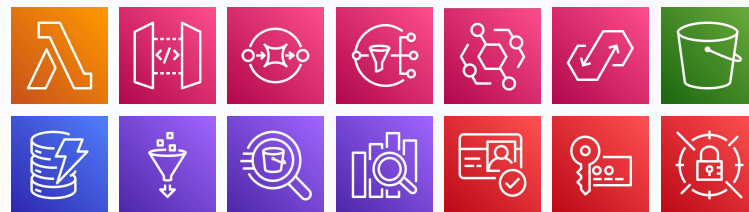


Beyond Lambda

Advanced serverless solution designs,
and the problems they solve.

chris.chen@cevo.com.au

Feb 2022



About me



Your friendly neighborhood jack of all trades.

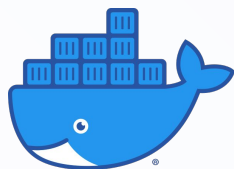


This talk is not for ...

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serverless 101



serverless vs. container



GCP and Azure

An unlikely way to get started



Specialty

Technical AWS Cloud experience in the Specialty domain as specified in the exam guide



More likely you have done this

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aws serverless

About 19,700,000 results (0.49 seconds)

<https://aws.amazon.com/serverless> : **Serverless Computing – Amazon Web Services**
AWS offers technologies for running code, managing data, and integrating applications, all without managing servers. Serverless technologies feature ...
AWS Serverless Customer... Category deep dive Startup Center
You've visited this page 3 times. Last visit: 6/02/22

<https://aws.amazon.com/lambda/serverless-architect> : **Serverless Architectures - Amazon AWS**
A serverless architecture is a way to build and run applications and services without having to manage infrastructure. Your application still runs on ...
<https://aws.amazon.com/serverless/getting-started> : **Getting started with AWS Serverless – Amazon Web Services**
AWS Serverless Application Model (AWS SAM) is an open-source framework for ...

People also ask

- What is serverless AWS?
- Which AWS resources are serverless?
- Is AWS EC2 serverless?
- Is S3 considered serverless?

<https://www.serverless.com/docs/providers/aws> : **AWS Documentation - Serverless**
The Serverless Framework documentation for AWS Lambda, API Gateway, EventBridge, DynamoDB and much more.

<https://www.serverless.com/docs/aws/guide/intro> : **Serverless Framework - AWS Lambda Guide - Introduction**
The Serverless Framework helps you develop and deploy your AWS Lambda functions, along with the AWS infrastructure resources they require.

<https://www.serverless.com/aws/lambda> : **AWS Lambda: The Ultimate Guide - Serverless**
AWS Lambda is a serverless computing service provided by Amazon Web Services (AWS). Users of AWS Lambda create functions, self-contained applications ...

<https://www.serverless.com> : **Serverless: Develop & Monitor Apps On AWS Lambda**
Easily develop and monitor auto-scaling applications on AWS Lambda, API Gateway, DynamoDB, etc., with the Serverless Framework and Serverless Monitoring ...

<https://medium.com/awesome-cloud/aws-serverless> : **AWS — Serverless services on AWS - Medium**

Serverless Computing

Serverless on AWS

Build and run applications without thinking about servers

AWS offers technologies for running code, managing data, and integrating applications, all without managing server infrastructure. Serverless architectures feature automatic scaling, built-in high availability, and a pay-for-use billing model to increase agility and optimize costs. Serverless applications start with AWS Lambda, an event-driven compute service natively integrated with other AWS services.

Move from idea to market, faster
Eliminate operational overhead so your teams can release quickly, get feedback, and iterate to get to market faster.

Adapt at scale
With technologies that automatically scale from zero to peak demands, you can adapt to customer needs faster than ever.

Lower your costs
With a pay-for-value billing model, resource utilization is automatically optimized and you never pay for over-provisioning.

Build better applications, easier
Serverless applications have built-in service integrations, so you can focus on building your application instead of configuring it.

Take the next step

- Builders**
Ready to build? Head over to the learning library to get started with hands-on serverless tutorials.
[Learning Library >](#)
- Business Leaders**
Want to empower your development teams? Check out these insights from IDC.
[Executive Insights >](#)
- Startups**
Need to build an MVP fast? Learn how to access credits, and build your first application.
[Startup Center >](#)

Serverless services on AWS

Getting Started

API Proxy	API Gateway	AWS API Gateway is a fully managed service that allows you to create, publish, maintain, monitor, and secure APIs at any scale. It offers a comprehensive platform for API management. API Gateway allows you to process hundreds of thousands of concurrent API calls and handles traffic management, authorization and access control, monitoring, and API version management.
	SNS	Amazon SNS is a fully managed pub/sub messaging service that makes it easy to decouple and scale microservices, distributed systems, and serverless applications.
Messaging & Integration	SQS	Amazon SQS is a fully managed message queuing service that makes it easy to decouple and scale microservices, distributed systems, and serverless applications.
	EventBridge	Amazon EventBridge is a serverless event bus that makes it easy to connect applications together using data from your own applications, Integrated Software-as-a-Service (SaaS) applications, and AWS services.
Orchestration	Step Functions	AWS Step Functions makes it easy to coordinate the components of distributed applications and microservices using visual workflows.

Let's build!

Below are a couple of resources to help introduce you to our core serverless services.

- Run a serverless "Hello, World!"**
Create a Hello World Lambda function using the AWS Lambda console and learn the basics of running code without provisioning or managing servers.
[Begin tutorial >>](#)
- Create a simple microservice**
Use the Lambda console to create a Lambda function and an Amazon API Gateway endpoint to trigger that function.
[Begin tutorial >>](#)
- Create thumbnails from uploaded images**
Create a Lambda function invoked by Amazon S3 every time an image file is uploaded into an S3 bucket and automatically create a thumbnail of that image.
[Begin tutorial >>](#)
- Create a serverless workflow**
Learn how to use AWS Step Functions to design and run a serverless workflow that coordinates multiple AWS Lambda functions.
[Begin tutorial >>](#)

Getting Started with Serverless

Building Your First Application with AWS Lambda

Classic serverless patterns

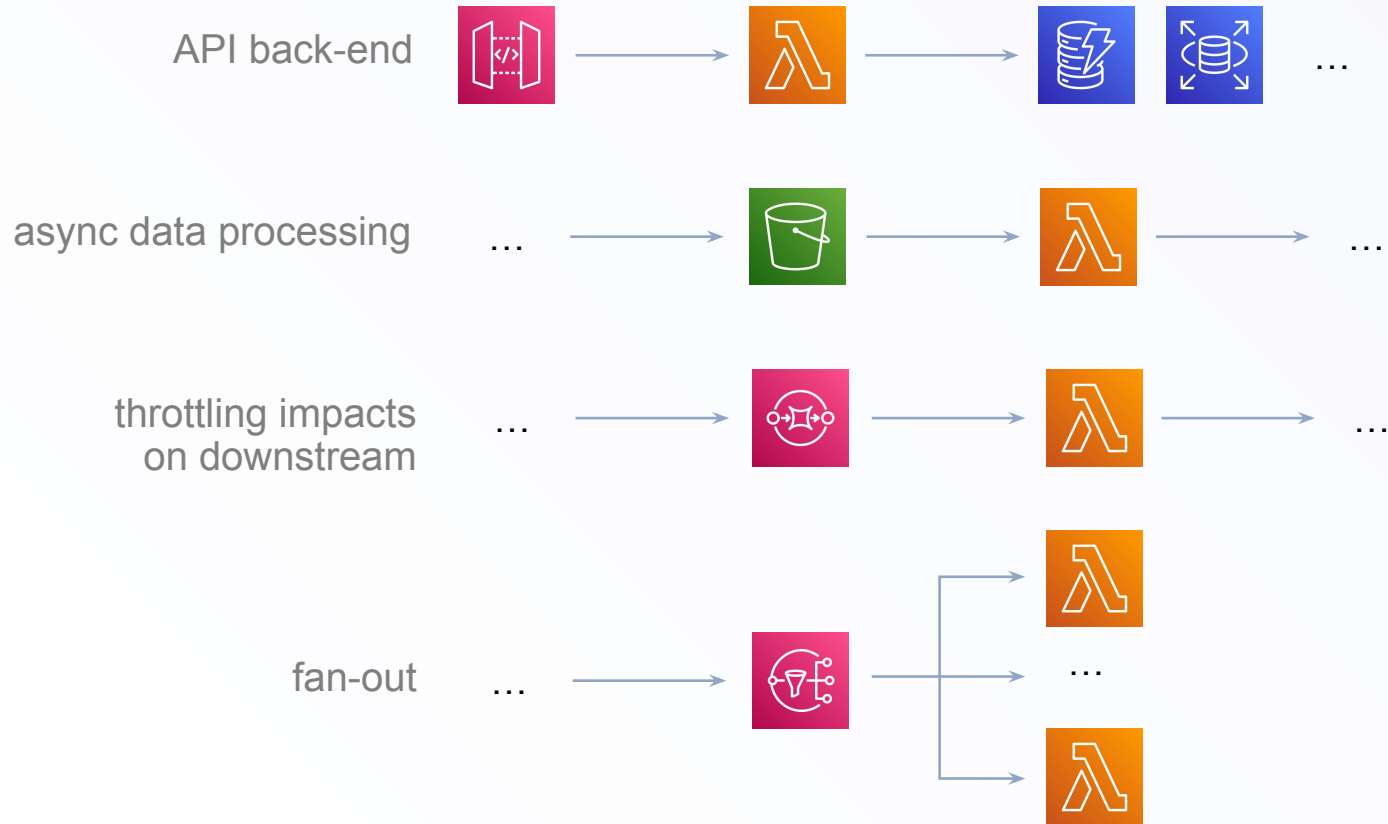
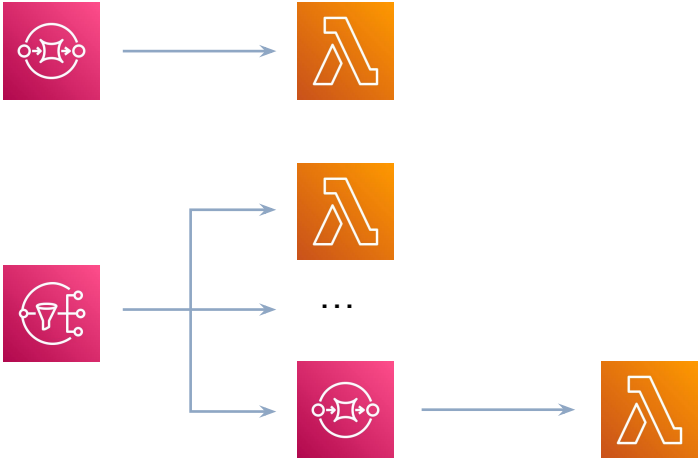




Photo by [Mohamed Nohassi](#) on [Unsplash](#)

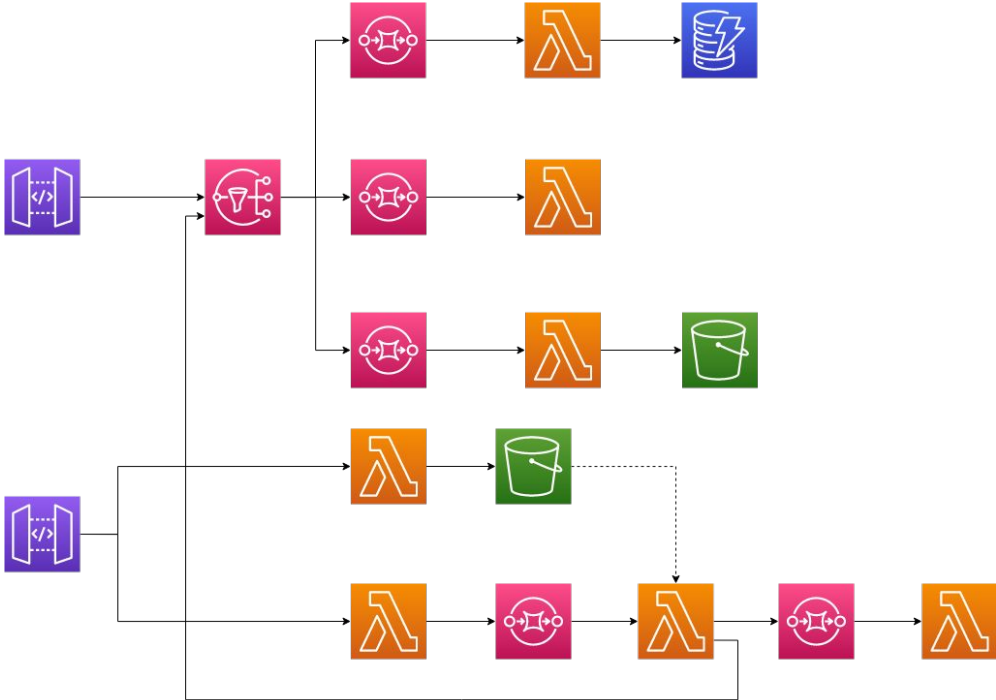
Problem:

SQS/SNS fatigue

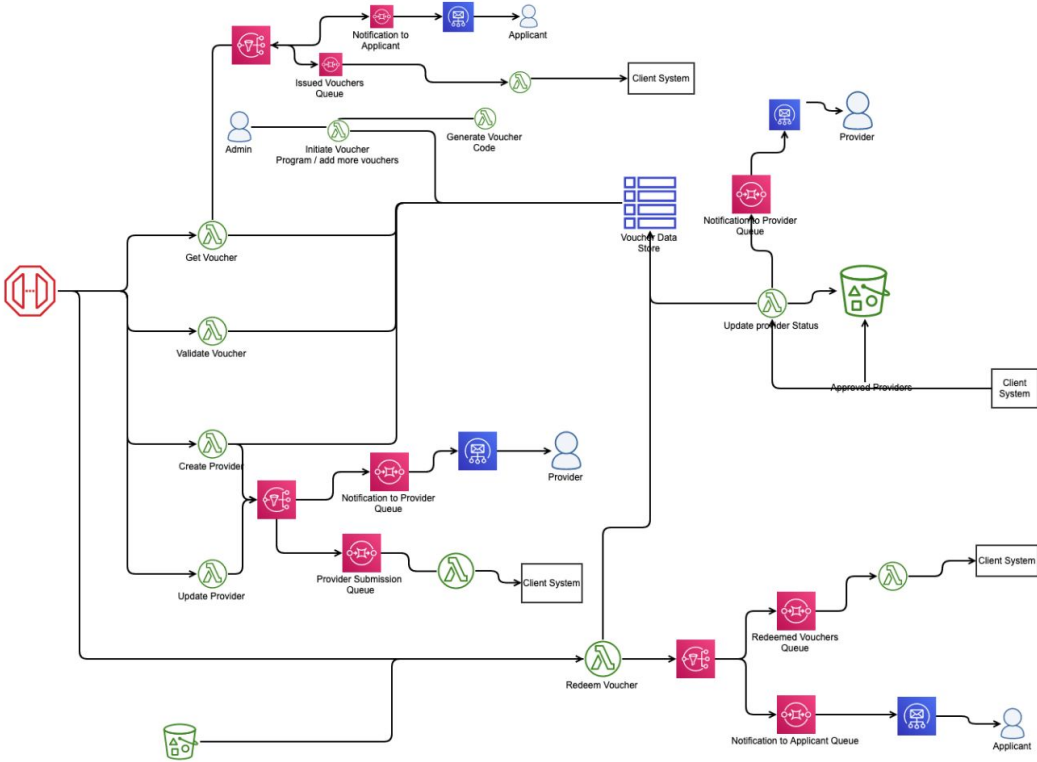


Problem:

SQS/SNS fatigue



Problem: SQS/SNS fatigue

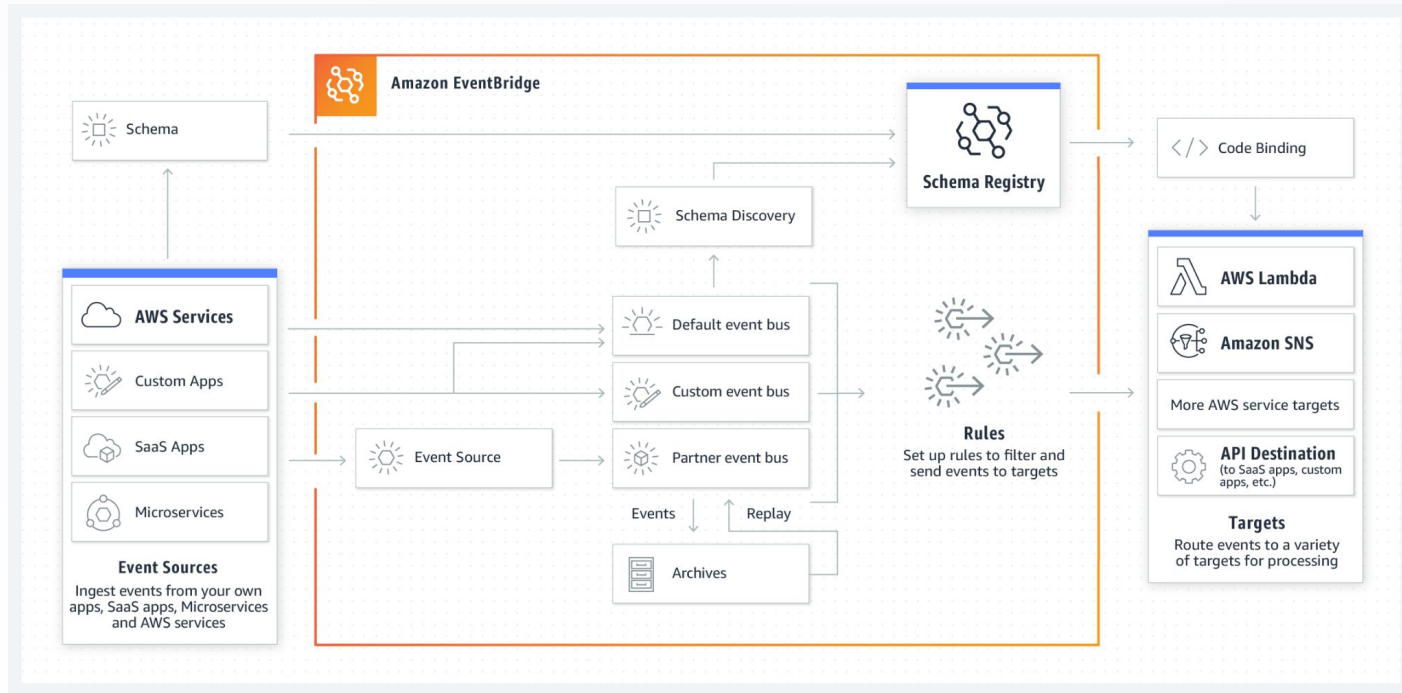


Problem:

SQS/SNS fatigue

- too much Infra-as-Code
- inconsistent queue/retry behaviours
- low maintainability and extensibility

AWS EventBridge



<https://aws.amazon.com/eventbridge/>

AWS EventBridge – event bus

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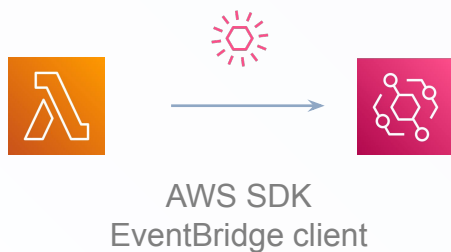
default



custom event bus

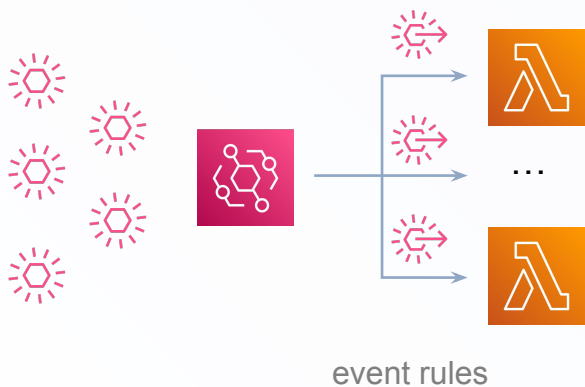
AWS EventBridge – sending events

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```
{
  "Entries": [
    {
      "Source": "au.com.cevo.eventbridge-demo",
      "DetailType": "OrderCreated",
      "Detail": "{\"key1\": \"value1\", \"key2\": \"value2\" }",
      "Resources": [
        "resource1",
        "resource2"
      ]
    }
  ]
}
```

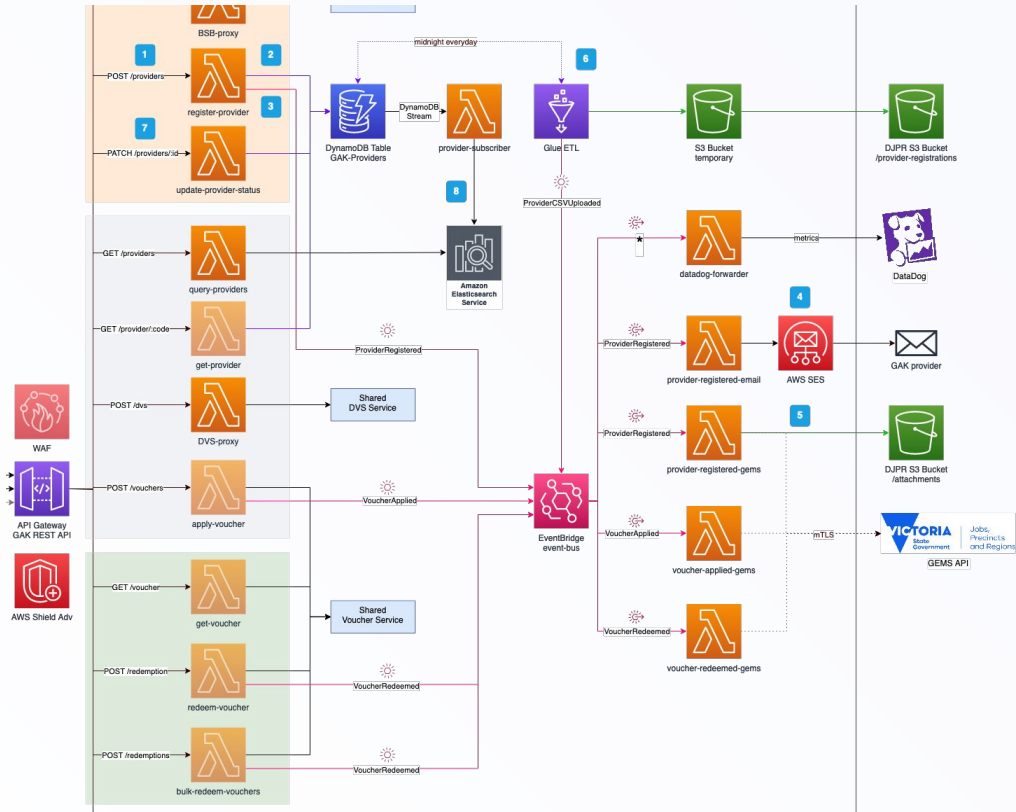
AWS EventBridge – handling events



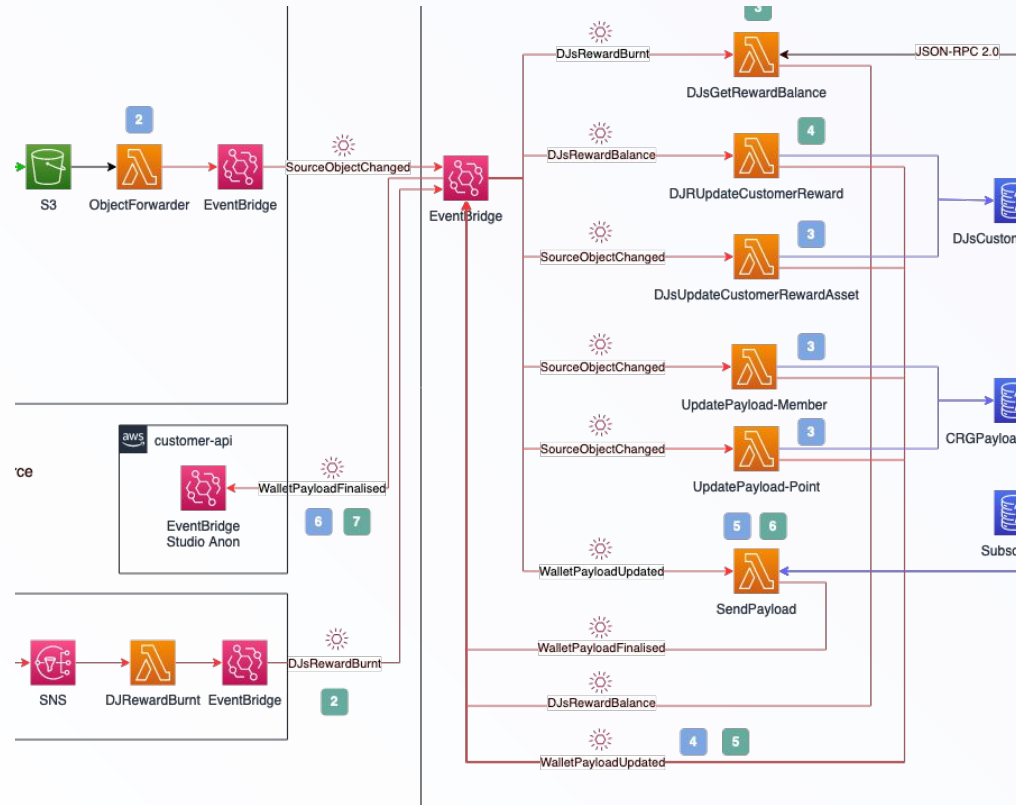
```
{  
  "source": ["au.com.cevo.eventbridge-demo"],  
  "detail-type": ["OrderCreated"]  
}
```

```
{  
  "source": ["au.com.cevo.eventbridge-demo"],  
  "detail-type": ["OrderCreated"],  
  "detail": {  
    "key1": "foo"  
  }  
}
```

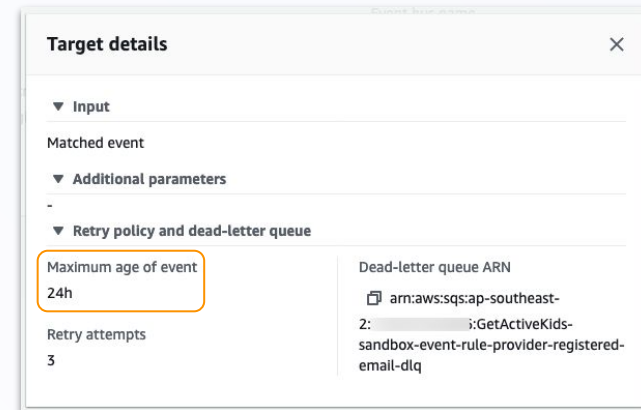
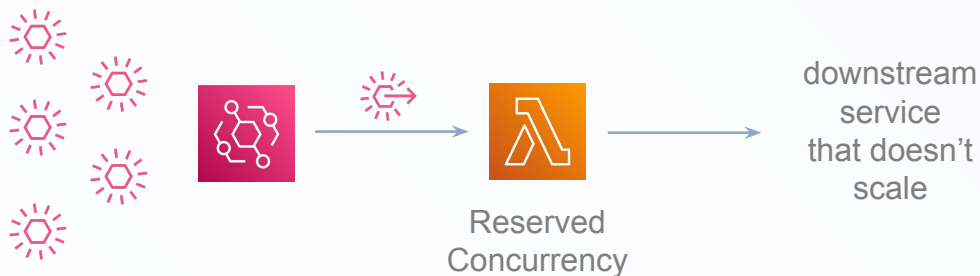

AWS EventBridge



AWS EventBridge

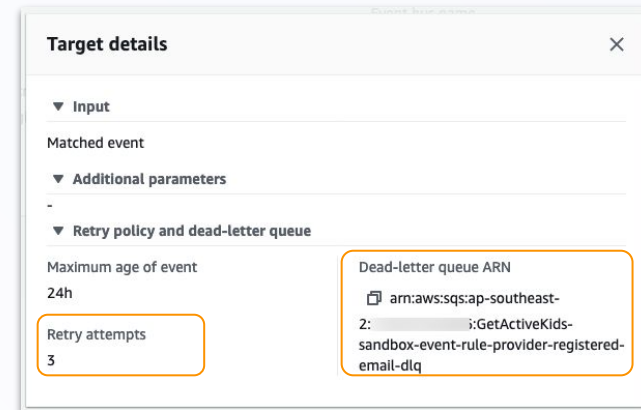
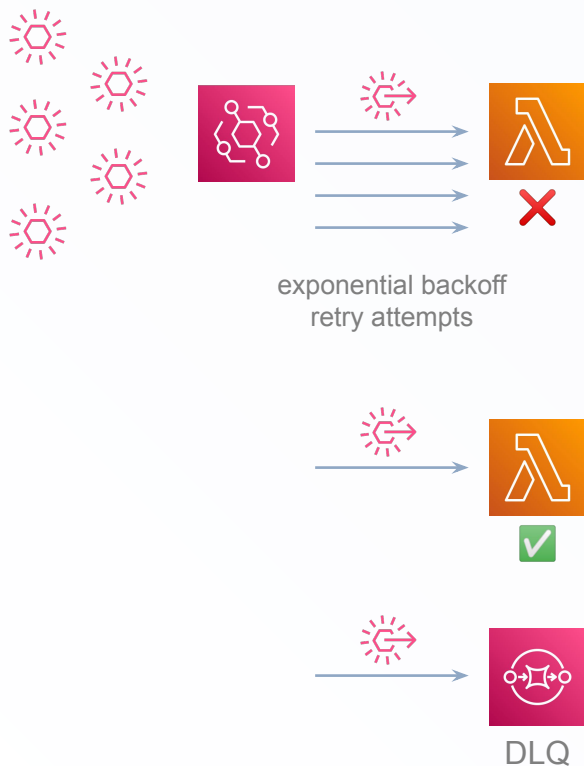


AWS EventBridge – throttling



- maximum age of event: 24 days
- minimum age of event: 1 minute

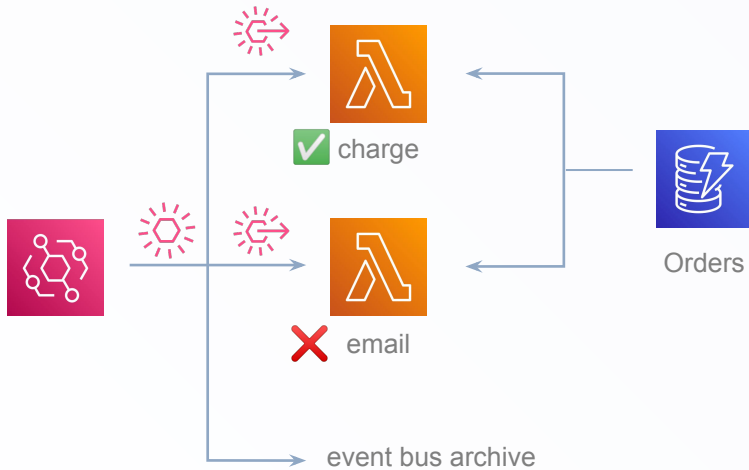
AWS EventBridge – retry & DLQ



- maximum retry attempts: 185

AWS EventBridge – archive & replay

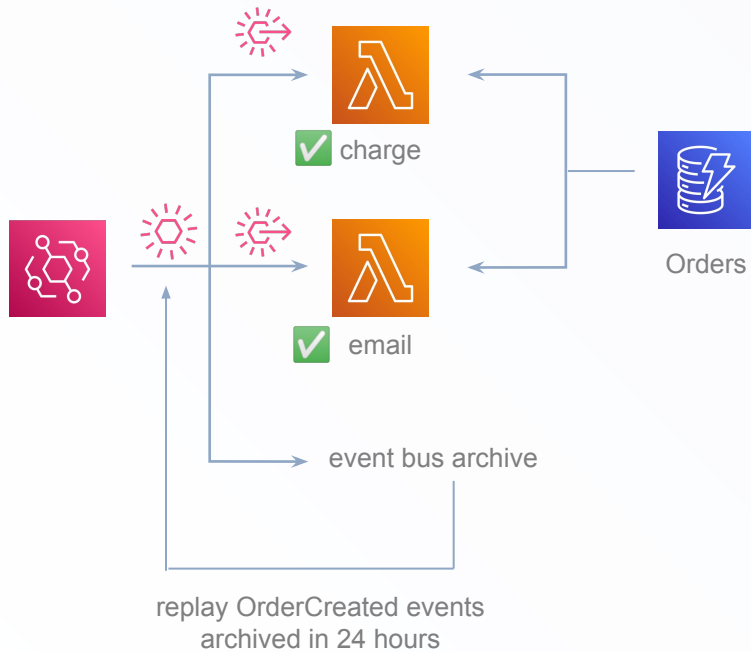
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ID	...	statusEvents
1	...	[{ "status": "order_charged", "timestamp": "2022-02-01T14:48:00.000Z" }]
...

AWS EventBridge – replay & idempotency

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ID	...	statusEvents
1	...	[{ "status": "order_charged", "timestamp": "2022-02-01T14:48:00.000Z" }, { "status": "email_sent", "timestamp": "2022-02-01T14:50:00.000Z" }]
...

Problem:

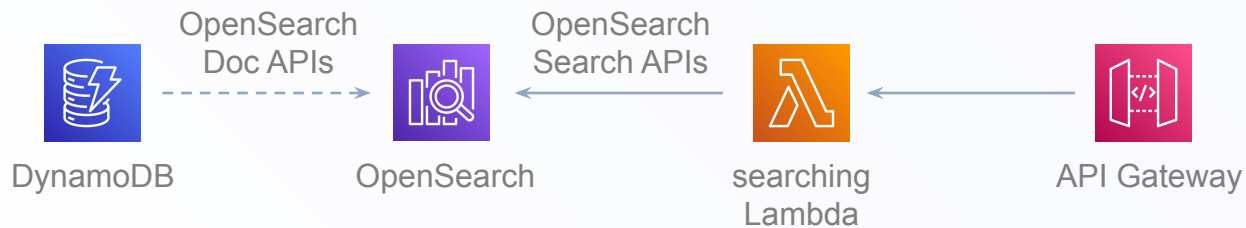
DynamoDB and text-based search

ID	name	description	...
1	Tennis Victoria	Tennis Victoria is the State Sporting Organisation for Tennis in Victoria ...	...
2	ANZ Hot Shots	ANZ Tennis Hot Shots is designed for all kids of age and ability ...	...
3	Australian Rugby Union	Rugby Australia is the sport's national governing body in Australia ...	...
4	RAFA Academy	Play tennis on clay court ...	...
...

```
SELECT *  
FROM company  
WHERE  
    name LIKE '%tennis%'  
OR  
    description LIKE '%tennis%'
```

DynamoDB + OpenSearch

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DynamoDB + OpenSearch



```
PUT company/_doc/1
{
  "name": "Tennis Victoria",
  "description": "Tennis Victoria is the ..."
```

```
PUT company/_doc/2
{
  "name": "ANZ Hot Shots",
  "description": "ANZ Tennis Hot Shots ..."
```

```
PUT company/_doc/3
{
  "name": "Australian Rugby Union",
  "description": "Rugby Australia is ..."
```

...

ID	name	description	...
1	Tennis Victoria	Tennis Victoria is the State Sporting Organisation for Tennis in Victoria ...	...
2	ANZ Hot Shots	ANZ Tennis Hot Shots is designed for all kids of age and ability ...	...
3	Australian Rugby Union	Rugby Australia is the sport's national governing body in Australia ...	...
4	RAFA Academy	Play tennis on clay court ...	...
...

<https://opensearch.org/docs/latest/opensearch/rest-api/document-apis/index/>

DynamoDB + OpenSearch

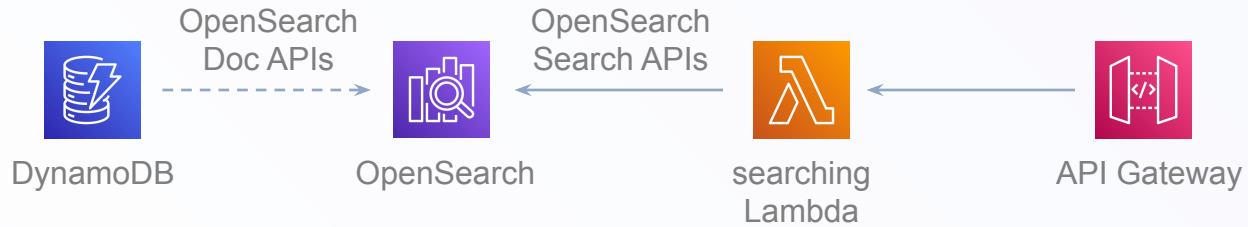
```
POST company/_search
{
  "size": 10,
  "query": {
    "query_string": "**tennis**",
    "fields": ["name", "description"]
  }
}
```

ID	name	description	...
1	Tennis Victoria	Tennis Victoria is the State Sporting Organisation for Tennis in Victoria ...	...
2	ANZ Hot Shots	ANZ Tennis Hot Shots is designed for all kids of age and ability ...	...
3	Australian Rugby Union	Rugby Australia is the sport's national governing body in Australia ...	...
4	RAFA Academy	Play tennis on clay court ...	...
...

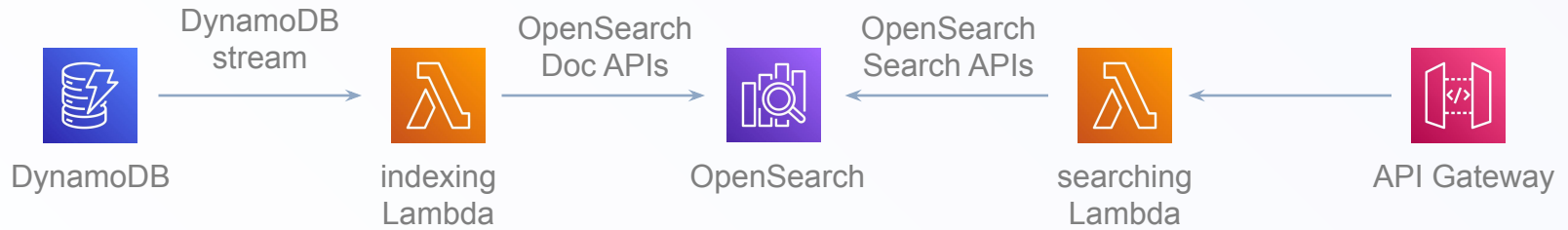
<https://opensearch.org/docs/latest/opensearch/rest-api/search/>

DynamoDB + OpenSearch

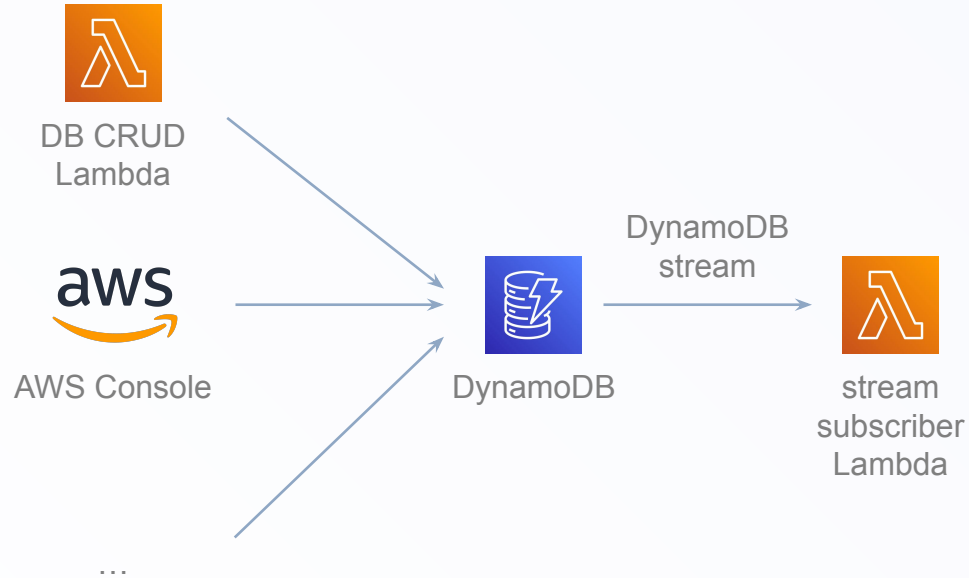
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DynamoDB + OpenSearch



DynamoDB Stream



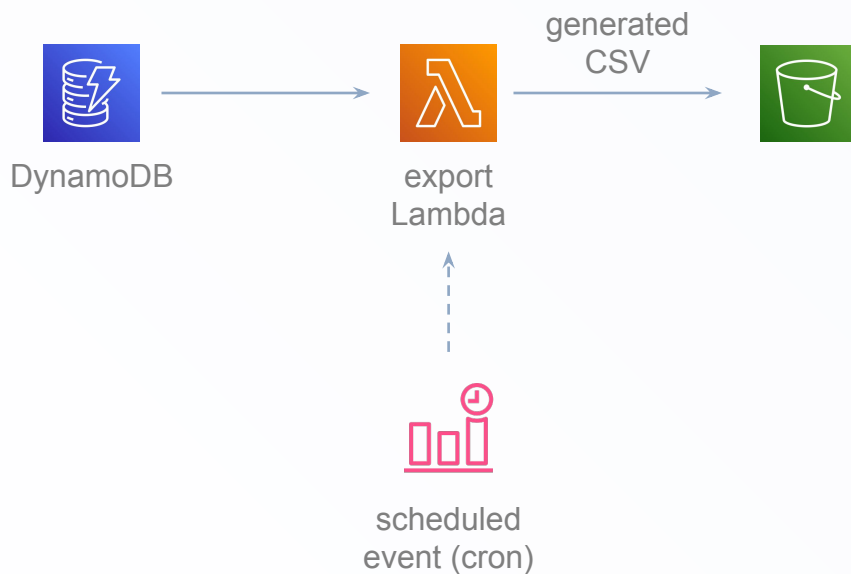
Problem:

DynamoDB
data export



export new
records everyday



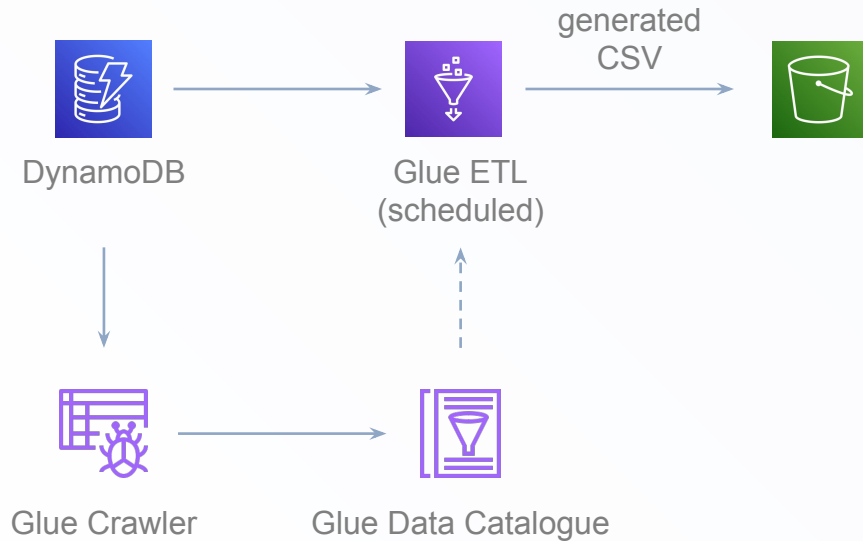


Constraints

- Lambda timeout limit (15mins)
- DynamoDB query limit (100 records/page)

DynamoDB data export – AWS Glue ETL

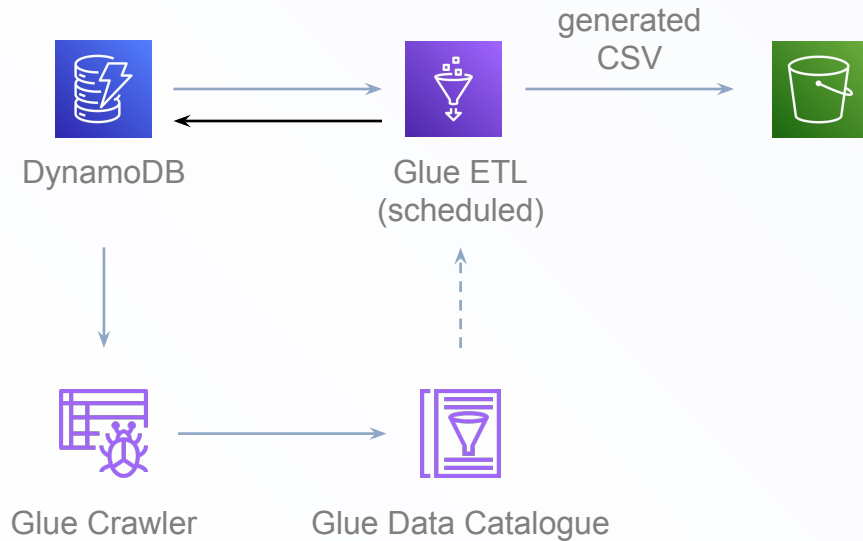
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Benefits

- Longer timeout limit (default 48 hrs)
- Operates on the whole data set
- Python + AWS SDK (Boto3)

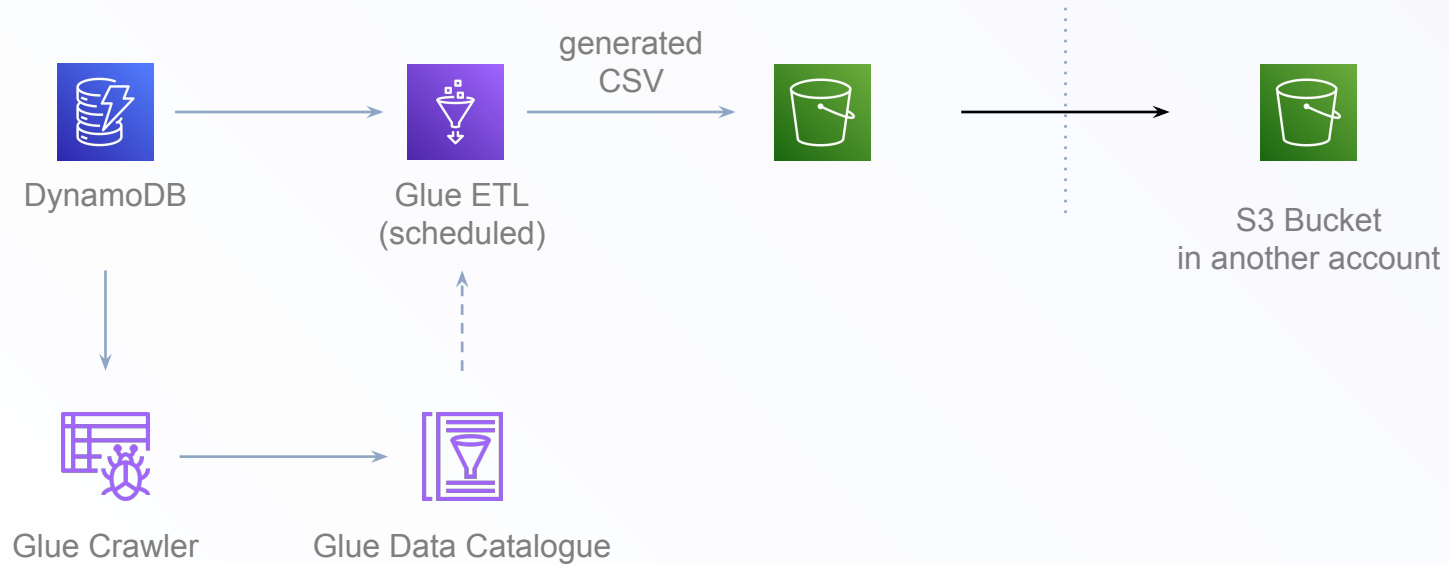
DynamoDB data export – AWS Glue ETL



ID	...	statusEvents
1	...	[{ "status": "csv_exported", "timestamp": "2022-02-01T14:48:00.000Z" }]
2	...	[]]
3	...	[{ "status": "csv_exported", "timestamp": "2022-02-01T14:48:00.000Z" }]
...

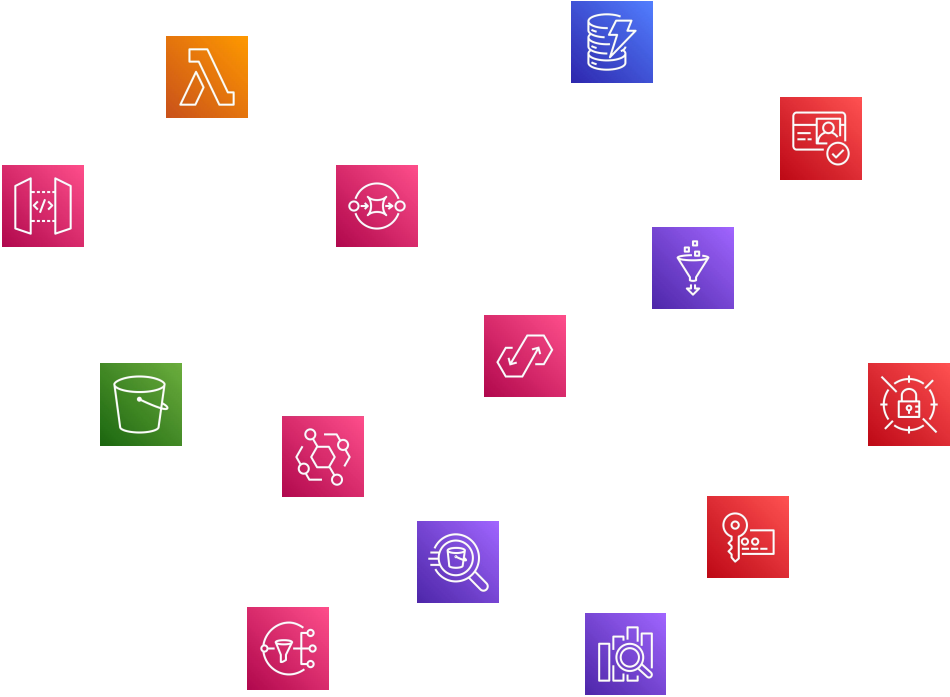
DynamoDB data export – AWS Glue ETL

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Problem:

Testing many moving parts



Testing Serverless Solution - integration test cevo

Deploy and test with real cloud services



Jest



Cucumber

...

Testing Serverless Solution - test downstream



send a request POST /orders

assert response: status code, payload

assert data changes in DynamoDB through AWS SDK

assert objects in S3 bucket through AWS SDK

assert impacts on downstream services though _____ API/SDK

There are more

...

- Authorise API Gateway with AWS Cognito User Pool and triggers
- Query and update large amount of DynamoDB records with AWS Athena
- Break through 15-min Lambda timeout limit with “hand-off” pattern
- Use AWS AppFlow to transfer data from SaaS production such as Salesforce
- ...

Takeaway from this talk

- Serverless \neq Lambda
- Constraints & solutions in serverless ecosystem
- Design event-driven serverless solutions
- Testing serverless solutions

Takeaway from this talk

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fs

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The Map Is Not the Territory

The Great Mental Models Volumes [One](#) and [Two](#) are out.
Learn more about [the project here](#).

The map of reality is not reality. Even the best maps are imperfect. That's because they are reductions of what they represent. If a map were to represent the territory with perfect fidelity, it would no longer be a reduction and thus would no longer be useful to us. A map can also be a snapshot of a point in time, representing something that no longer exists. This is important to keep in mind as we think through problems and make better decisions.

"The map appears to us more real than the land."

— D.H. LAWRENCE

<https://fs.blog/map-and-territory/>

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