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ARCHITECTING A CONTINUOUS INTEGRATION AND CONTINUOUS DEPLOYMENT PROCESS ON AWS

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AMAZON X-RAY

Amazon X-RAY

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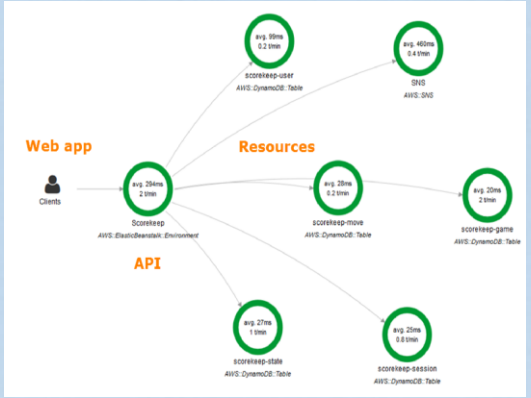
Amazon X-Ray – What is it?

- AWS X-Ray helps developers analyze and debug production, distributed applications, such as those built using a microservices architecture.
  - It provides tools that can be used to view, filter, and gain insights into that data to identify issues and opportunities for optimization.

- By using X-Ray, how an application and its underlying services are performing can be analyzed to identify and troubleshoot the root cause of performance issues and errors.
  - X-Ray provides a user-centric model, instead of service-centric or resource-centric model, for collecting data related to requests made to the application.
  - By correlating and aggregating data, X-Ray enables the focus on improving the experience for end-users of the application.

- X-Ray provides an end-to-end view of requests as they travel through the application and its components and shows a map of the application's underlying components.

- X-Ray can be used to analyze both applications in development and in production, from simple three-tier applications to complex microservices applications consisting of thousands of services.



Amazon X-Ray – Capabilities / Use cases

- **Create a service map**
  - By tracking requests, X-Ray can create a map of services used by the application.
    - This provides a view of connections among services in the application, and enables
      - The creation of a dependency tree,
      - Detect latency or errors when working across AWS Availability Zones or Regions,
      - Zero in on services not operating as expected.

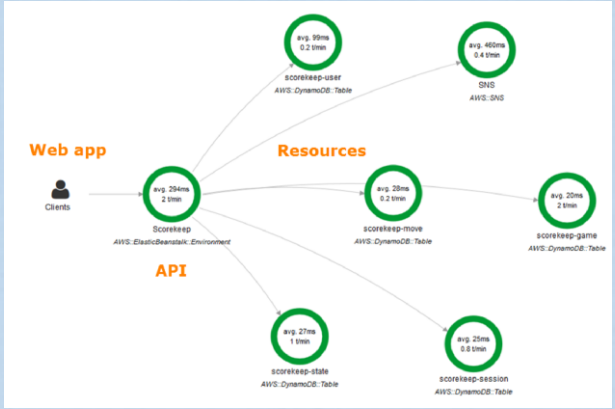
- **Identify errors and bugs**
  - X-Ray can automatically highlight bugs or errors in the application code by analyzing the response code for each request made to your application.
    - This enables easy debugging of application code without requiring to reproduce the bug or error.

- **Build own analysis and visualization apps**
  - X-Ray provides a set of query APIs the can be used to build custom analysis and visualizations apps using X-Ray data.

Amazon X-Ray - Concepts

- **A Trace**
  - An X-Ray trace is a set of data points that share the same trace ID.
  - Ex., when a client makes a request to the application, it is assigned a unique trace ID.
    - As the request makes its way through services in the application, the services relay information regarding the request back to X-Ray using this unique trace ID.
    - The piece of information relayed by each service in the application to X-Ray is a segment,
  - A trace is a collection of segments.

- **A Segment**
  - An X-Ray segment encapsulates all the data points for a single component (for example, authorization service) of the distributed application.
  - Ex., when the application makes a call to a database in response to a request, it creates a segment for that request with a sub-segment representing the database call and its result.
    - The sub-segment can contain data such as the query, table used, timestamp, and error status.



Amazon X-Ray - Concepts

- **Sampling**
  - To provide a performant and cost-effective experience, X-Ray does not collect data for every request that is sent to an application.
    - Instead, it collects data for a statistically significant number of requests.
    - X-Ray should not be used as an audit or compliance tool because it does not guarantee data completeness.

- **An annotation**
  - An X-Ray annotation is system-defined or user-defined data associated with a segment.
    - A segment can contain multiple annotations.
    - System-defined annotations include data added to the segment by AWS services,
    - User-defined annotations are metadata added to a segment by a developer.
    - Ex., a segment created by the application can automatically be injected with region data for AWS service calls, or the user can add region data for calls made to non-AWS services.

- **Errors**
  - X-Ray errors are system annotations associated with a segment for a call that results in an error response.

Amazon X-Ray

Amazon X-Ray Agent

- The X-Ray agent collects data from log files and sends them to the X-Ray service for aggregation, analysis, and storage.
- The agent makes it easier to send data to the X-Ray service, instead of using the APIs directly
- For applications running on other AWS services, such as EC2 or ECS, install the X-Ray agent and instrument the application code.
- It is available for Amazon Linux AMI, Red Hat Enterprise Linux (RHEL), and Windows Server 2012 R2 or later operating systems.

Amazon X-Ray Groups

- Groups are a collection of traces that are defined by a filter expression, which decides which traces join the group.
  - Groups can be used to generate additional service graphs and supply Amazon CloudWatch metrics.
- You can use groups to generate additional service graphs and supply Amazon CloudWatch metrics.
- You can use the X-Ray API to manage groups in an account.
- Once a group is created, incoming traces are checked against the group's filter expression as they are stored in the X-Ray service.
  - Call the group by name or ARN to generate its own service graph, trace summaries, and CloudWatch metrics

Amazon X-Ray Data Handling

- X-Ray can be used to track requests flowing through applications or **services across multiple regions.**
  - X-Ray data is stored locally to the processed region but with enough information to enable client applications to combine the data and provide a global view of traces.
- Trace data sent to X-Ray is generally available for retrieval and filtering within 30 seconds of it being received by the service.
- X-Ray stores trace data for the last 30 days. This enables to query trace data going back 30 days.

Cross Account:

- If the application has components in different AWS Accounts, X-Ray can be used to collect data across These AWS accounts
- The X-Ray agent can assume a role to publish data into an account different from the one in which it is running.
- This enables for publishing data from various components of your application into a central account.

Amazon X-Ray Integration with AWS services

- X-Ray can be used with applications running on
  - EC2, ECS, Lambda, and Elastic Beanstalk.
  - It also integrates with API Gateway and ELB services.
  - The X-Ray SDK automatically captures metadata for API calls made to AWS services using the AWS SDK.
  - The X-Ray SDK provides add-ons for MySQL and PostgreSQL drivers.

- X-Ray can be used with distributed applications of any size to trace and debug both synchronous requests and asynchronous events.
  - Ex., X-Ray can be used to trace web requests made to a web application or asynchronous events that utilize Amazon SQS queues.

- AWS X-Ray integrates with AWS CloudTrail to record API actions made by a user, a role, or an AWS service in X-Ray

Data Protection in Amazon X-Ray

- AWS X-Ray is accessed through public regional endpoints over TLS encrypted HTTPS.
- AWS X-Ray always encrypts traces and related data at rest.

AWS Config – Tracking X-Ray's encryption configuration changes

- AWS X-Ray integrates with AWS Config to record configuration changes made to the X-Ray encryption resources.
- AWS Config can be used to inventory X-Ray encryption resources, audit the X-Ray configuration history, and send notifications based on resource changes.
- AWS Config supports logging the following X-Ray encryption resource changes as events:
  - Configuration changes
    - Changing or adding an encryption key, or reverting to the default X-Ray encryption setting.