS Management Console, APIs, SDK, or CLI

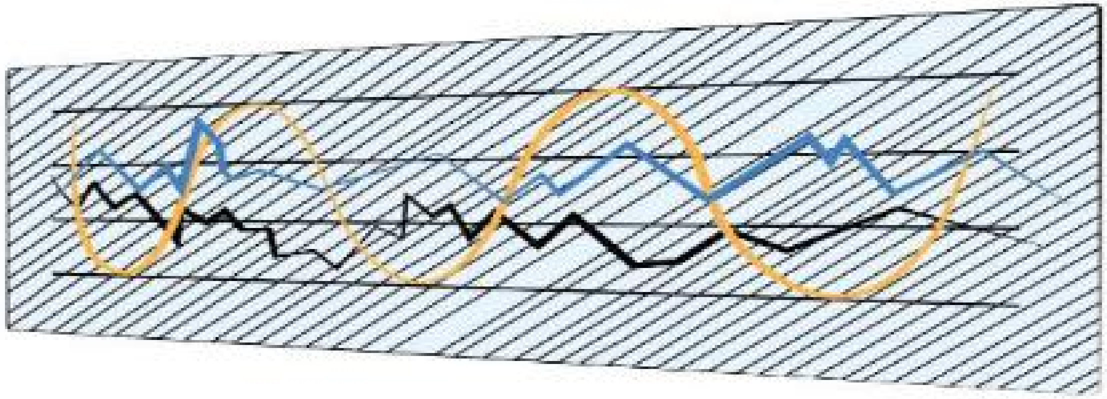
AMAZON CLOUDWATCH FACTS

Monitor other AWS resources

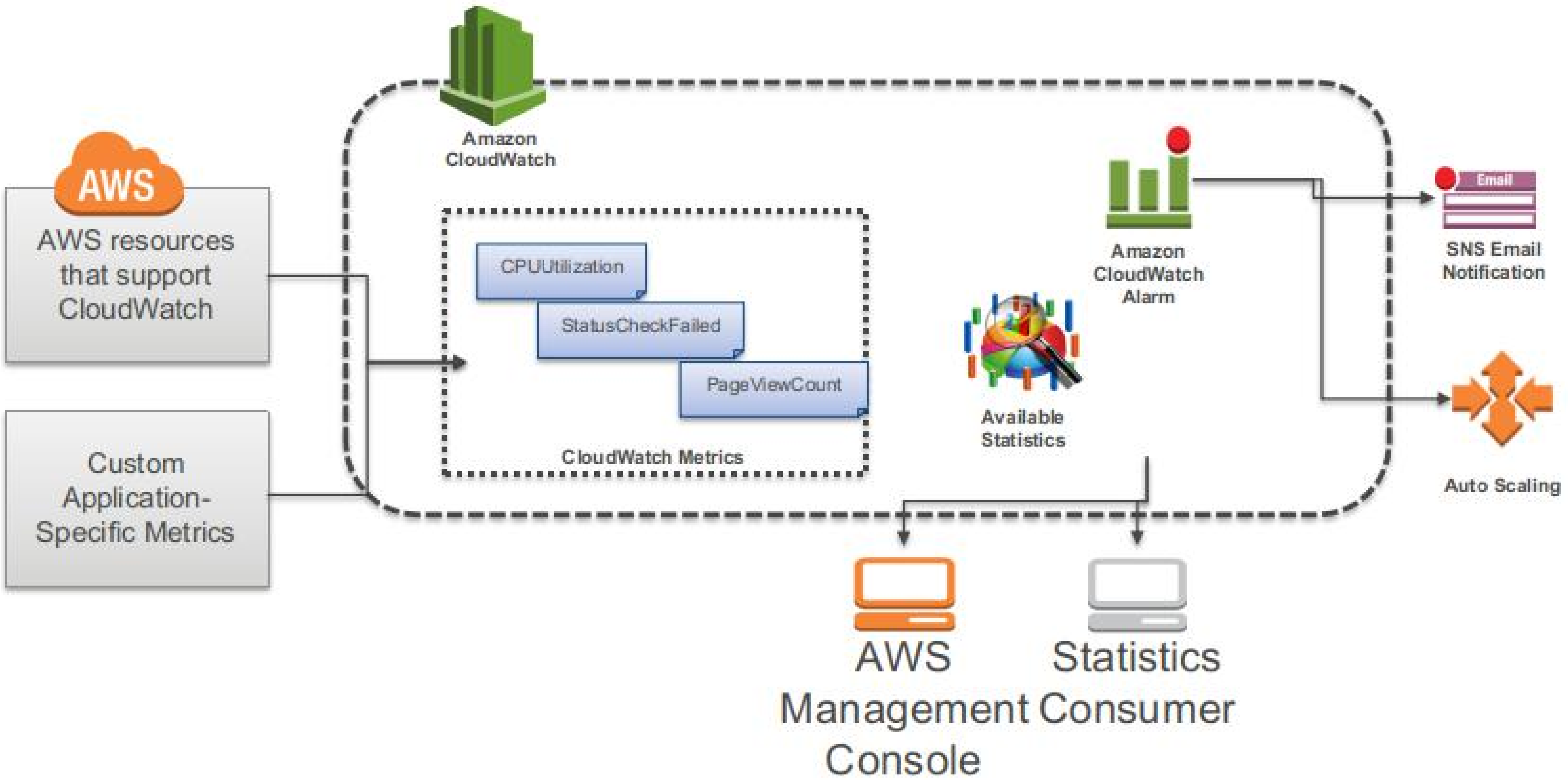
- View graphics and statistics

Set Alarms

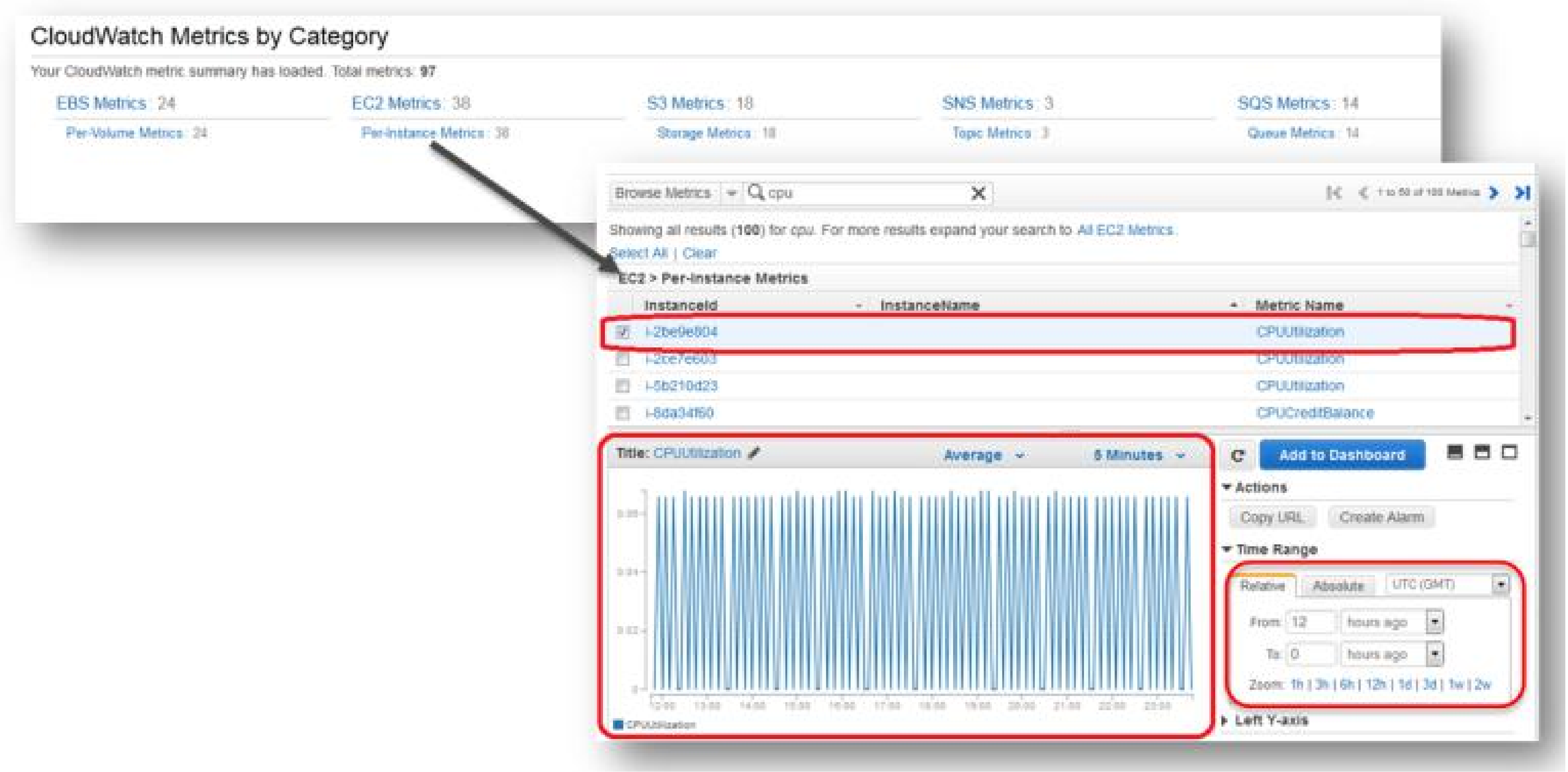




AMAZON CLOUDWATCH ARCHITECTURE



CLOUDWATCH METRICS EXAMPLES



CloudWatch Metrics by Category

Your CloudWatch metric summary has loaded. Total metrics: **97**

EBS Metrics : 24	EC2 Metrics : 38	S3 Metrics : 18	SNS Metrics : 3	SQS Metrics : 14
Per-Volume Metrics : 24	Per-Instance Metrics : 38	Storage Metrics : 18	Topic Metrics : 3	Queue Metrics : 14

Browse Metrics ▾ cpu ✕ | 1 to 50 of 100 Metrics

Showing all results (**100**) for cpu. For more results expand your search to All EC2 Metrics.

Select All | Clear

EC2 > Per-Instance Metrics

	InstanceId	InstanceName	Metric Name
☑	i-2be9e804		CPUUtilization
□	i-2be7e603		CPUUtilization
□	i-5b210d23		CPUUtilization
□	i-8da34f60		CPUCreditBalance

Title: CPUUtilization | Average ▾ | 5 Minutes ▾

▾ Actions

Copy URL | Create Alarm

▾ Time Range

Relative | Absolute | UTC (GMT)

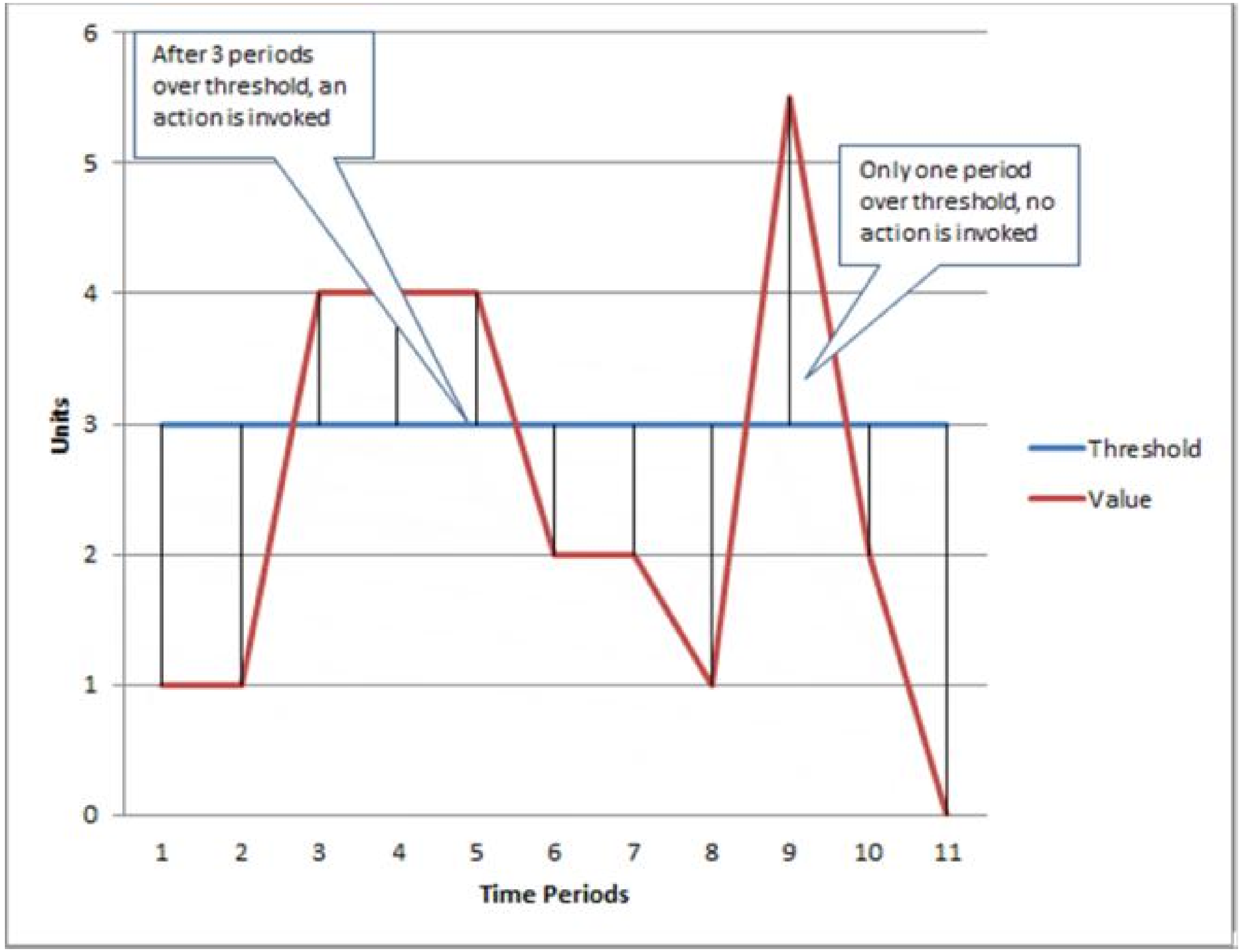
From: 12 hours ago

To: 0 hours ago

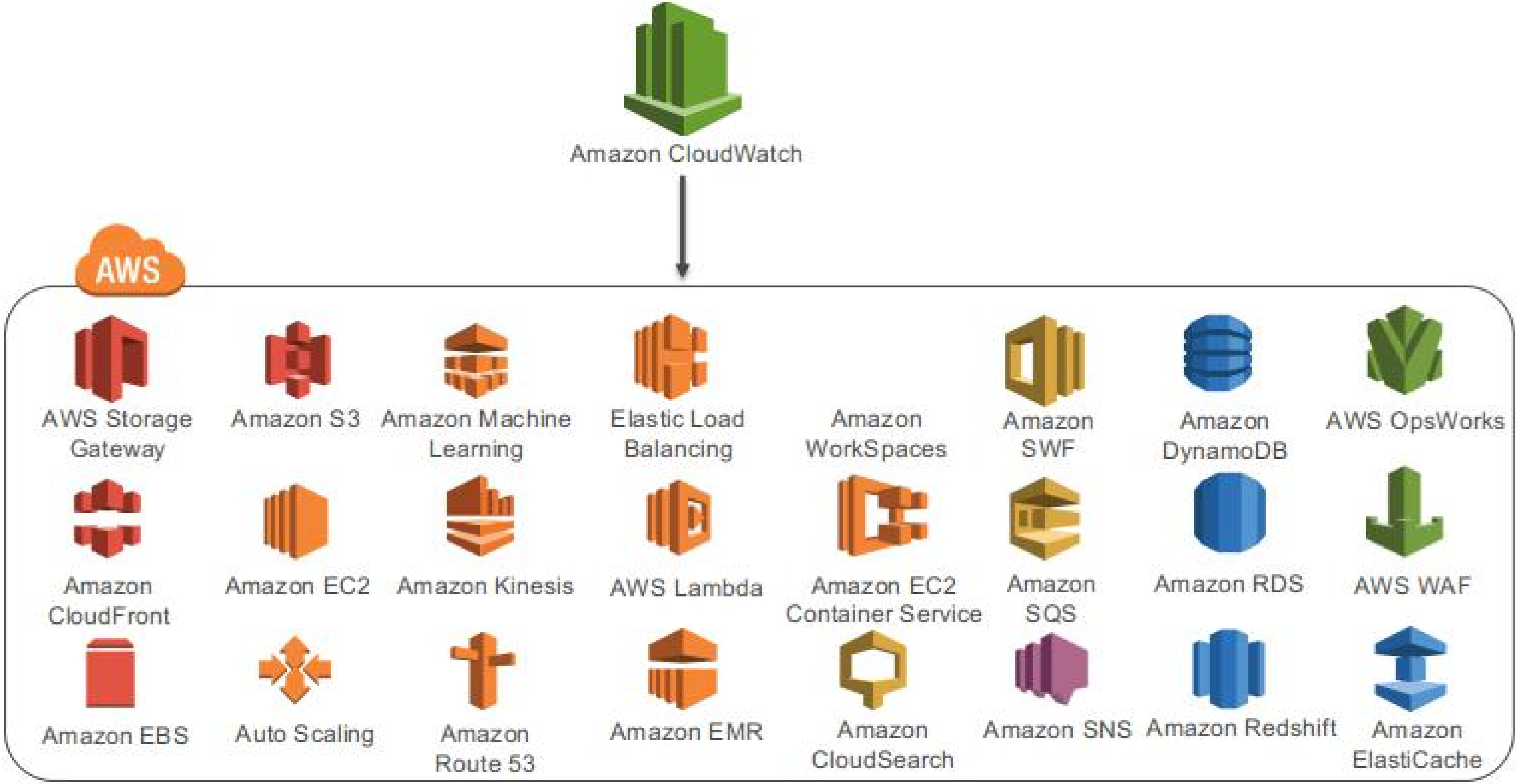
Zoom: 1h | 3h | 6h | 12h | 1d | 3d | 1w | 2w

▸ Left Y-axis

CLOUDWATCH ALARMS



SUPPORTED AWS SERVICES



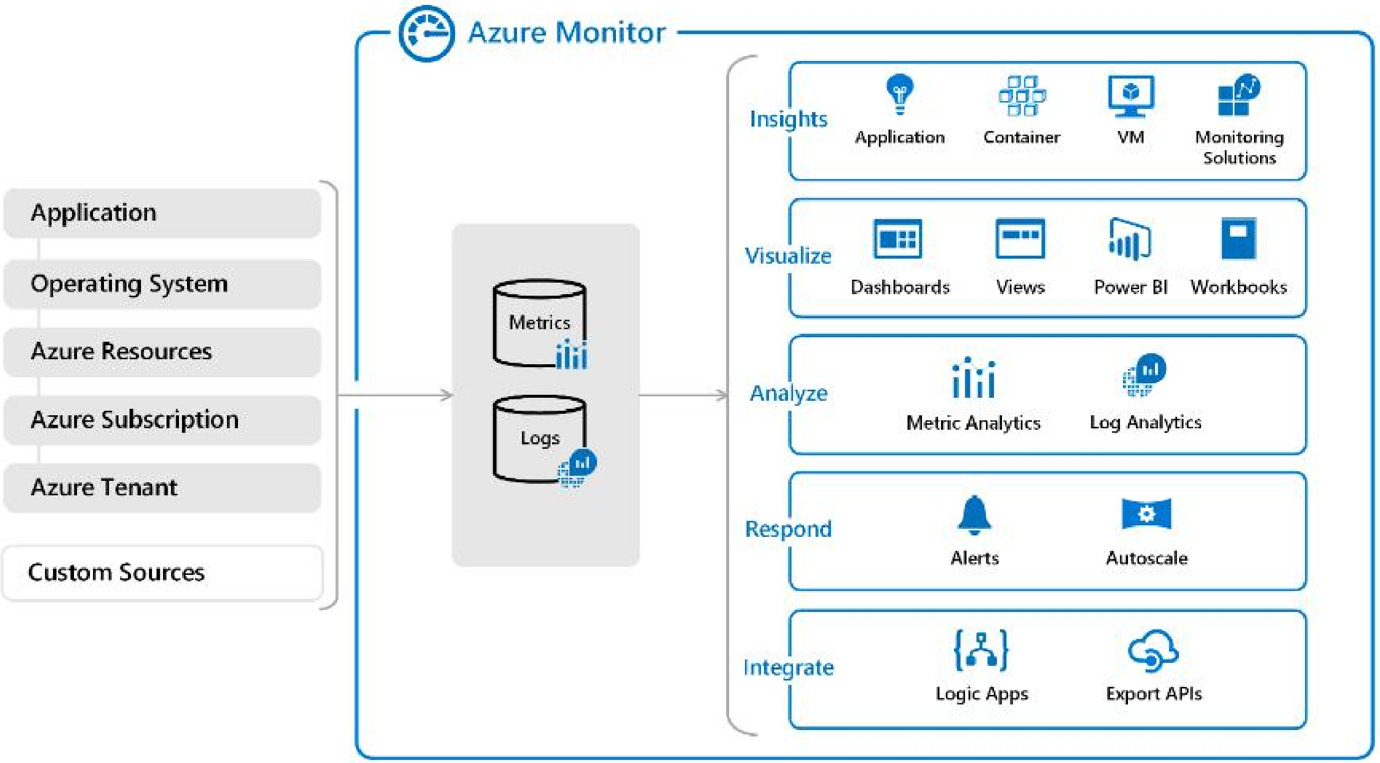
AZURE MONITOR

Azure Monitor

- A platform for collecting, analyzing, visualizing,
- Taking action based on the metric and logging data from your entire Azure and on-premises environment

Part of a suite

- Azure Advisor
- Azure Monitor
- Azure Service Health



QUIZ

You want to be alerted when new recommendations to improve your cloud environment are available. Which service will do this?

- A. Azure Advisor
- B. Azure Monitor
- C. Azure Service Health

QUIZ

Which service provides official outage root cause analyses (RCAs) for Azure incidents?

- A. Azure Advisor
- B. Azure Monitor
- C. Azure Service Health

QUIZ

Which service is a platform that powers Application Insights, monitoring for VMs, containers, and Kubernetes?

- A. Azure Advisor
- B. Azure Monitor
- C. Azure Service Health

BACKGROUND SLIDES

SRE

SRE stands for Site Reliability Engineering

SRE is an area that was recently developed at Google

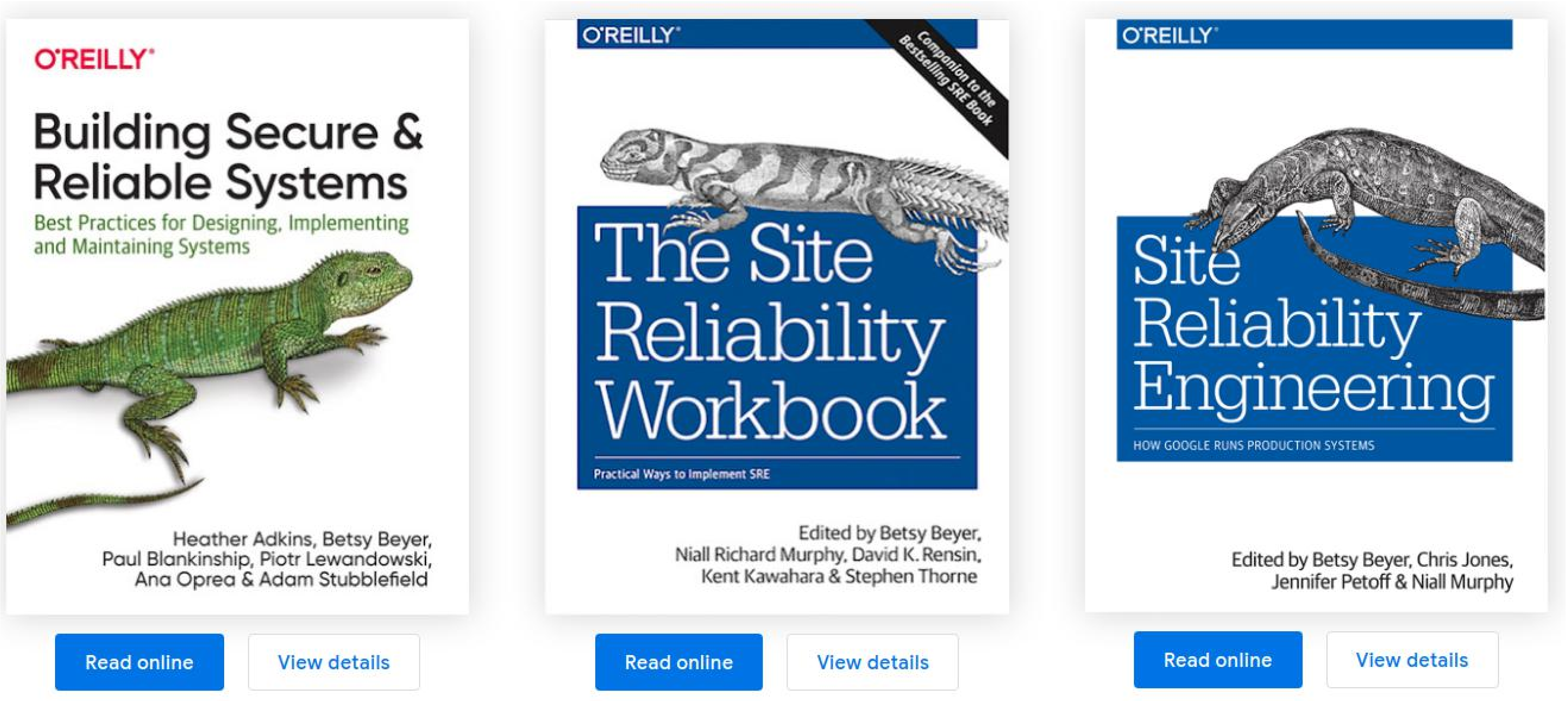
It studies stability and scalability

Its tenets are

- A significant portion of a software system’s lifespan is spent in use, not in design or implementation.
- This calls in question the conventional wisdom that insists that software engineers focus primarily on the design and development of large-scale computing systems?
- SRE teaches how and why the DevOps commitment to the entire lifecycle can enable the company to successfully build, deploy, monitor, and maintain some of the largest software systems in the world.

SRE BOOKS

Free on Google site here


O'REILLY
Building Secure & Reliable Systems
Best Practices for Designing, Implementing and Maintaining Systems
Heather Adkins, Betsy Beyer, Paul Blankinship, Piotr Lewandowski, Ana Oprea & Adam Stubblefield
Read online
View details
O'REILLY
Companion to the Bestselling SRE Book
The Site Reliability Workbook
Practical Ways to Implement SRE
Edited by Betsy Beyer, Niall Richard Murphy, David K. Rensin, Kent Kawahara & Stephen Thorne
Read online
View details
O'REILLY
Site Reliability Engineering
HOW GOOGLE RUNS PRODUCTION SYSTEMS
Edited by Betsy Beyer, Chris Jones, Jennifer Petoff & Niall Murphy
Read online
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SRE 1

Introduction

- The Sysadmin Approach to Service Management
- Google’s Approach to Service Management: Site Reliability Engineering
- Tenets of SRE
- Demand Forecasting and Capacity Planning
- Efficiency and Performance

SRE 2

Principles

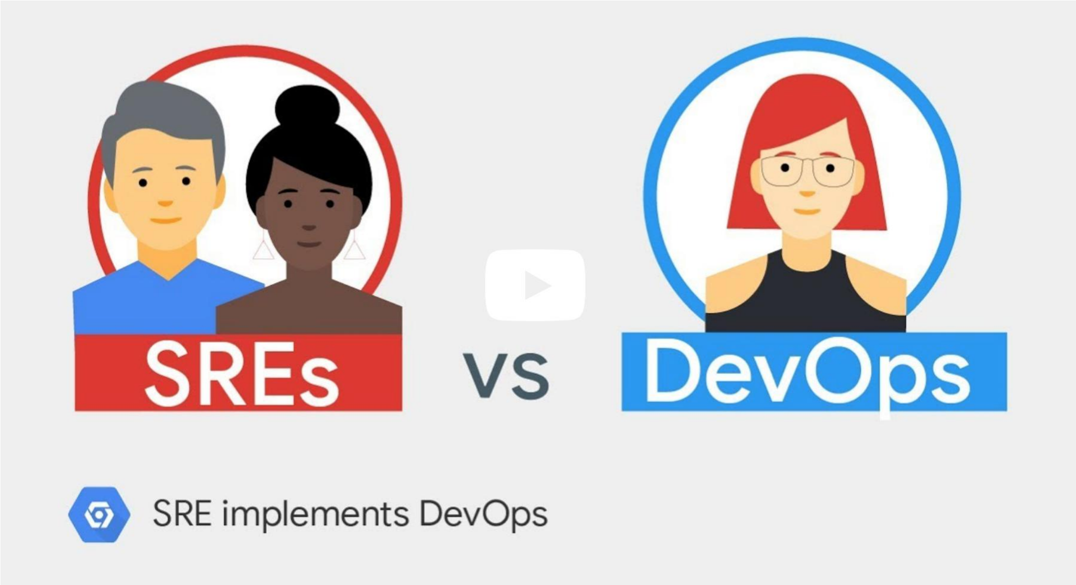
- Embracing Risk
- Managing Risk
- Motivation for Error Budgets
- Benefits

Service Level Objectives

- Service Level Terminology
- Indicators in Practice
- What Do You and Your Users Care About?
- Agreements in Practice

Spanner
SRE

SRE 3



Eliminating Toil

- Toil Defined
- Why Less Toil Is Better

Monitoring Distributed Systems

- Why Monitor?
- Setting Reasonable Expectations for Monitoring
- Symptoms Versus Causes
- Black-Box Versus White-Box
- As Simple as Possible, No Simpler
- Bigtable SRE: A Tale of Over-Alerting
- Gmail: Predictable, Scriptable Responses from Humans

CONGRATS ON COMPLETION