



Amazon OpenSearch Service

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Solutions Architect



Agenda

Challenges customers face

What is Amazon OpenSearch Service

Why Amazon OpenSearch Service

Leading use cases

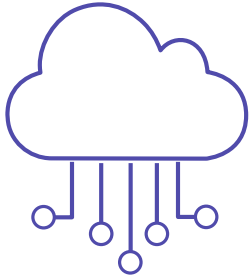
New capabilities

Getting started

Challenges customers face

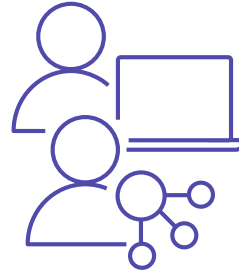
Machine-generated data is exploding

Applications and infrastructure



Services/micro-services
Web Applications
Business Applications
APIs

IT and DevOps



Databases
Load balancers
Networking
Servers

IoT and wireless

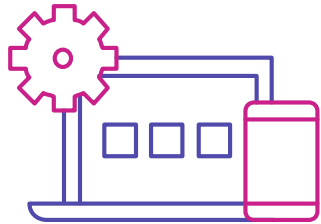


Automotive
Home devices
Manufacturing
Mobile Applications


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net-1-141.eden.com - - [01/Jul/1995:00:00:19 -0400] "GET /shuttle/missions/sts-71/images/KSC-95EC-0916.jpg HTTP/1.0" 200 34029
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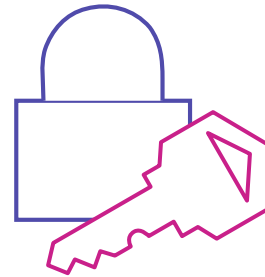
Machine-generated data is exploding

Applications



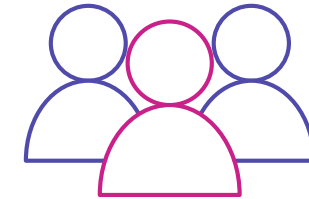
Is my infrastructure working?
What is the latency and error rate?
What caused my application issue?

Security



Is there any suspicious authentication activity?
What data was accessed by this IP address?
Are there instances of fraud?

Business insights

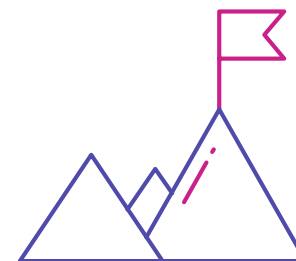


What content/products are my users interested in?
Which features are used most or least?
What users are most active and why?

There's a need for real-time search at scale



Customers want to **find the right product, service, document, or answer to their problem as quickly** as possible. Their searches will be across both semi-structured and unstructured data, and across different facets and attributes.



In today's world, **search results have to be relevant and delivered in real time. Building and maintaining** a system that achieves this **cost-effectively, securely, and at scale is challenging.**

Where is there a need for real-time search at scale?



If you have an **e-commerce platform**, you want customers to find the product they are looking for quickly.



If you offer a **document portal** with documents including, but not limited to, scientific research articles, investment analyses, or health records, you want to enable a speedy and relevant search experience for your users



You may want to increase user engagement on your platform by **delivering personalized recommendations**, like a weekly music playlist or food recipes.



Beyond these examples, you may have other parts of your tech stack where you want to add an **easy to use and snappy search experience**, especially with the option to integrate machine learning capabilities to power a personalized experience.

Amazon OpenSearch Service





Amazon OpenSearch Service

Amazon OpenSearch Service makes it easy for you to perform interactive log analytics, real-time application monitoring, website search, and more. OpenSearch is an open source, distributed search and analytics suite derived from Elasticsearch. Amazon OpenSearch Service offers the latest versions of OpenSearch, support for 19 versions of Elasticsearch (1.5 to 7.10 versions), and visualization capabilities powered by OpenSearch Dashboards and Kibana (1.5 to 7.10 versions).

OpenSearch

- OpenSearch is a **community-driven**, open source search and analytics suite derived from Apache 2.0 licensed Elasticsearch 7.10.2
- The OpenSearch project consists of a distributed search engine powered by Apache Lucene, *OpenSearch*, and a data visualization and user interface, *OpenSearch Dashboards*
- OpenSearch also includes all of the advanced functionality ported over from Open Distro for Elasticsearch



OpenSearch is a powerful analytics engine

```
import java.io.BufferedReader; import java.io.InputStreamReader; import java.io.IOException; import java.util.ArrayList; import java.util.List; import java.util.Scanner; import java.util.regex.Pattern; import java.util.regex.Matcher; import java.util.concurrent.TimeUnit; import java.util.concurrent.Executors; import java.util.concurrent.ExecutorService;
public class Optimization {
    private static void main(String[] args) throws java.lang.Exception {
        BufferedReader file_reader = new BufferedReader(new InputStreamReader(System.in));
        String text = file_reader.readLine();
        while (!text.equals("")) {
            System.out.println(text);
            Optimization o = new Optimization(text);
            o.optimize();
            text = file_reader.readLine();
        }
    }
    private void optimize() {
        Scanner scanner = new Scanner(System.in);
        while (scanner.hasNextLine()) {
            String line = scanner.nextLine();
            System.out.println(line);
            Optimization o = new Optimization(line);
            o.optimize();
        }
    }
    private void process(String words) {
        String[] sArray = words.split(" ");
        for (String word : sArray) {
            System.out.println(word);
        }
    }
}
```



Text search

- Natural language
- Boolean queries
- Relevance

Streaming data

- High-volume ingest
- Near real time
- Distributed storage

Analysis

- Time-based visualizations
- Nestable statistics
- Time series tools

How does it work?

1

Send data as JSON via REST APIs

2

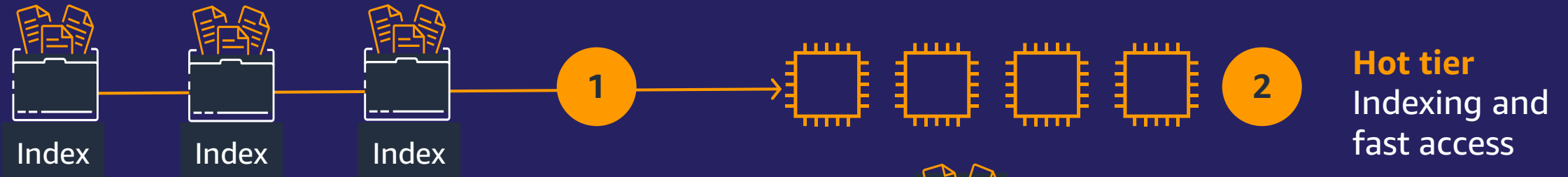
Data is indexed - all fields searchable, including nested JSON

3

REST APIs, for fielded matching, Boolean expressions, sorting, and analysis



Data lifecycle in Amazon OpenSearch Service



1

Send data to Amazon OpenSearch Service. Index State Management (ISM) automates index migrations or deletions

2

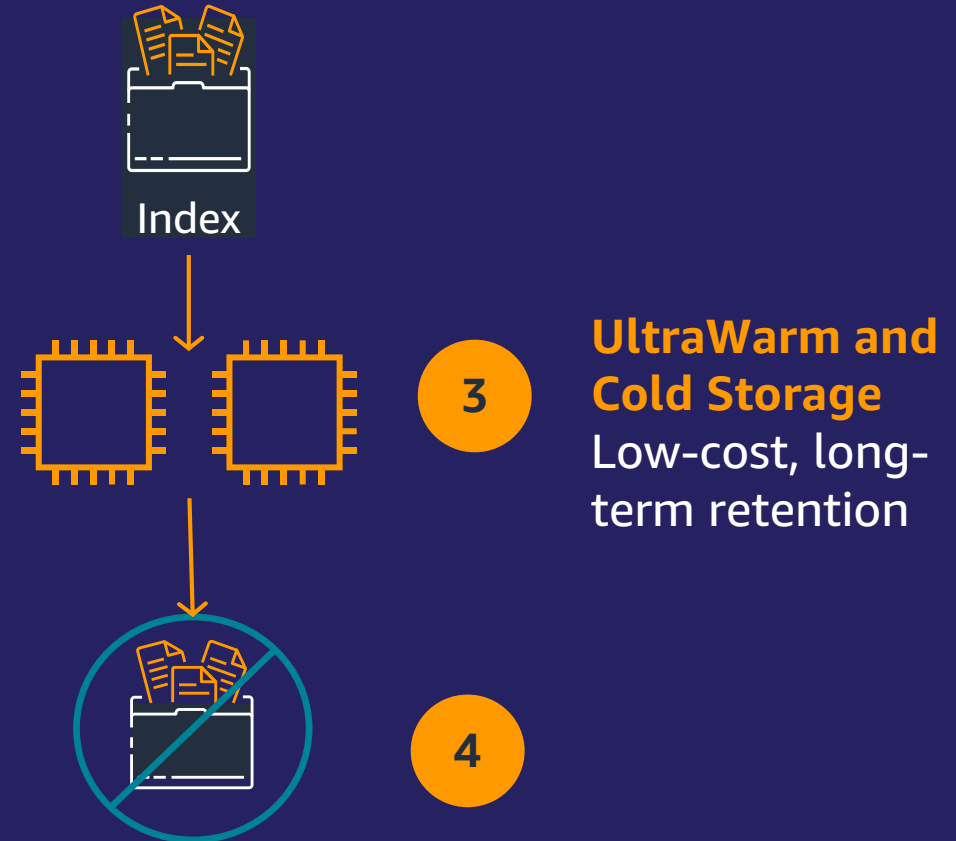
Data is indexed and stored in the hot tier

3

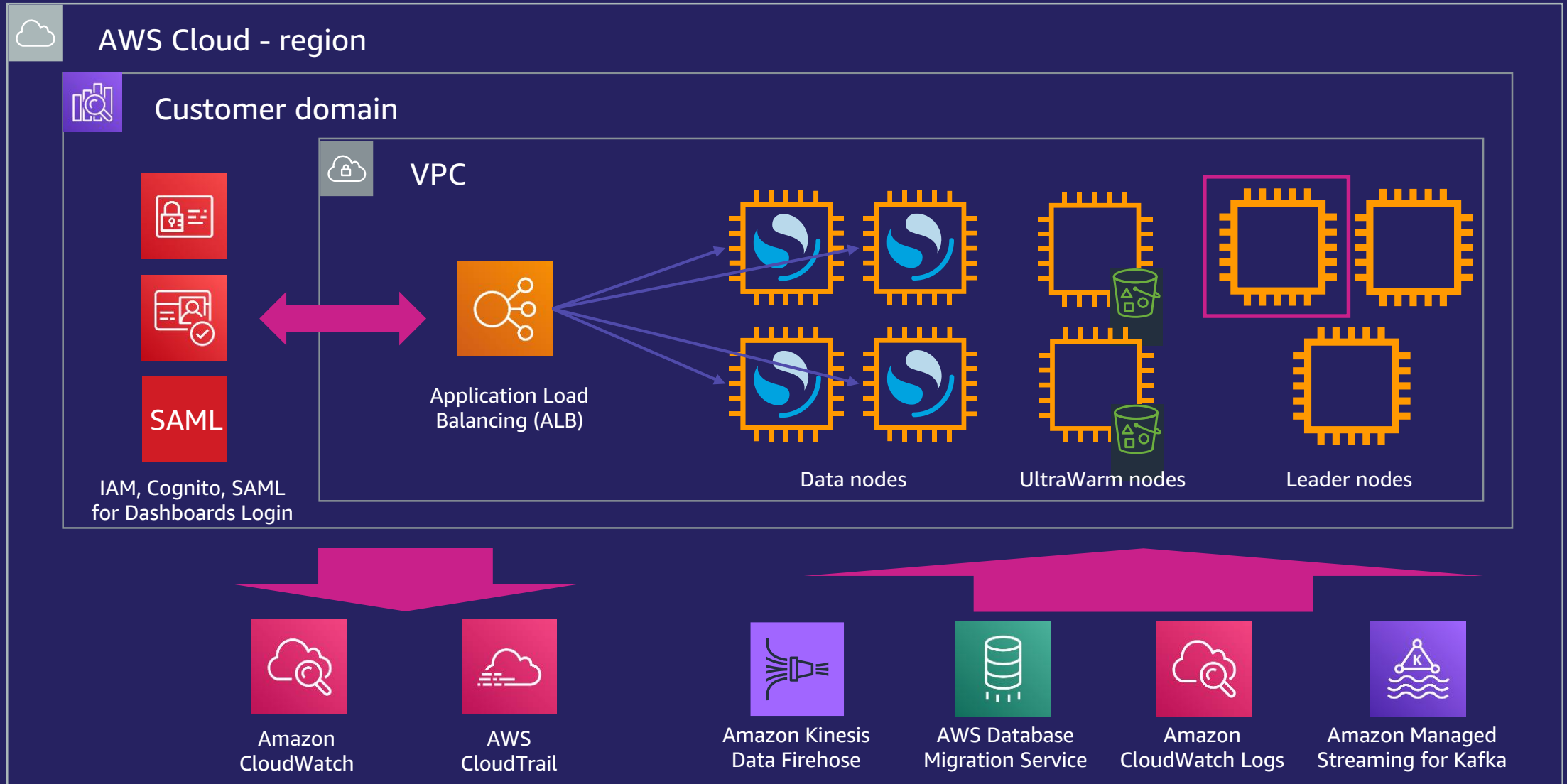
Migrate the index to UltraWarm and Cold Storage for long-term, low cost storage

4

Delete the index at end-of-life



Amazon ES Deployment Architecture

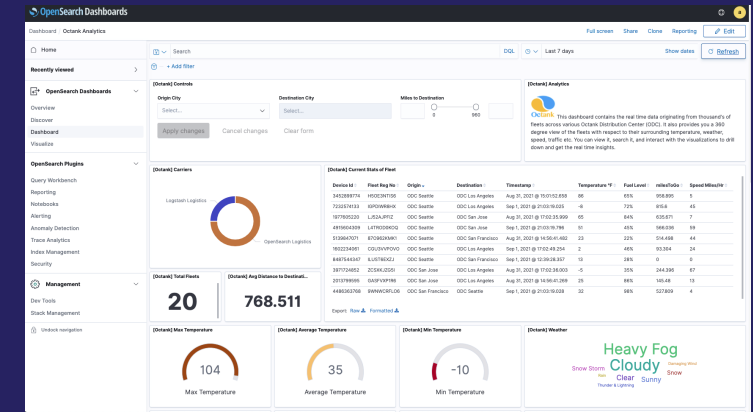


Getting insights from your data

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unicomp6.unicomp.net -- [01/Jul/1995:00:00:06 -0400] "GET /shuttle/countdown/ HTTP/1.0" 200 3985
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```

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199.72.81.55	[01/Jul/1995:00:00:01	GET	/history/apollo/	HTTP/1.0	200	6245
unicomp6.unicomp.net	[01/Jul/1995:00:00:06	GET	/shuttle/countdown/	HTTP/1.0	200	3985
199.120.110.21	[01/Jul/1995:00:00:09	GET	/shuttle/missions/sts-73/mission-sts-73.html	HTTP/1.0	200	4085
burger.letters.com	[01/Jul/1995:00:00:11	GET	/shuttle/countdown/liftoff.html	HTTP/1.0	304	0
199.120.110.21	[01/Jul/1995:00:00:11	GET	/shuttle/missions/sts-73/sts-73-patch-small.gif	HTTP/1.0	200	4179
burger.letters.com	[01/Jul/1995:00:00:12	GET	/images/NASA-logosmall.gif	HTTP/1.0	304	0
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129.94.144.152	[01/Jul/1995:00:00:13	GET	/	HTTP/1.0	200	7074



OpenSearch delivers near real-time insights



OpenSearch Dashboards is a lightweight, real-time visualization tool

OpenSearch Dashboards Octank Analytics

Full screen Share Clone Reporting Edit

Home Search DQL Last 7 days Show dates Refresh

[Octank] Controls

Origin City: Select... Destination City: Select... Miles to Destination: 0 to 960

Apply changes Cancel changes Clear form

[Octank] Analytics

Octank This dashboard contains the real time data originating from thousand's of fleets across various Octank Distribution Center (ODC). It also provides you a 360 degree view of the fleets with respect to their surrounding temperature, weather, speed, traffic etc. You can view it, search it, and interact with the visualizations to drill down and get the real time insights.

[Octank] Carriers

Logstash Logistics (blue) OpenSearch Logistics (orange)

[Octank] Current Stats of Fleet

Device Id	Fleet Reg No	Origin	Destination	Timestamp	Temperature °F	Fuel Level	milesToGo	Speed Miles/Hr
3452899774	H5OE3NTIS6	ODC Seattle	ODC Los Angeles	Aug 31, 2021 @ 15:01:52.658	86	65%	958.895	5
7232574133	IGPDIWR8HX	ODC Seattle	ODC Los Angeles	Sep 1, 2021 @ 21:03:19.025	-8	72%	815.6	45
1977605220	LJ52AJPFIZ	ODC Seattle	ODC San Jose	Aug 31, 2021 @ 17:02:35.999	65	84%	635.671	7
4915604309	L4TRODOKOQ	ODC Seattle	ODC San Jose	Sep 1, 2021 @ 21:03:19.796	51	45%	566.036	59
5139847071	870962KMK1	ODC Seattle	ODC San Francisco	Aug 31, 2021 @ 14:56:41.482	23	22%	514.498	44
1602234061	CGU3VVPOVO	ODC Seattle	ODC Los Angeles	Sep 1, 2021 @ 17:02:49.254	2	46%	93.304	24
8487544347	ILUST6EXZJ	ODC Seattle	ODC San Francisco	Sep 1, 2021 @ 12:39:28.357	13	28%	0	0
3971724852	ZCSXKJZG5I	ODC San Jose	ODC Los Angeles	Aug 31, 2021 @ 17:02:36.003	-5	35%	244.396	67
2013799595	GASFVXP1R6	ODC San Jose	ODC Los Angeles	Aug 31, 2021 @ 14:56:41.269	25	86%	145.48	13
4486363768	9WNWCRFLO6	ODC San Francisco	ODC Seattle	Sep 1, 2021 @ 21:03:19.028	32	98%	527.809	4

Export: Raw Formatted

[Octank] Total Fleets: 20

[Octank] Avg Distance to Destinati...: 768.511

[Octank] Max Temperature: 104

[Octank] Average Temperature: 35

[Octank] Min Temperature: -10

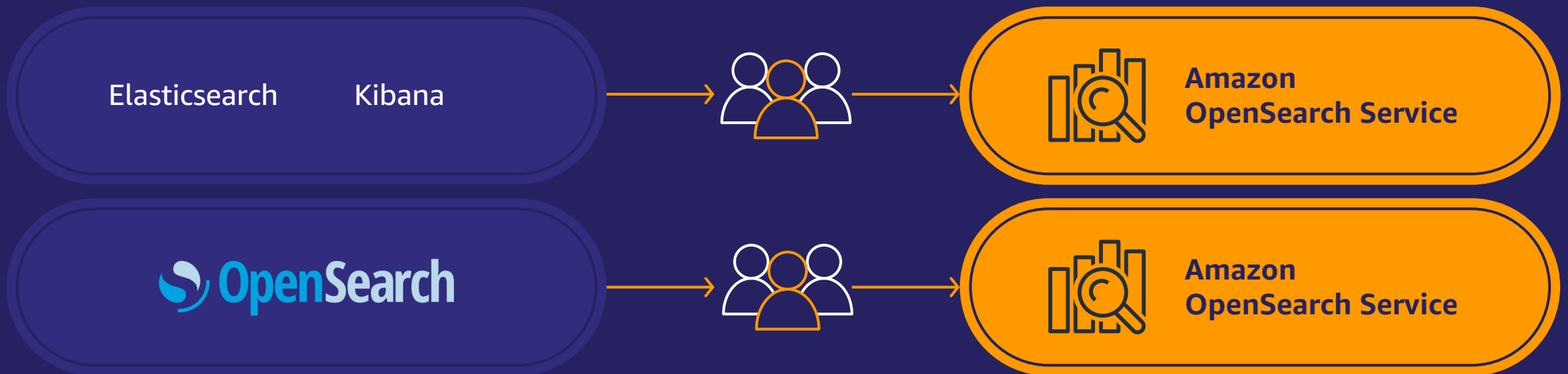
[Octank] Weather: Heavy Fog, Cloudy, Snow Storm, Rain, Clear, Sunny, Damaging Wind, Snow, Thunder & Lightning

Why Amazon OpenSearch Service



Moving from self-managing open-source solutions to Amazon OpenSearch Service

- Managing and scaling requires dedicated expertise, driving up the total cost of ownership
- Customers need to build or pay for advanced security, alerting, and other features
- Customers need to purchase and manage their own infrastructure



Self-managed vs. Amazon OpenSearch Service

Self-Managed		Managed Service
On-Premises	Amazon EC2	Amazon OpenSearch Service
App dev/optimization	App dev/optimization	App dev/optimization
Hot/warm storage tiers	Hot/warm storage tiers	Hot/warm storage tiers
Plugins (additional cost)*	Plugins (additional cost)*	Plugins
24x7 monitoring & repair	24x7 monitoring & repair	24x7 monitoring & repair
In-place upgrades/patches	In-place upgrades/patches	In-place upgrades/patches
Cluster scaling	Cluster scaling	Cluster scaling
Cross-AZ data transfer cost	Cross-AZ data transfer cost	Cross-AZ data transfer cost
Backups	Backups	Backups
High availability	High availability	High availability
Security (FGAC, Auth)	Security (FGAC, Auth)	Security (FGAC, Auth)
Hardware & OS maintenance	Hardware & OS maintenance	Hardware & OS maintenance
Hardware lifecycle	Hardware lifecycle	Hardware lifecycle
Power/network/HVAC	Power/network/HVAC	Power/network/HVAC

* SQL querying, Real-time Alerting, Index State Management, Anomaly Detection, Machine Learning



Moving from licensed solutions to Amazon OpenSearch Service



- Other, more packaged solutions can drive excessive cost as data volumes grow
- Database solutions and some packaged solutions have lower limits on capacity and higher latency
- Amazon OpenSearch Service is a very flexible tool, supporting search—for application data, but also for logging data. This enables many customers to use Amazon OpenSearch Service for issue debugging and repair

Benefits of Amazon OpenSearch Service



Operationalize OpenSearch with the leading contributor of the community-driven, open-source software



Quickly search and analyze your unstructured and semi-structured data to easily find what you need

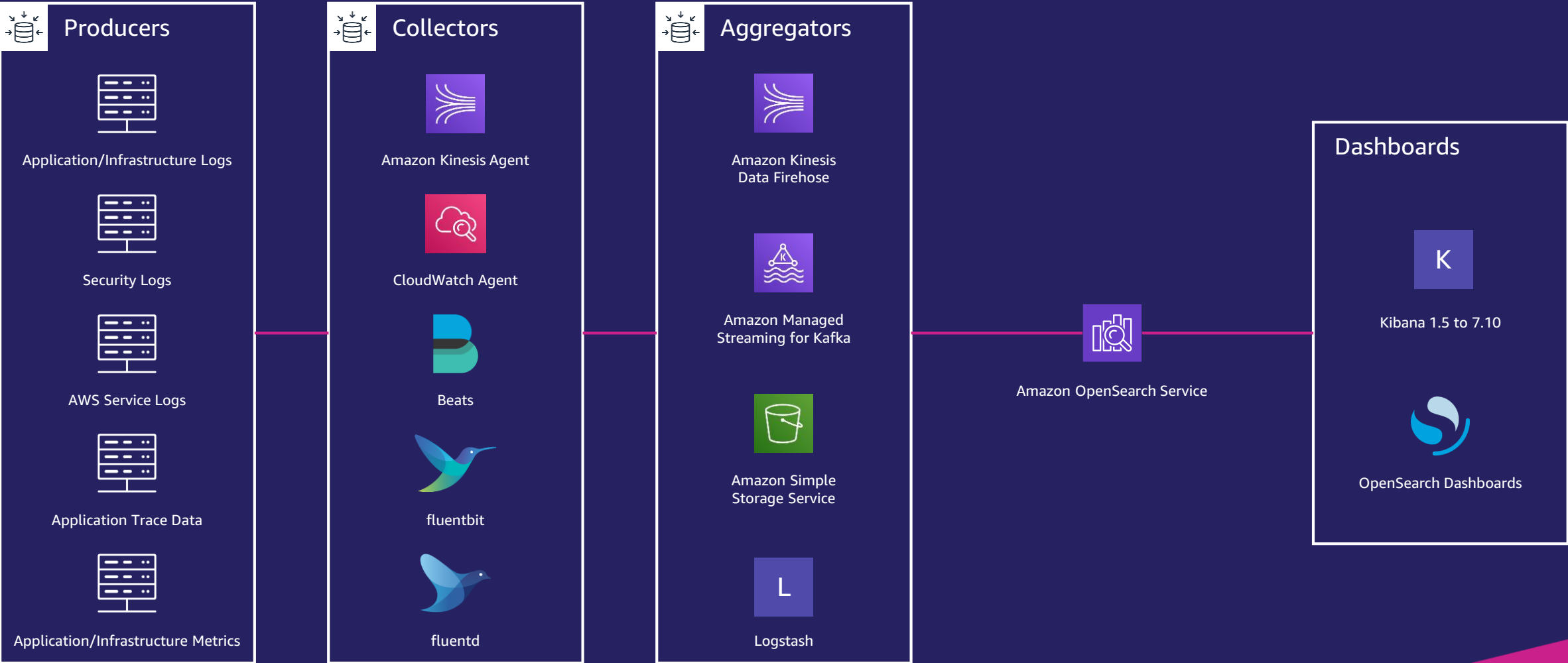


Use machine learning to detect anomalies in real time, autotune your clusters, and personalize your search results



Eliminate operational overhead and reduce cost with automated provisioning, software installation, patching, storage tiering, and more

Amazon OpenSearch Service data ingestion flow



Amazon OpenSearch Service customers

Software and Internet



Education Technology



BioTech and Pharma



Financial Services



Media and Entertainment



Social Media



Telecommunications



Travel and Transportation



Real Estate



Logistics and Operations



Publishing



Other



Use cases

Use case #1

Observability



Pinterest case study

Why observability?

You need to correlate logs, metrics, and traces to gain insights into application health and performance and resolve issues across the business.

How Amazon OpenSearch Service can help

Centralizes log analytics to identify or predict performance problems across your business. With cross-cluster search, you can analyze and query all of your log data via a single OpenSearch Dashboards interface.

Use case #2

Application & infrastructure monitoring



Autodesk case study

Why application and infrastructure monitoring?

You need to proactively monitor your applications and infrastructure log data to find performance issues faster and improve operational health.

How Amazon OpenSearch Service can help

Provides real-time search and log analytics capabilities to identify or predict performance problems and enable your teams to do real-time root cause and forensic analysis, therefore reducing Mean Time to Detect (MTTD) and Mean Time to Resolve (MTTR) issues.

Use case #3

Search

COMPASS

[Compass blog](#)

Why search?

You need a fast search experience for your applications, websites, and data lake catalogs, allowing your users to quickly find relevant data.

How Amazon OpenSearch Service can help

Delivers high-quality and personalized search results to customers. You get access to all of Elasticsearch's search APIs, supporting natural language search, auto-completion, faceted search, adjustable ranking, and location-aware search.

Use case #4

Security monitoring



[Pearson case study](#)

Why security monitoring?

You need to keep your data safe, preventing security threats such as data breaches, unauthorized login attempts, DoS attacks, and fraud.

How Amazon OpenSearch Service can help

Accelerate security incident detection, forensic analysis, and response by being able to quickly analyze logs from disparate applications and systems across your network.

Key features



Key Amazon OpenSearch Service functionality



Currency &
scalability

Improve search quality and relevance with **K-Nearest Neighbor (K-NN)** and **Learning to Rank (LTR)** models

Update search accuracy on the fly with **custom dictionaries** and **hot-reload of synonym files**



Easy to use

Secure your domain at every level with **Fine Grained Access Control** and **Audit Logging**

Troubleshoot performance and availability issues in your distributed applications with **Trace Analytics**



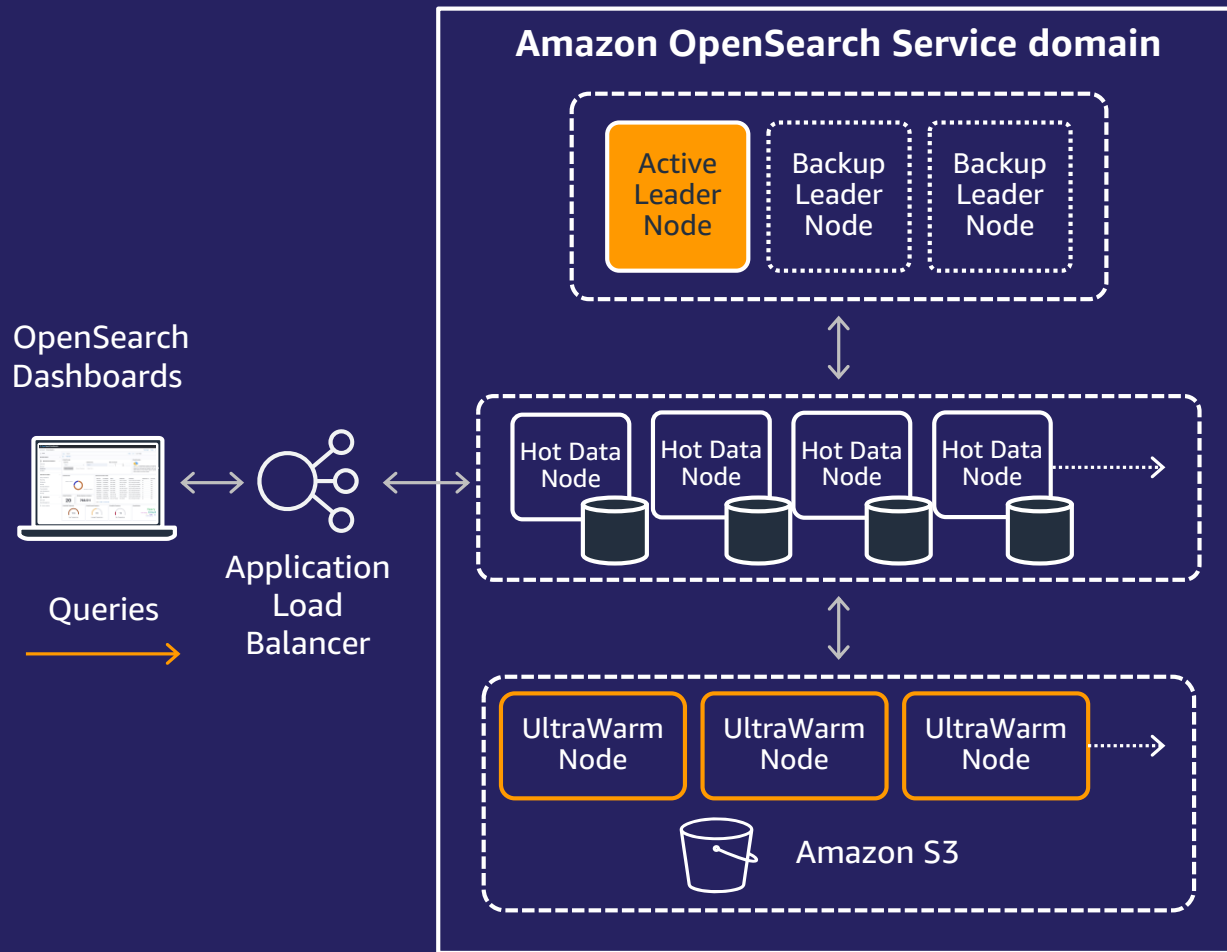
Security &
availability

Lower your storage costs and extend your data retention with **UltraWarm** and **Cold Storage**

Self-healing nodes and automatically optimize memory resources with **Auto-tune**

UltraWarm for Amazon OpenSearch Service

A low-cost storage tier for Amazon OpenSearch Service



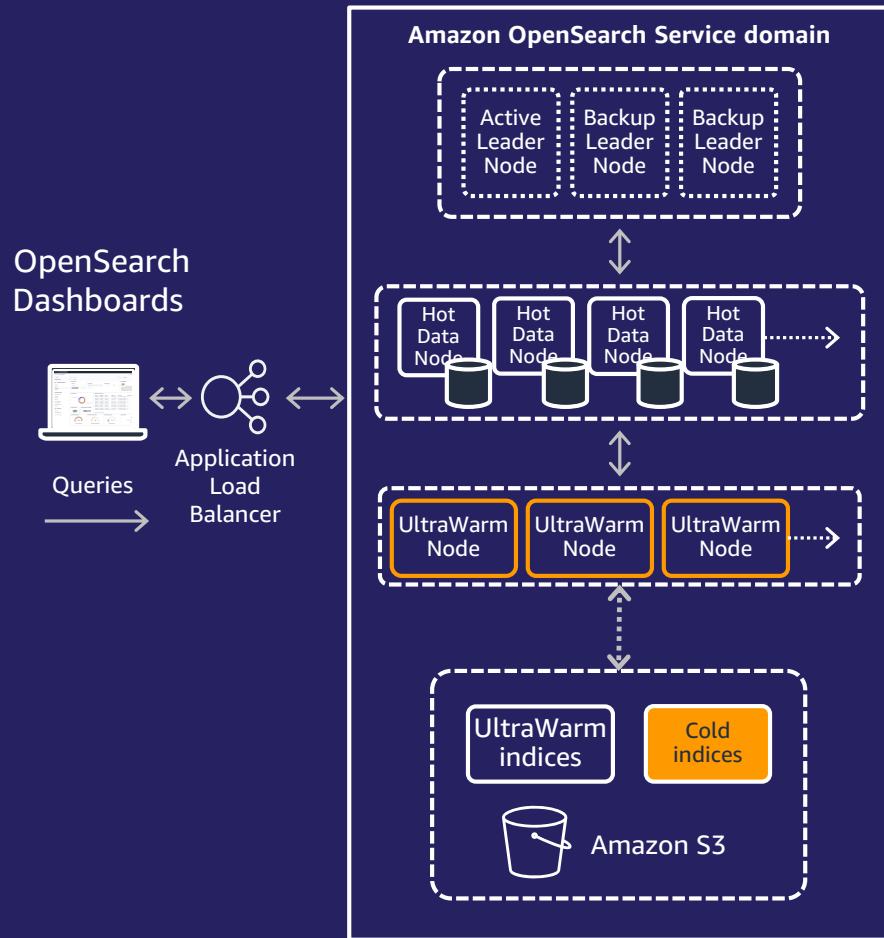
Up to 90% storage cost reduction vs. hot storage tier

Scale up to 3 PB per domain

Analyze years of operational data

Interactive log analytics and visualization

Cold storage



A fully-managed lowest cost storage tier to durably store infrequently accessed or historical logs at near Amazon S3 prices.

No limits: You can keep as much data you need in cold storage.

Keep your data: Don't throw away older data. Generate valuable business insights from historical long tail data.

Lower cost: Decouple compute from storage. No longer pay for compute for data that you only need to analyze infrequently.

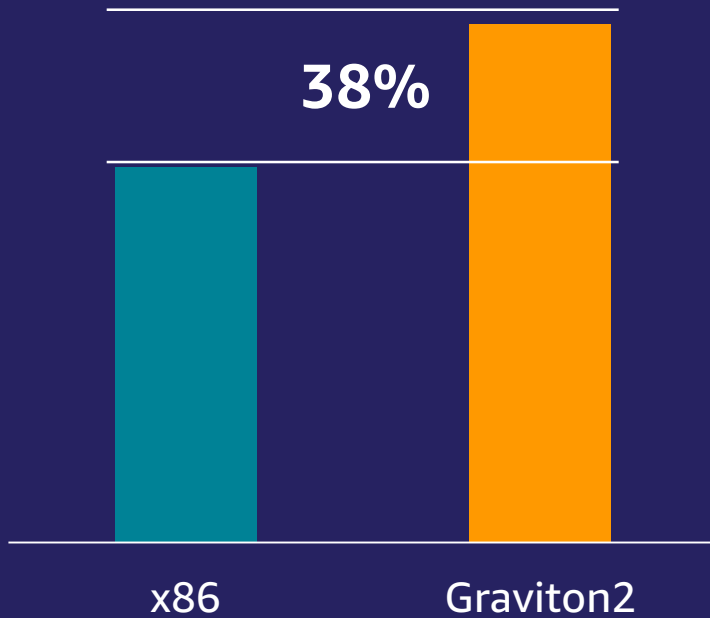
Easy: Simple discovery features gives your users secure access to their data via self-service.

On-demand access: Migrate the data you need to analyze from cold storage to your UltraWarm nodes in seconds.

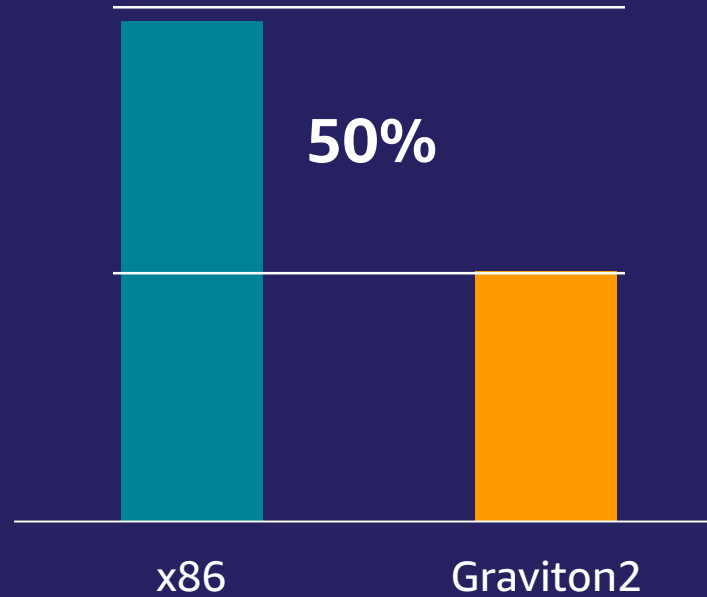
AWS Graviton2 on Amazon OpenSearch Service

Custom-built silicon with next-generation performance improvement

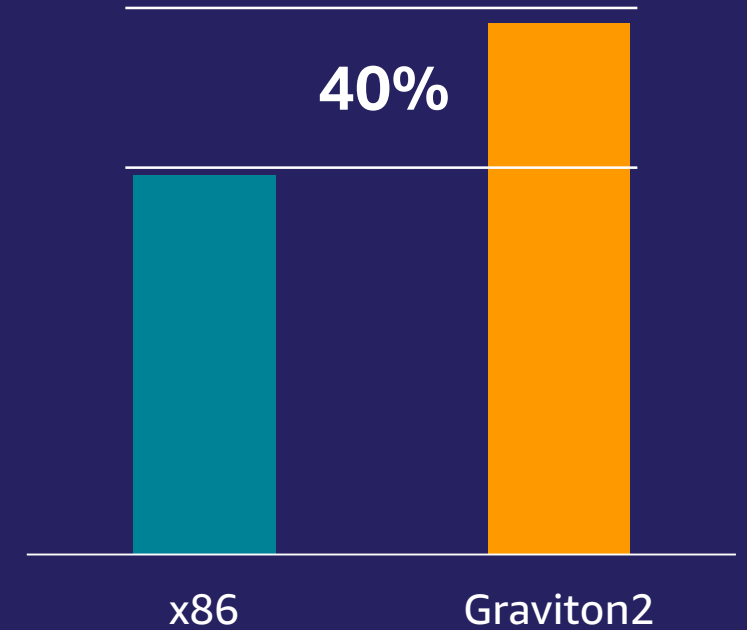
Indexing Throughput



Indexing Latency



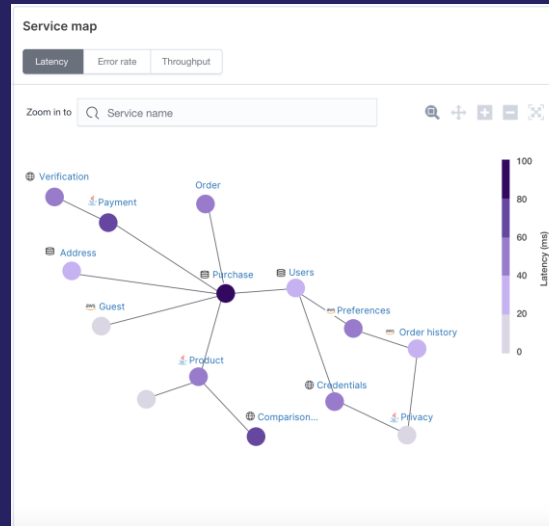
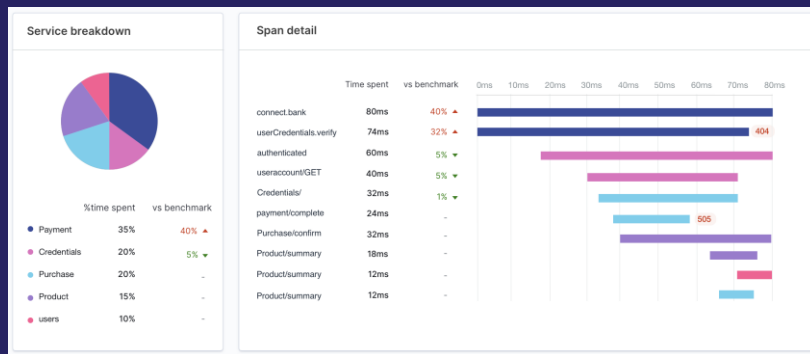
Query Performance



44% better price to performance compared to fifth-generation instances

What is Trace Analytics?

Supports OpenTelemetry (Jaeger, Zipkin, X-Ray SDKs)



Trace group name	Latency variance	Average latency (ms)	Average latency vs benchmark	24-hour latency trend	Error rate	Traces
MakePayment.auto	45	30% ▲	20%	1,500		
Order.confirmation	48	5% ▼	1%	2,000		
MakePayment.oneoff	42	30% ▲	2%	1,200		
Product.comparison	40	5% ▼	3%	1,000		
Purchase.buynow	60	30% ▲	3%	800		
MakePayment.auto	46	30% ▲	2%	900		
Order.confirmation	64	15% ▼	0%	200		
MakePayment.oneoff...	65	30% ▲	10%	400		
Product.comparison...	43	10% ▼	10%	100		
Purchase.buynow...	28	10% ▼	10%	1,100		

Trace-Span Details

Single request performance
Diagnose root cause

Service Maps

End-to-end view
Isolate issues to services

Trace Groups

Monitor performance
Identify issues early

Cross-cluster search for Amazon OpenSearch Service

Increase scalability, efficiency, and availability, by separating distinct workloads



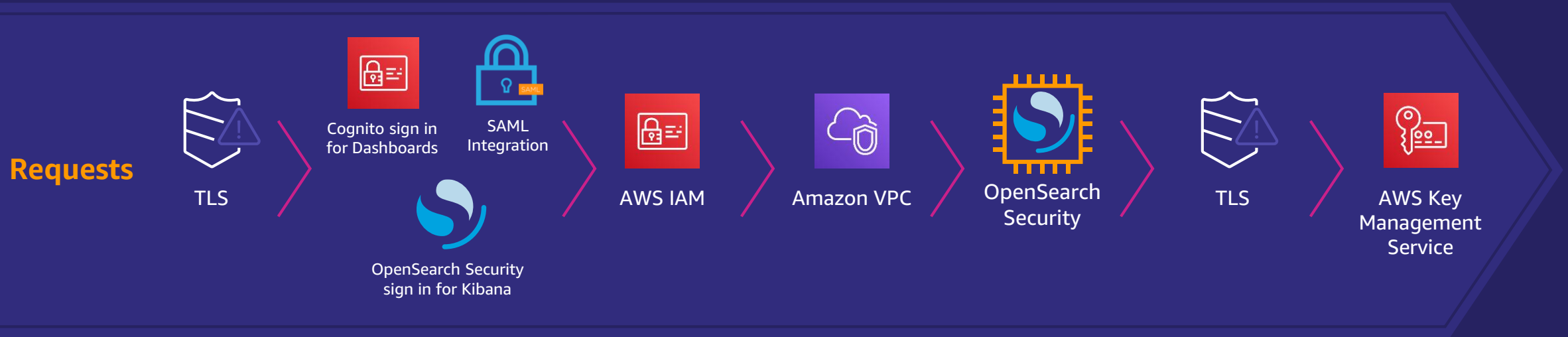
Search and visualize data across multiple domains from a single OpenSearch Dashboards interface

Increase efficiency— optimize domain resources for specific workloads

Improve availability— isolate failures to specific workloads

Secured through Fine Grained Access Control (FGAC) policies

Multi-layer security with Amazon OpenSearch Service



Integrate with SAML and Cognito for OpenSearch Dashboards login

IAM to control access to the endpoint

Use a private endpoint to deploy into your VPC and security groups for traffic control.

Use OpenSearch fine-grained access control to secure your data and dashboards

Encrypt your data, in flight and at rest

Machine learning in Amazon OpenSearch Service

Mitigate issues faster with anomaly detection in streaming data

Improve search quality and relevance with K-Nearest Neighbor (K-NN) and Learning to Rank models

Performant at scale. Machine learning models are distributed and processed across nodes

Easy to use. Machine learning expertise is not required to leverage the service



Dashboard

Create detector

All detectors

All detector states

All indices

Live anomalies Live

Live anomaly results across detectors for the last 30 minutes. The results refresh every 1 minute. For each detector, if an anomaly occurrence is detected at the end of the detector interval, you will see a bar representing its anomaly grade.

View full screen

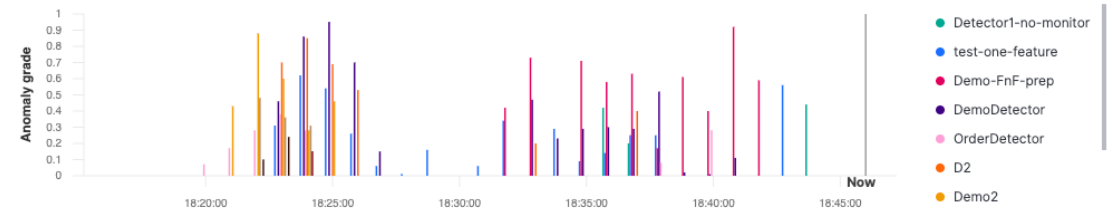
Last updated time
05/13/2020 06:46 PM

Detector with most recent anomaly occurrence
Detector1-no-monitor

Most recent anomaly grade
0.44

You are viewing 10 detectors with the most recent anomaly occurrences.

10 detectors with the most recent anomalies are shown on the chart. Adjust filters if there are specific detectors you would like to monitor.



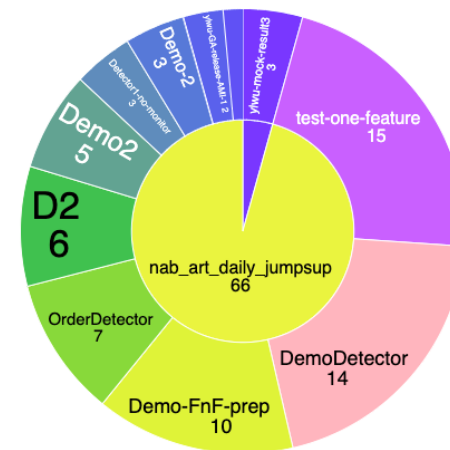
Anomalies by index and detector

The inner circle shows the anomaly distribution by your indices. The outer circle shows the anomaly distribution by your detectors.

Last 24 hours

Indices with anomalies
2

Detectors with anomalies
11



Detectors and features

Detector ↑	Features
D1	F1 F2 F3
D2	error
Demo-2	aaa bbb
Demo-FnF-prep	Total_order Avg_price
Demo-all-hands	Total_order Avg_price
Demo-one-feature	Total-Order
Demo-verizon	F1 F2 F3
Demo1	F1
Demo2	f1 f2
DemoDetector	F1 F2

Rows per page: 10 < 1 2 3 4 >

Getting started



Resources

OpenSearch project

opensearch.org

Amazon OpenSearch Service Immersion Days

Provides a deep dive into Amazon OpenSearch Service through a mix of online trainings and hands-on labs led by AWS Solutions Architects. You will learn all the key concepts to leverage the service along with the operational best practices.

Interested in scheduling Immersion Days?

Contact us

searchservices-ww-gtm@amazon.com

New releases

[What's New](#)

Documentation

[Developer Guide](#)

Blogs

[Moving to managed: The case for the Amazon OpenSearch Service](#)

[Best practices for configuring your Amazon OpenSearch Service domain](#)



Simple to get started...

1



Create an AWS
Free Tier account

2



Launch an Amazon
OpenSearch Service
Cluster in minutes

3



Follow the [Getting Started Tutorial](#) to build a log analytics solution



Thank you!