What is streaming and why does it matter?

STREAMING DATA WITH AWS KINESIS AND LAMBDA

Maksim Pecherskiy
Data Engineer

Batch vs stream

Batch vs stream

Batch

- ~~"Better"~~
- Larger datasets
- More complex analysis
- Slower moving data
- Ex. Daily sales report
- Ex. Forecasting next month's sales
- Ex. Churn prediction

Stream

- ~~"Cooler"~~
- Simpler analysis: aggregation / filtering
- Individual records / micro batches
- Data moves FAST
- Ex. Fraud detection
- Ex. Monitoring wind turbines
- Ex. Real time alerting

Cody and the fleet

Cody

The Fleet

Telematics streaming

Amazon Kinesis

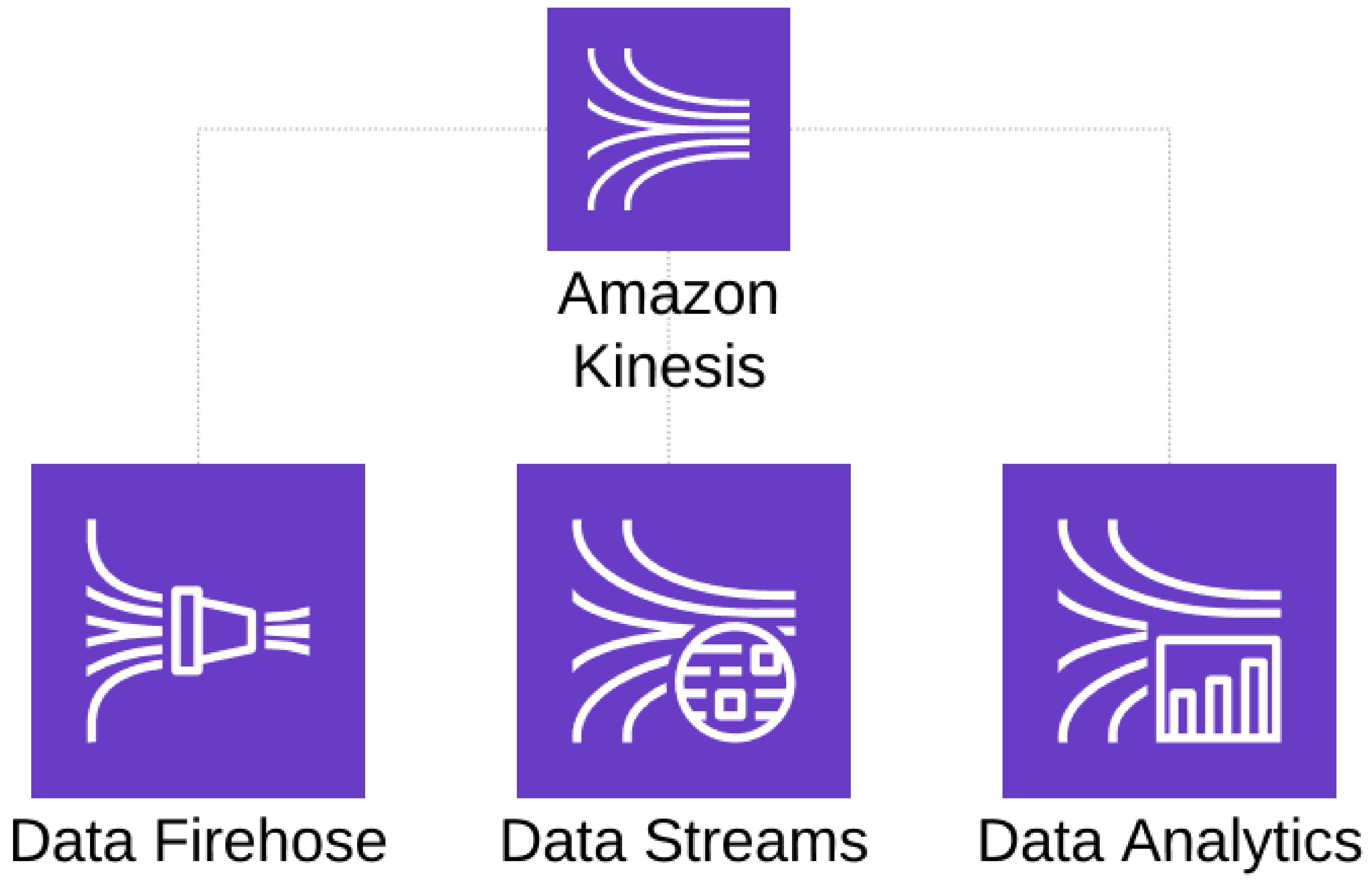
AWS Lambda

Amazon S3

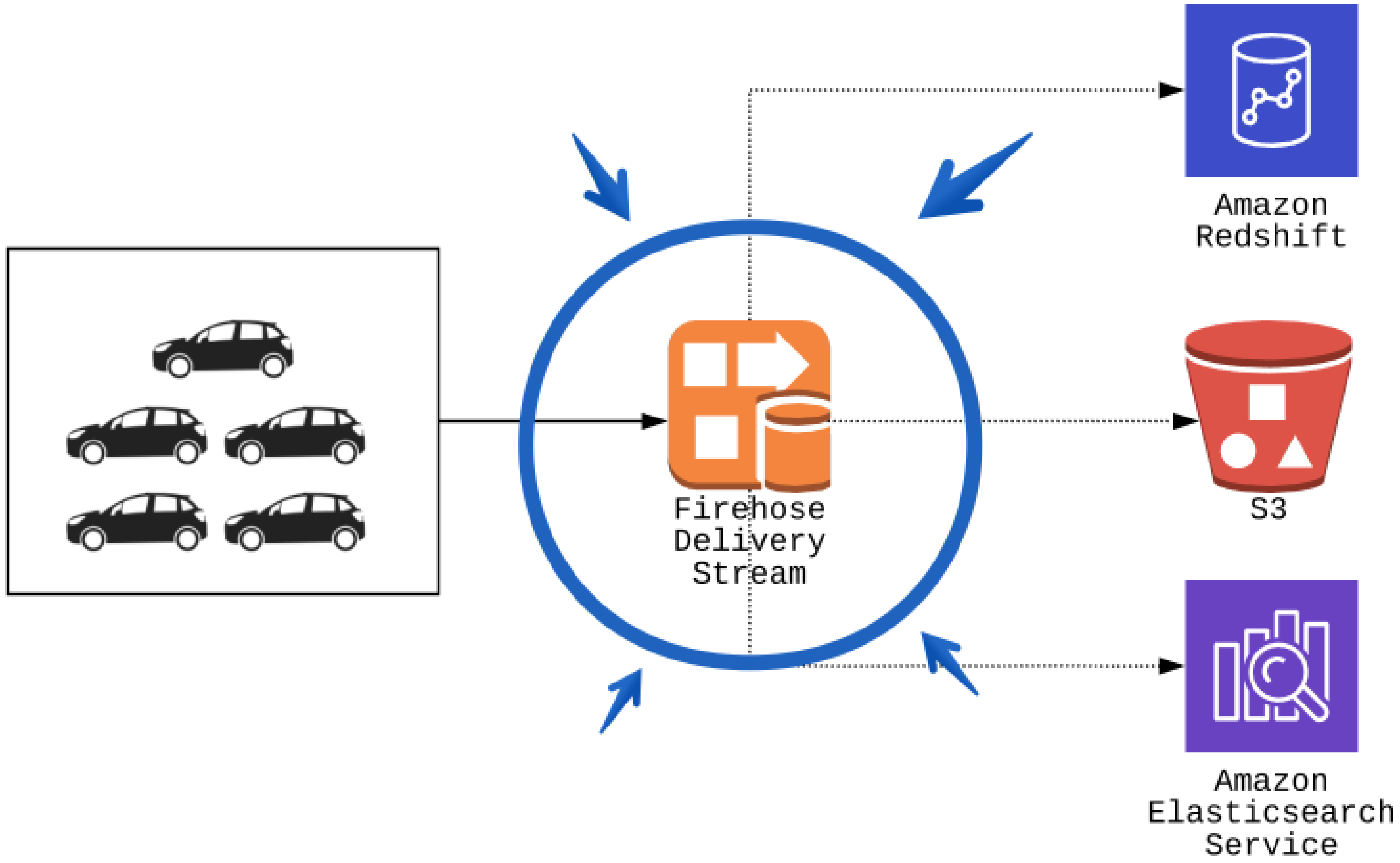
IAM

Amazon SNS

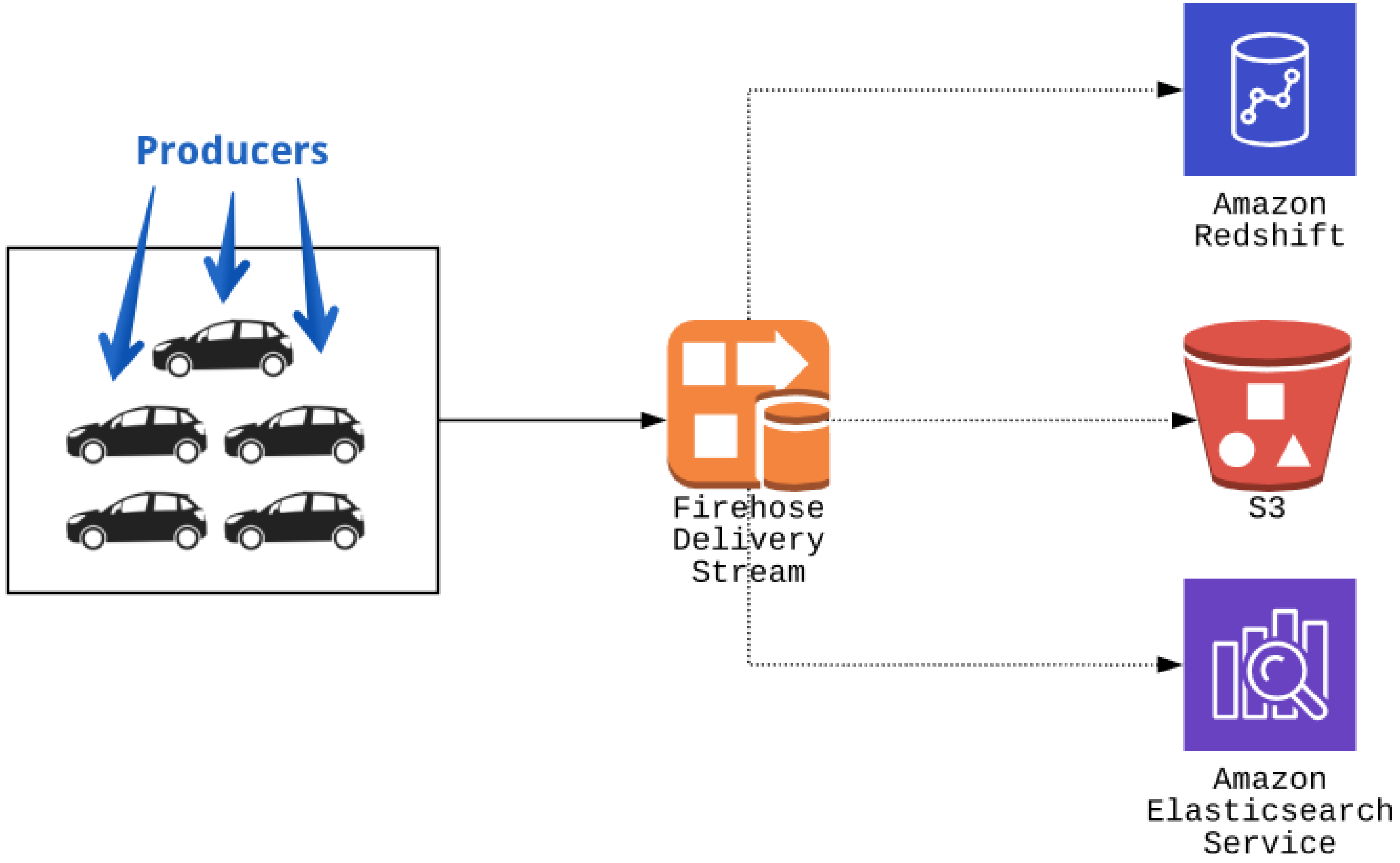
AWS Kinesis



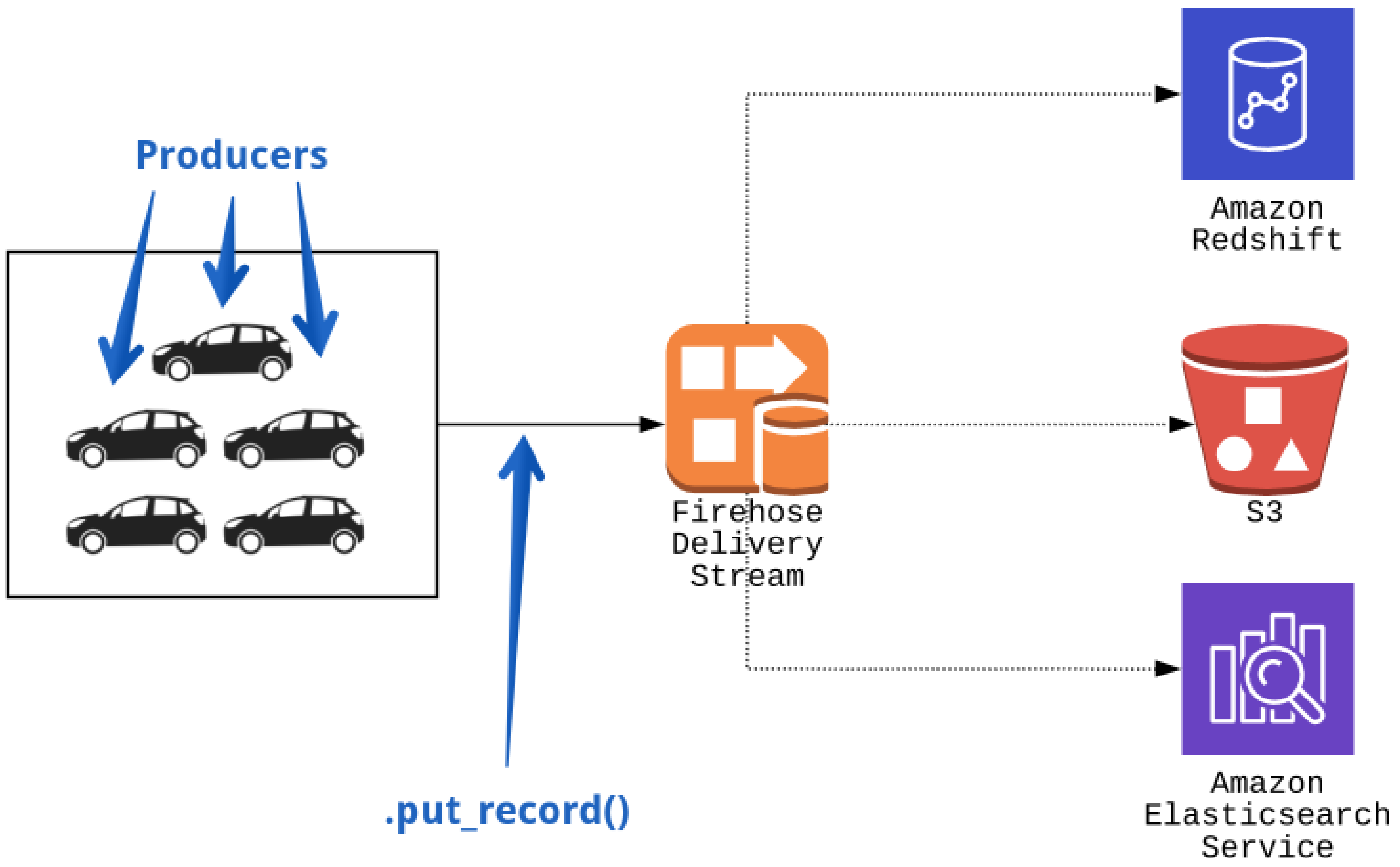
Data Firehose



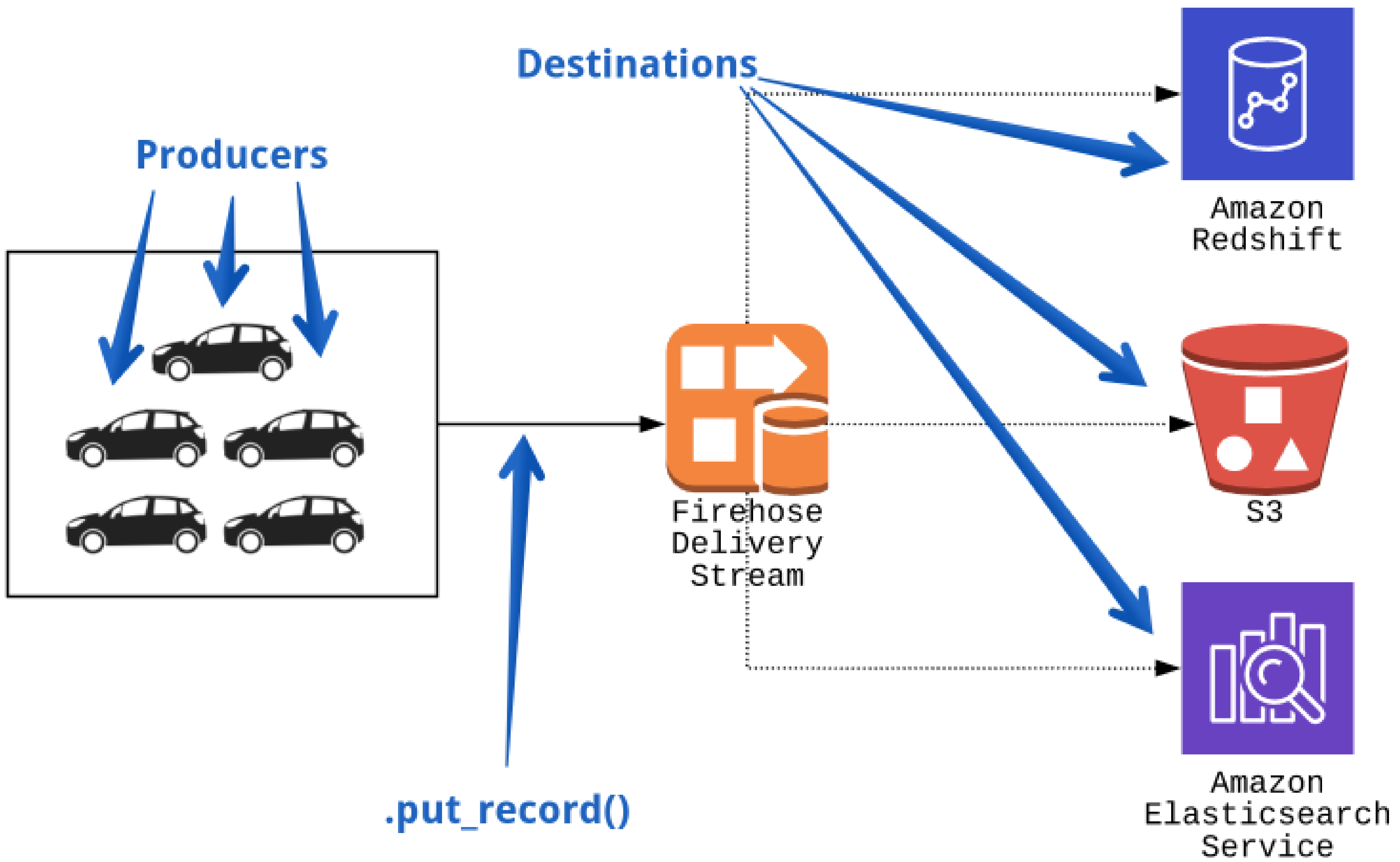
Delivery streams



Delivery streams



Delivery streams



Creating a Firehose client

```python
import boto3
firehose = boto3.client('firehose',
                        aws_access_key_id=AWS_KEY_ID,
                        aws_secret_access_key=AWS_SECRET,
                        region_name='us-east-1')
```

Working with delivery streams

```python
# Show created delivery streams
response = firehose.list_delivery_streams()
print(response['DeliveryStreamNames'])
```

```
['old-delivery-stream1', 'a-test-stream']
```

Delete streams

```python
# Show created delivery streams
response = firehose.list_delivery_streams()
# Delete them all!
for stream_name in response['DeliveryStreamNames']:
      firehose.delete_delivery_stream(DeliveryStreamName=stream_name)
```

Review

- Batch vs stream
- Cody and telematics collection
- AWS Kinesis
- Kinesis Firehose Delivery Streams
- AWS Kinesis Data Firehose
- List and delete Firehose delivery streams
- Producer -> data generator
- Destination -> where the data is going

Let's practice!

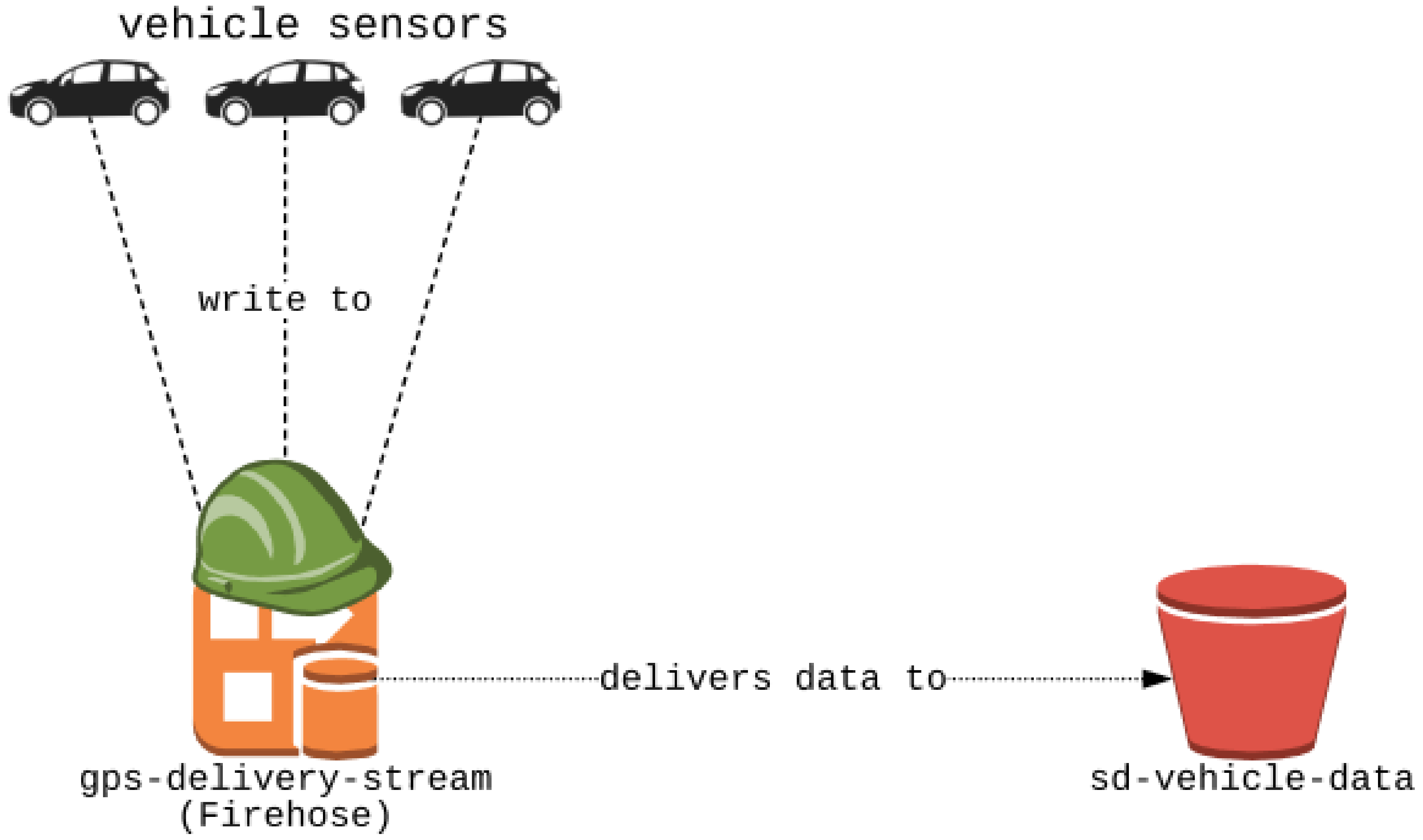
STREAMING DATA WITH AWS KINESIS AND LAMBDA

Getting ready for the first stream

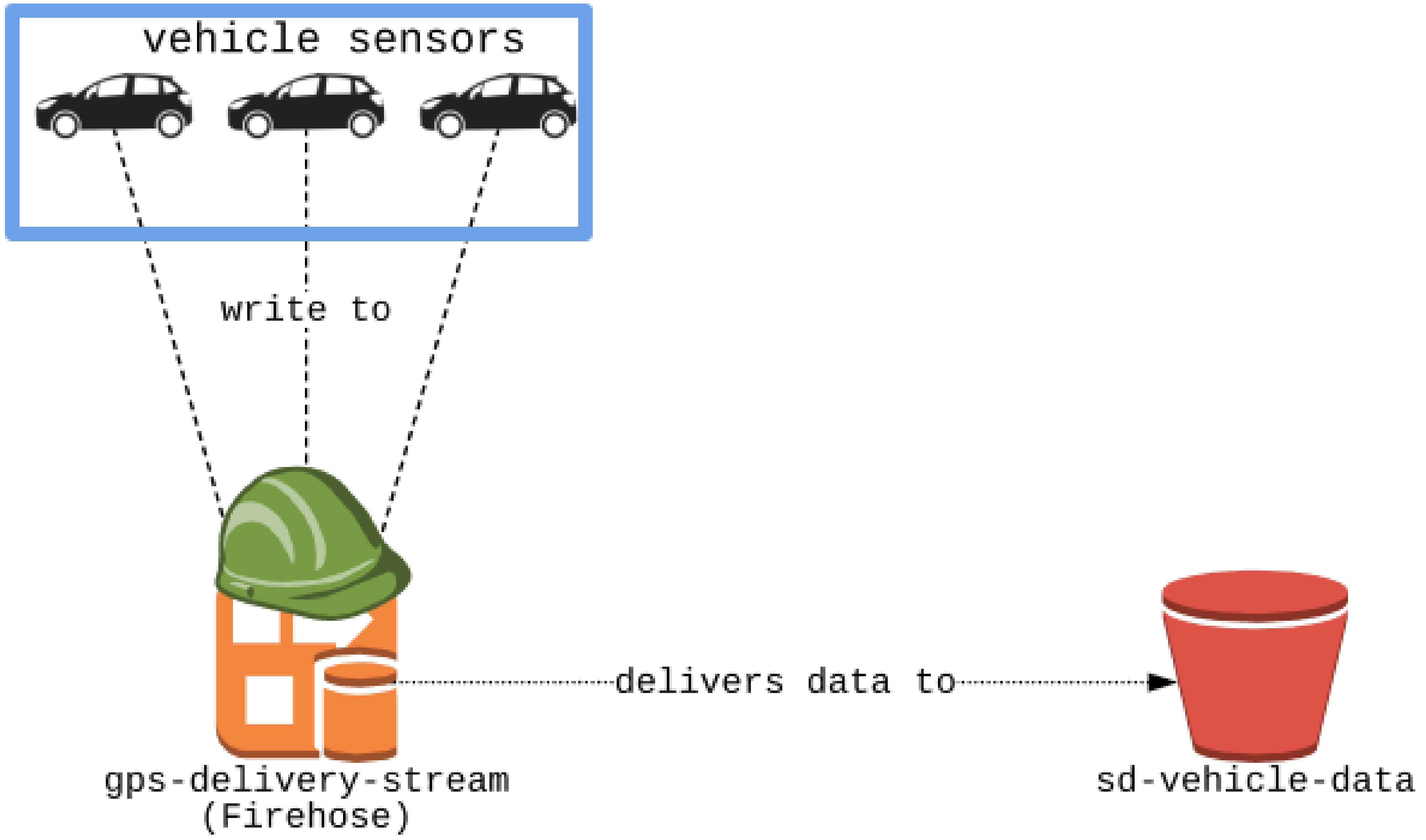
STREAMING DATA WITH AWS KINESIS AND LAMBDA

Maksim Pecherskiy
Data Engineer

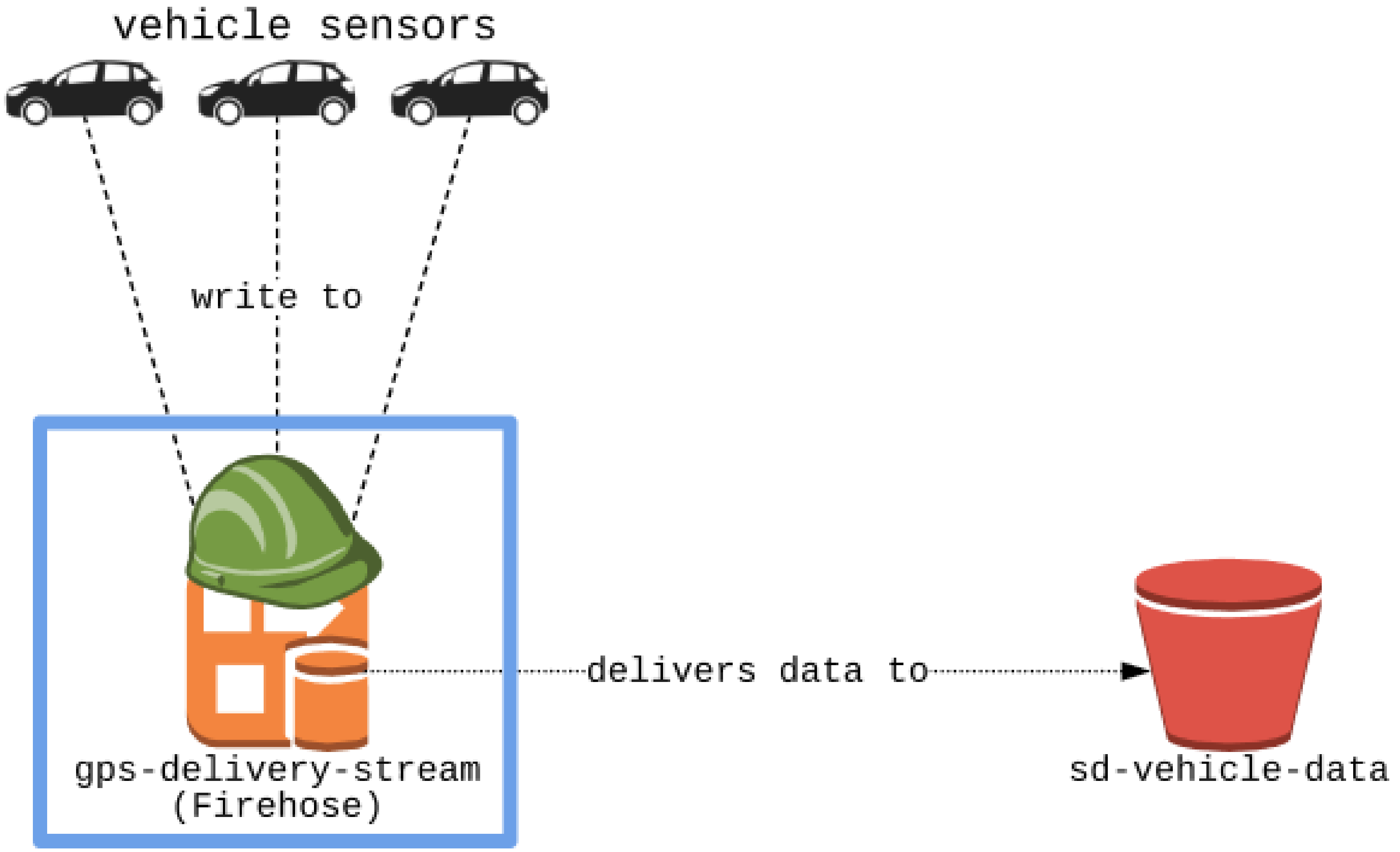
End goal


vehicle sensors
write to
delivers data to
gps-delivery-stream
(Firehose)
sd-vehicle-data

End goal


vehicle sensors
write to
gps-delivery-stream
(Firehose)
delivers data to
sd-vehicle-data

End goal


vehicle sensors
write to
gps-delivery-stream
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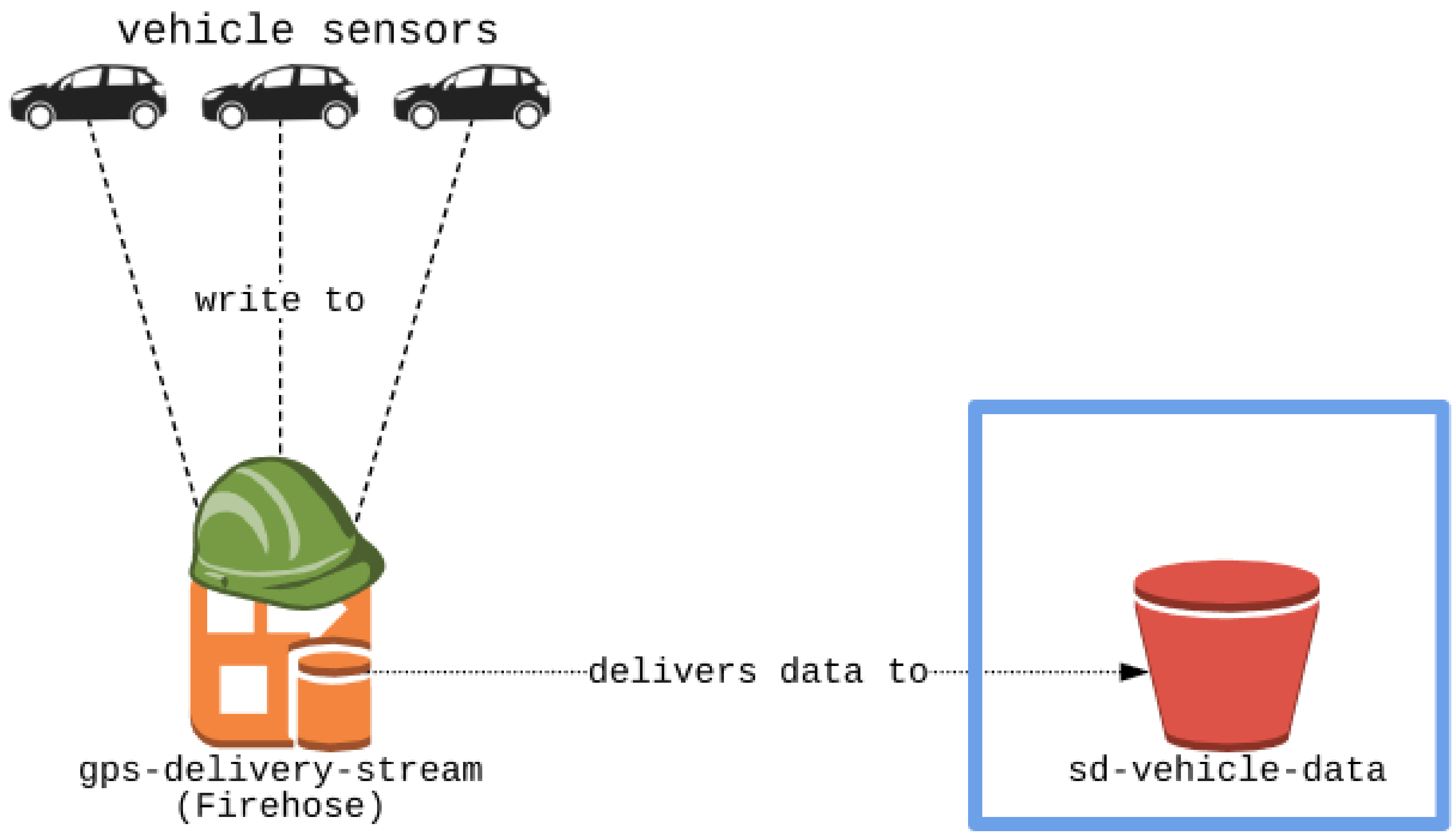
sd-vehicle-data

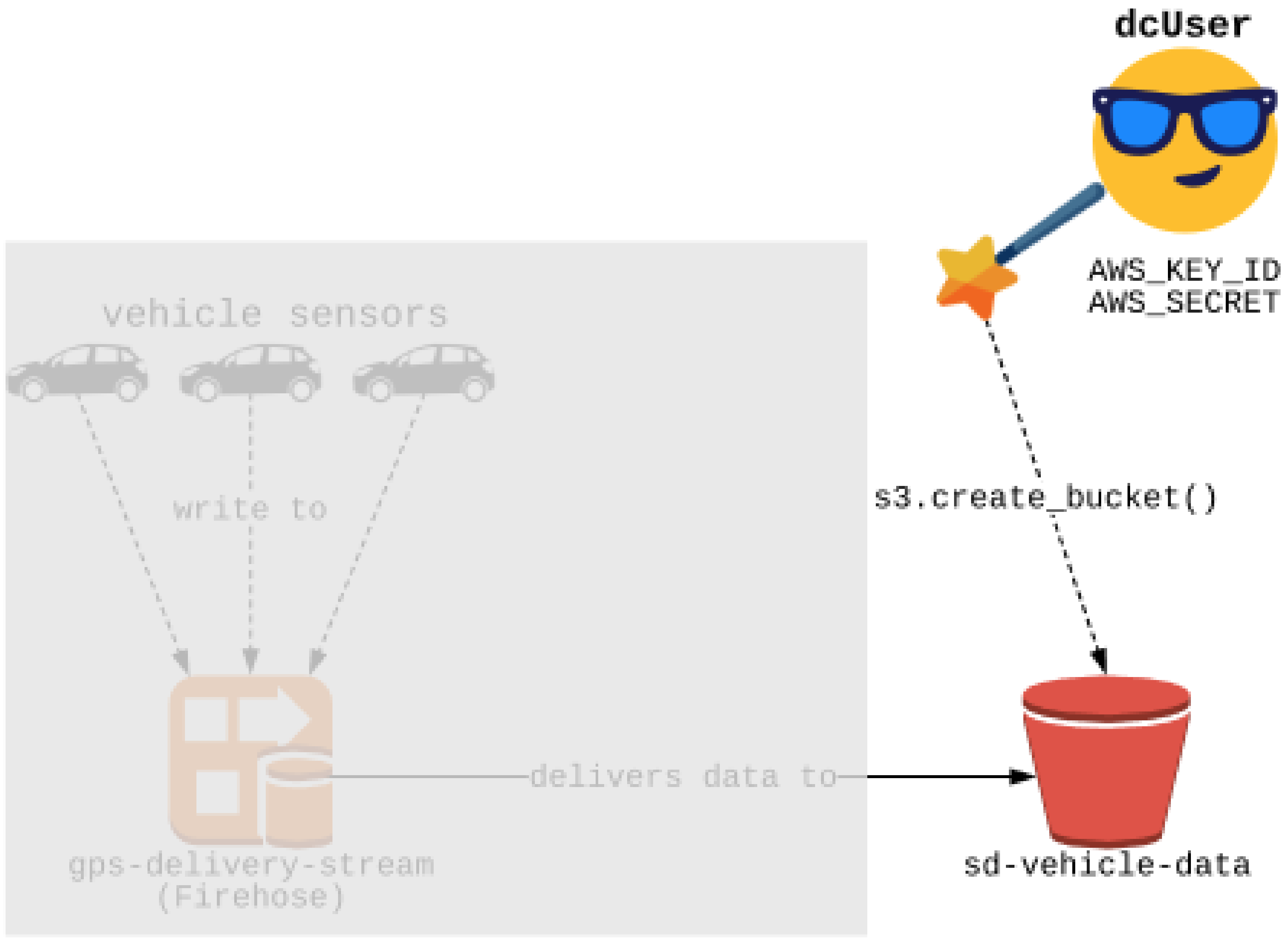
End goal


vehicle sensors
write to
delivers data to
gps-delivery-stream
(Firehose)
sd-vehicle-data

dcUser

AWS_KEY_ID
AWS_SECRET

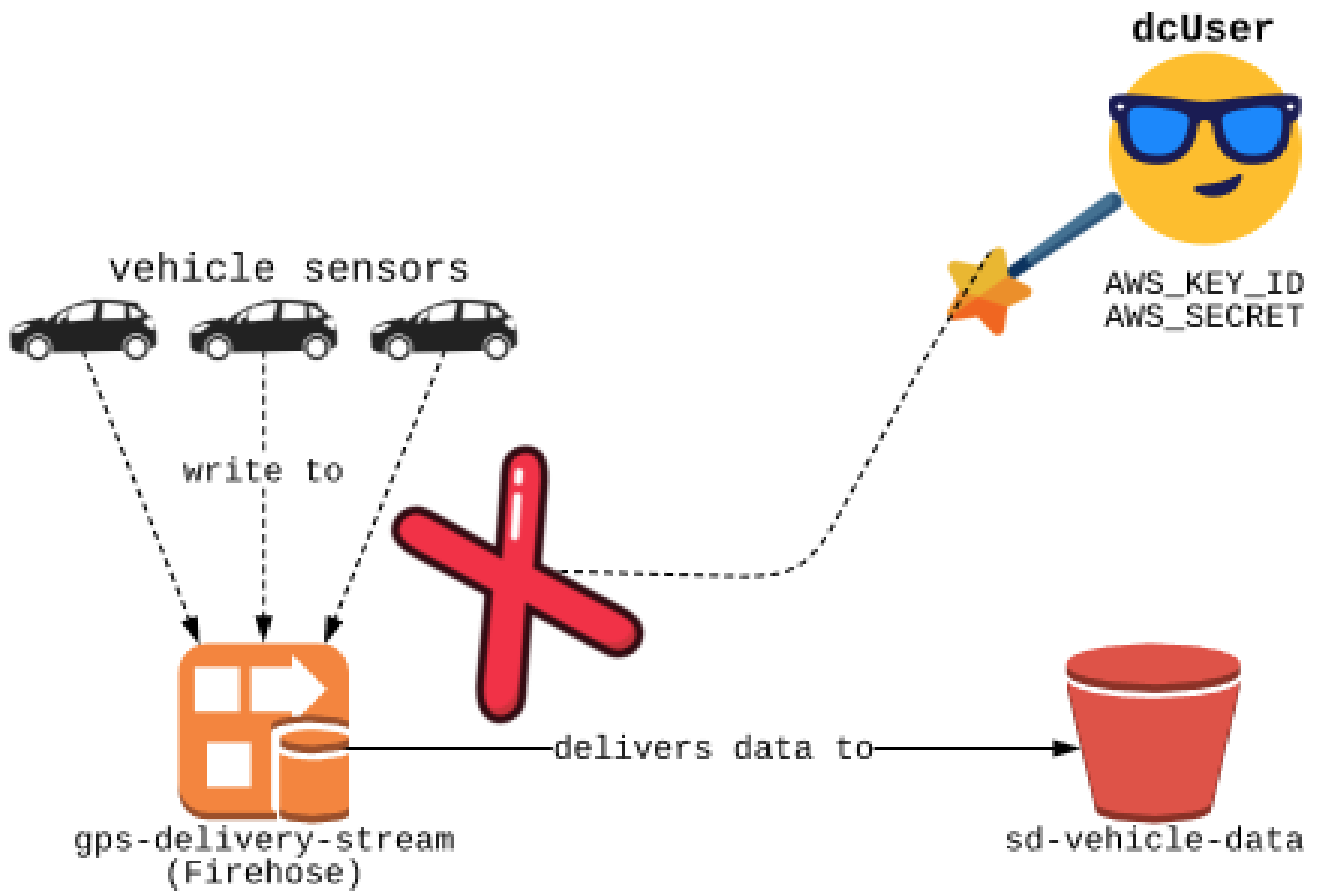
dcUser

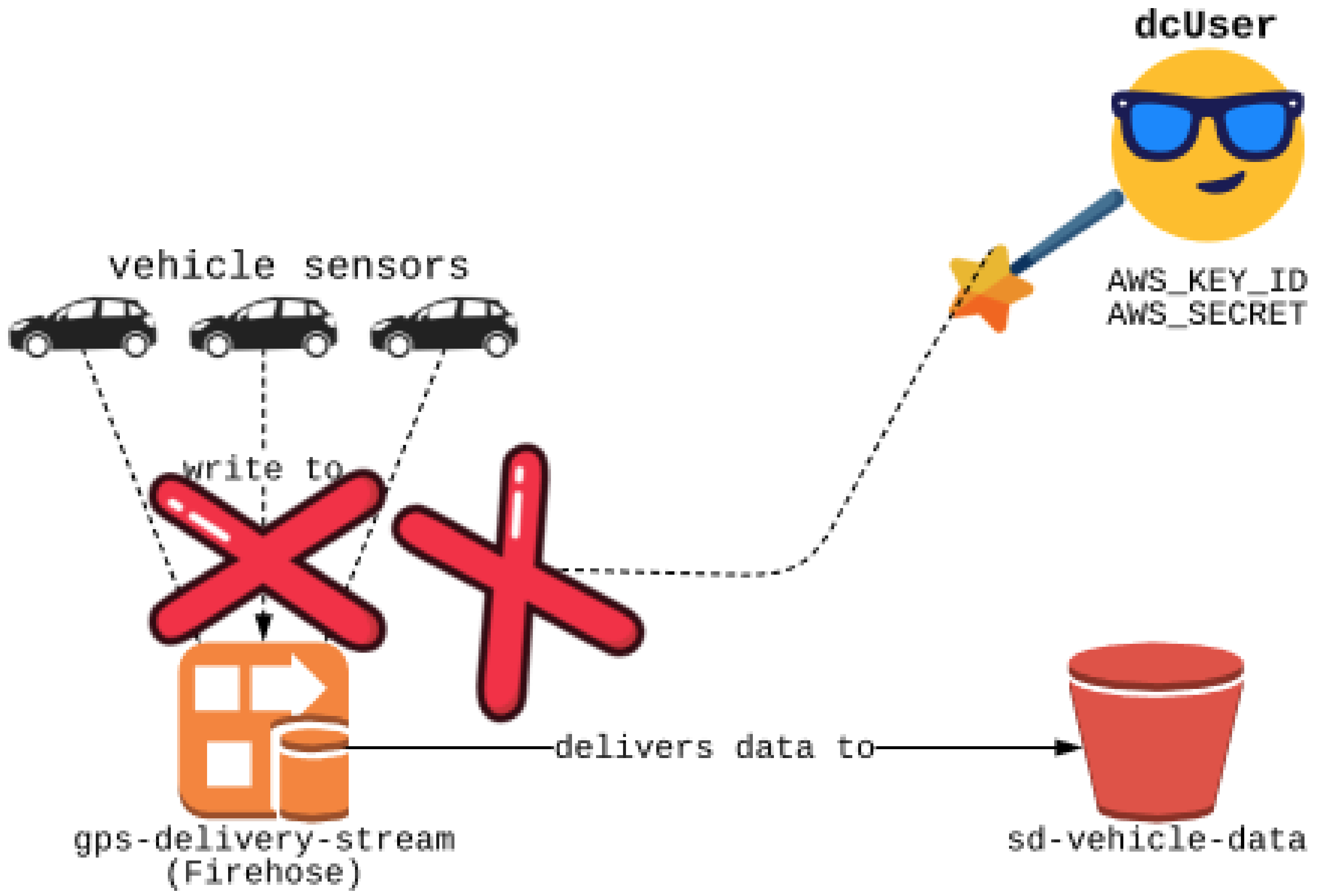

dcUser
AWS_KEY_ID
AWS_SECRET
vehicle sensors
write to
s3.create_bucket()
delivers data to
gps-delivery-stream
(Firehose)
sd-vehicle-data

A destination S3 bucket

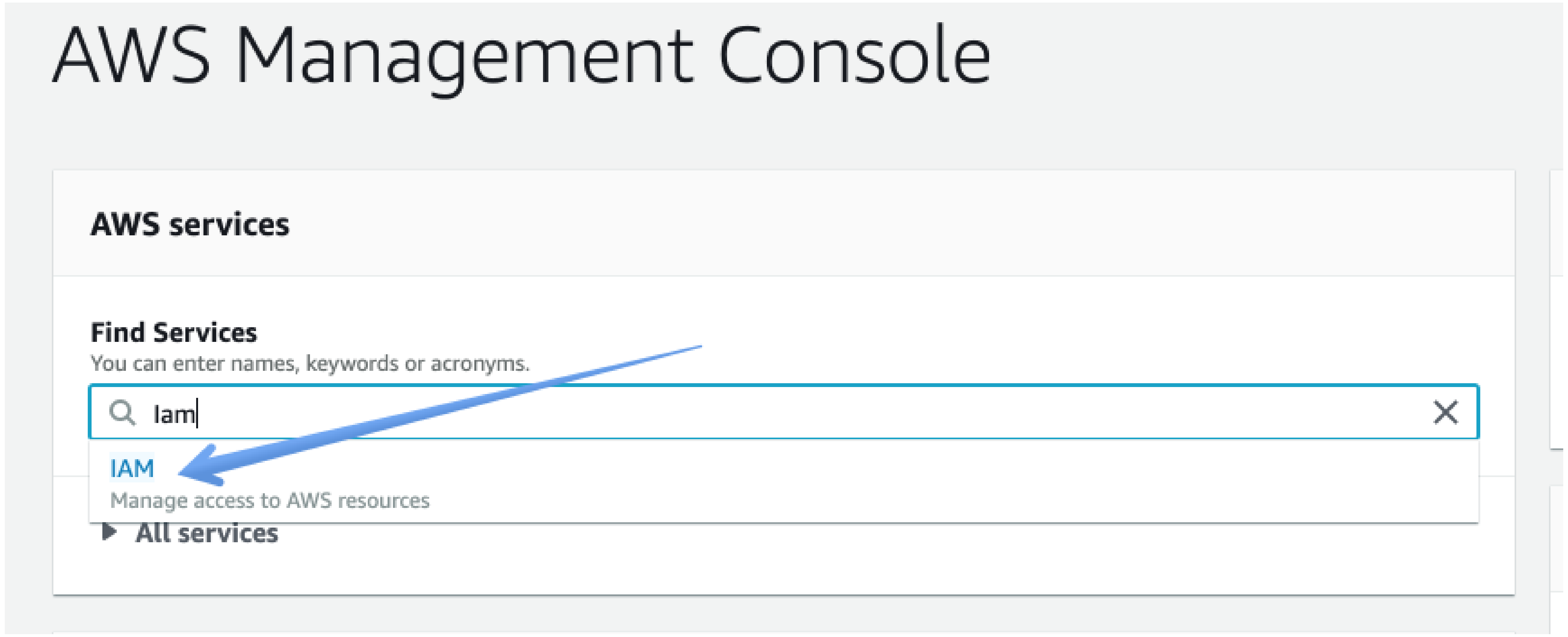
```
s3 = boto3.client('s3',
                  aws_access_key_id=AWS_KEY_ID,
                  aws_secret_access_key=AWS_SECRET,
                  region_name='us-east-1')
```

```
s3.create_bucket(Bucket='sd-vehicle-data')
```


dcUser
AWS_KEY_ID
AWS_SECRET
vehicle sensors
write to
delivers data to
gps-delivery-stream
(Firehose)
sd-vehicle-data


dcUser
AWS_KEY_ID
AWS_SECRET
vehicle sensors
write to
delivers data to
gps-delivery-stream
(Firehose)
sd-vehicle-data

Add permissions to user



AWS Management Console

AWS services

Find Services

You can enter names, keywords or acronyms.

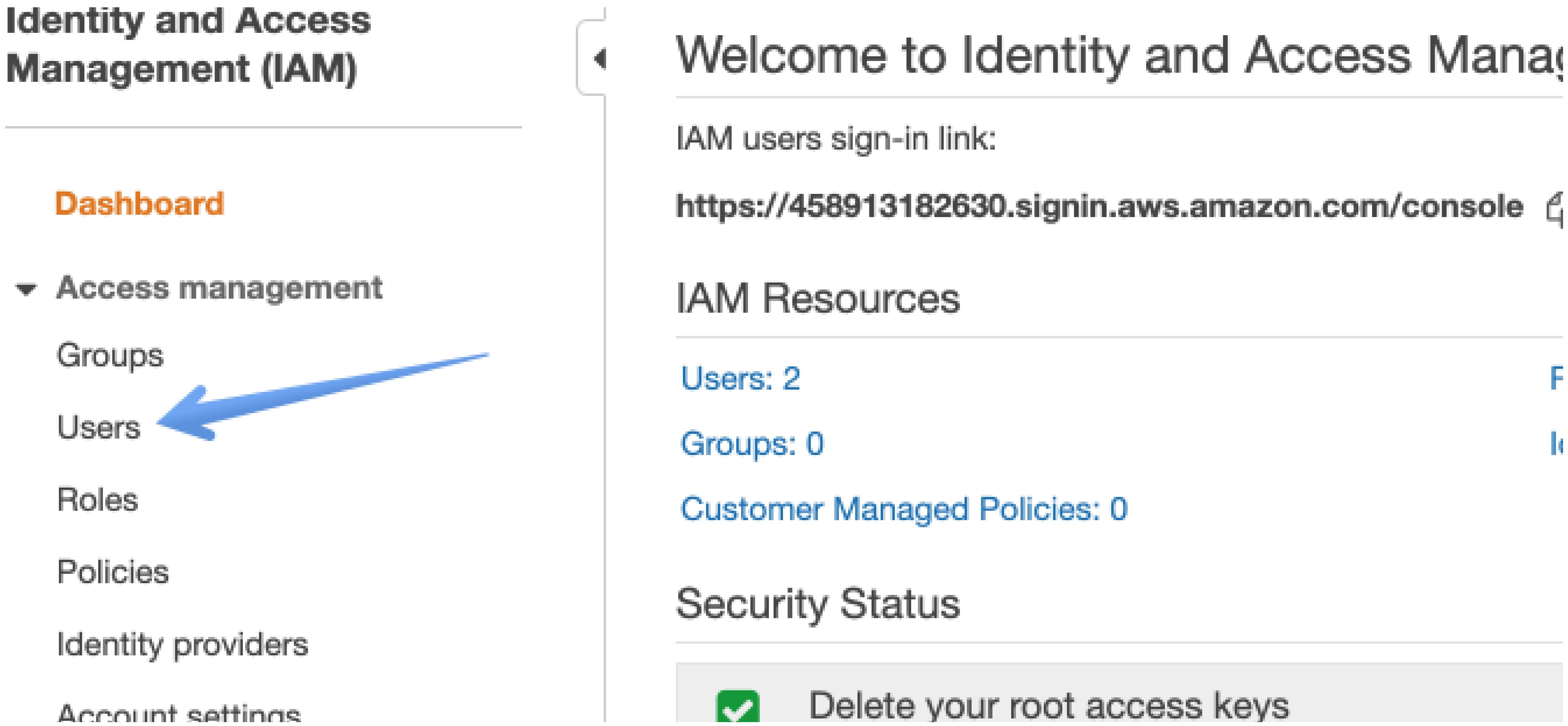
Iam

IAM

Manage access to AWS resources

▶ All services

Add permissions to user



Identity and Access Management (IAM)

Dashboard

Access management

Groups

Users

Roles

Policies

Identity providers

Account settings

Welcome to Identity and Access Mana

IAM users sign-in link:

https://458913182630.signin.aws.amazon.com/console

IAM Resources

Users: 2

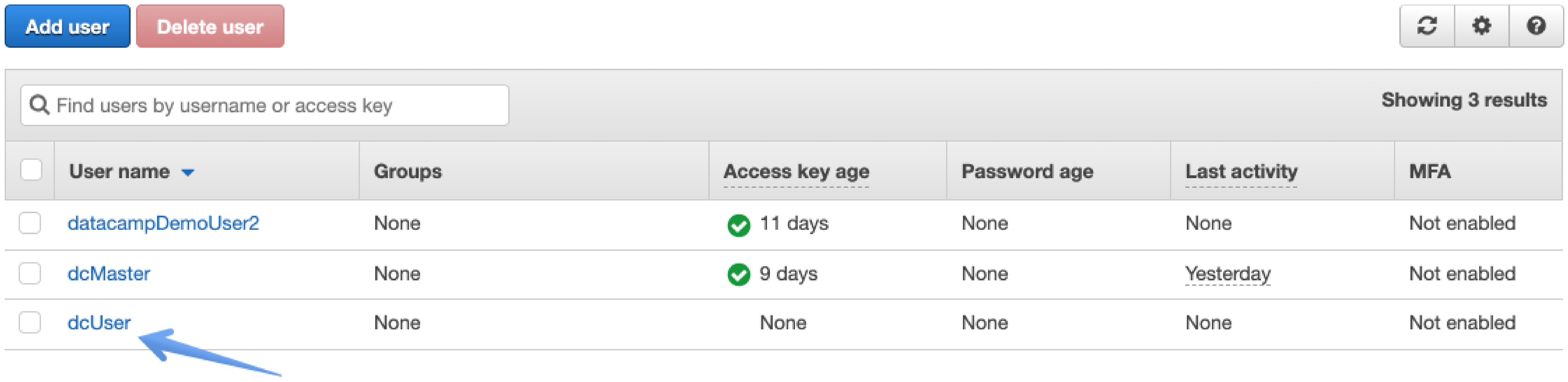
Groups: 0

Customer Managed Policies: 0

Security Status

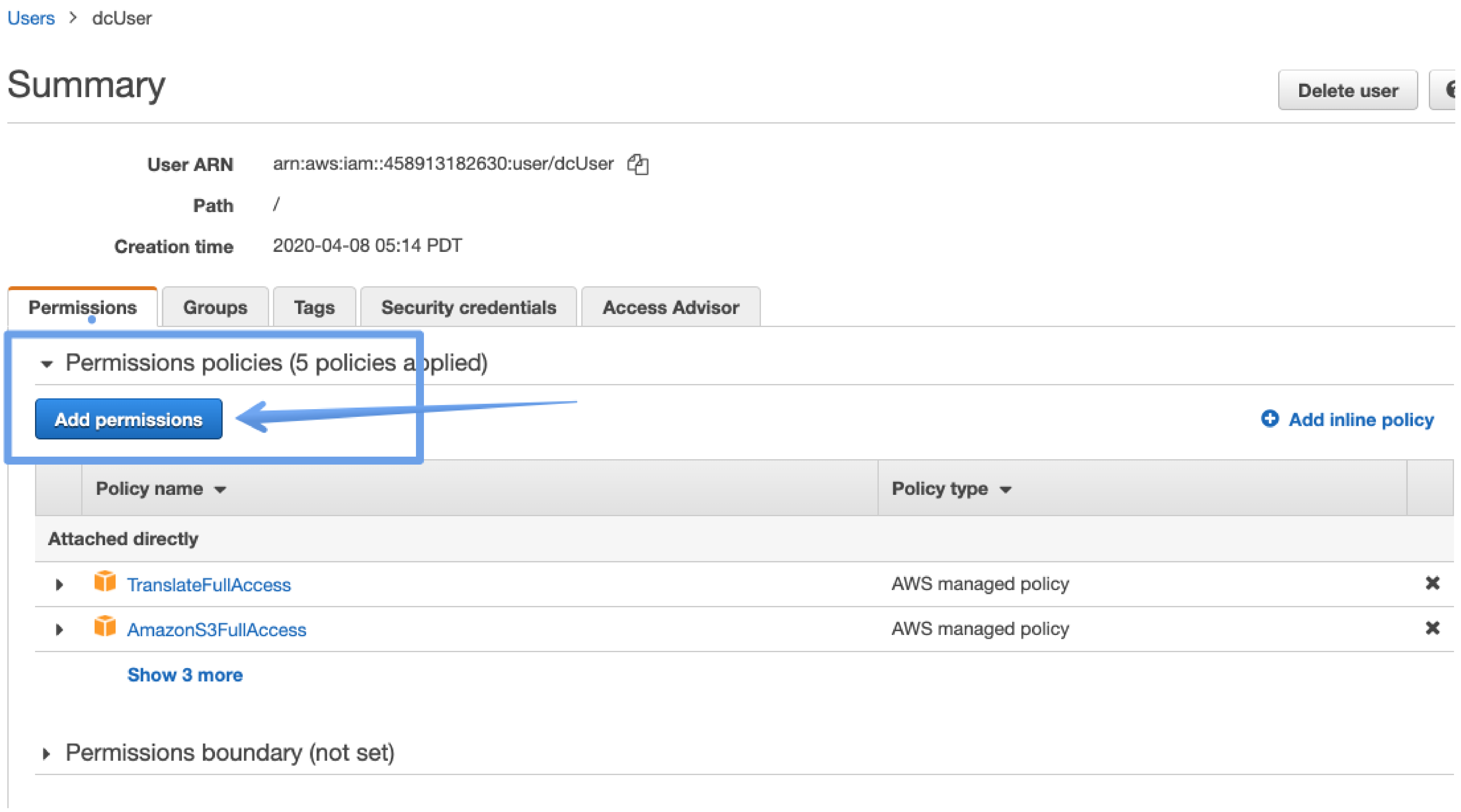
✓ Delete your root access keys

Add permissions to user



User name	Groups	Access key age	Password age	Last activity	MFA
datacampDemoUser2	None	✓ 11 days	None	None	Not enabled
dcMaster	None	✓ 9 days	None	Yesterday	Not enabled
dcUser	None	None	None	None	Not enabled

Add permissions to user



Users > dcUser

Summary

Delete user

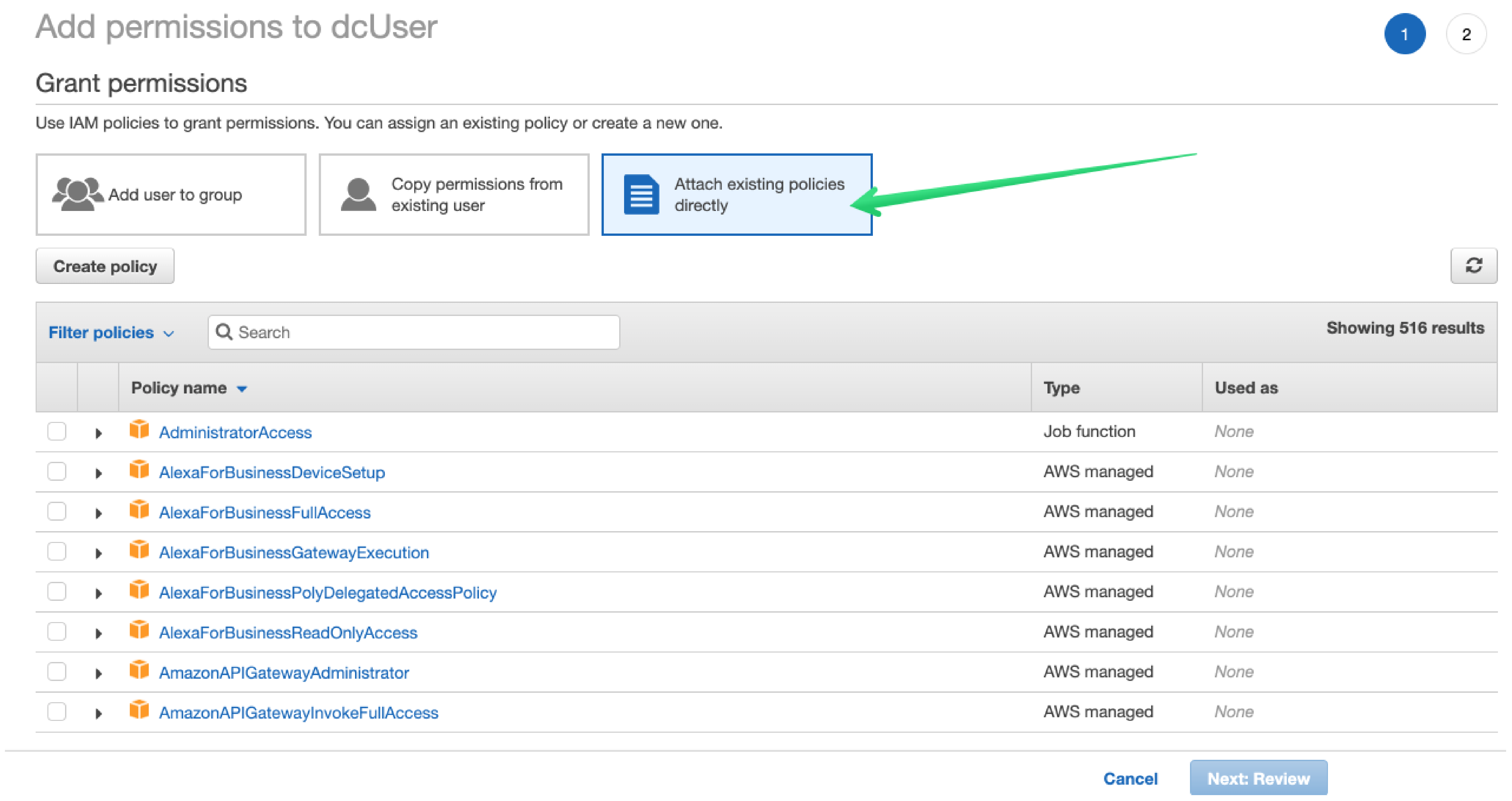
User ARN	arn:aws:iam::458913182630:user/dcUser
Path	/
Creation time	2020-04-08 05:14 PDT

Permissions policies (5 policies applied)

Policy name	Policy type
Attached directly	
TranslateFullAccess	AWS managed policy
AmazonS3FullAccess	AWS managed policy

Permissions boundary (not set)

Add permissions to user



Add permissions to dcUser

Grant permissions

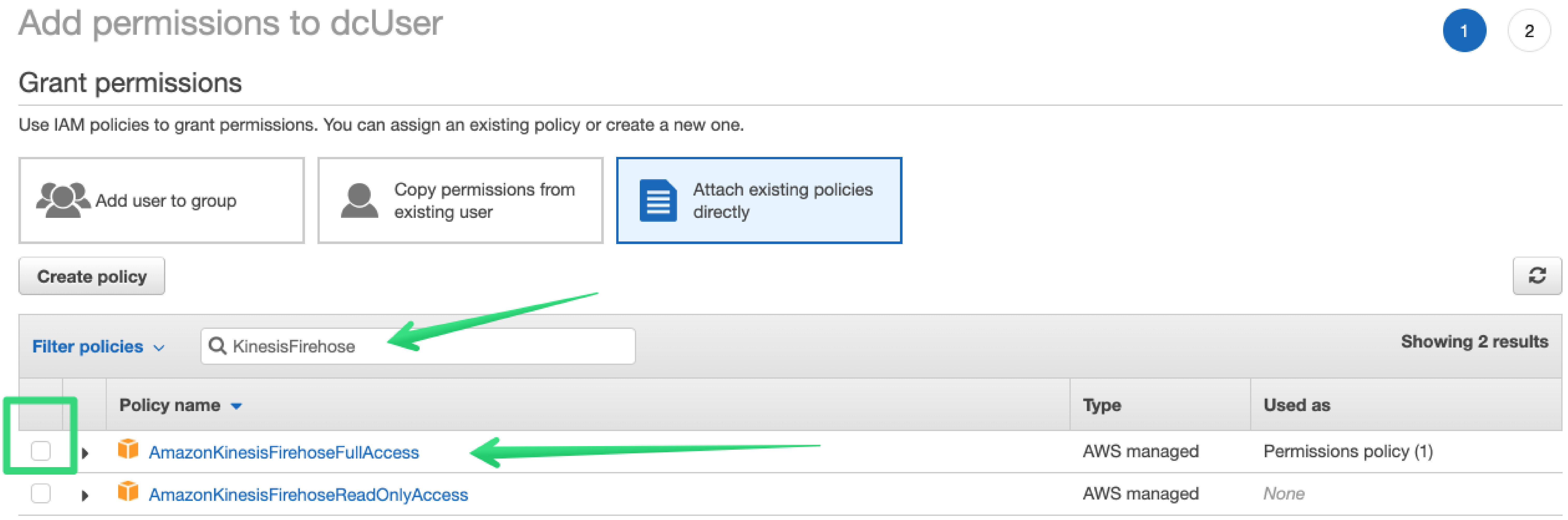
Use IAM policies to grant permissions. You can assign an existing policy or create a new one.

Add user to group
Copy permissions from existing user
Attach existing policies directly
Create policy
Filter policies
Search

Showing 516 results

	Policy name	Type	Used as
☐	AdministratorAccess	Job function	None
☐	AlexaForBusinessDeviceSetup	AWS managed	None
☐	AlexaForBusinessFullAccess	AWS managed	None
☐	AlexaForBusinessGatewayExecution	AWS managed	None
☐	AlexaForBusinessPolyDelegatedAccessPolicy	AWS managed	None
☐	AlexaForBusinessReadOnlyAccess	AWS managed	None
☐	AmazonAPIGatewayAdministrator	AWS managed	None
☐	AmazonAPIGatewayInvokeFullAccess	AWS managed	None

Add permissions to user



Add permissions to dcUser

Grant permissions

Use IAM policies to grant permissions. You can assign an existing policy or create a new one.

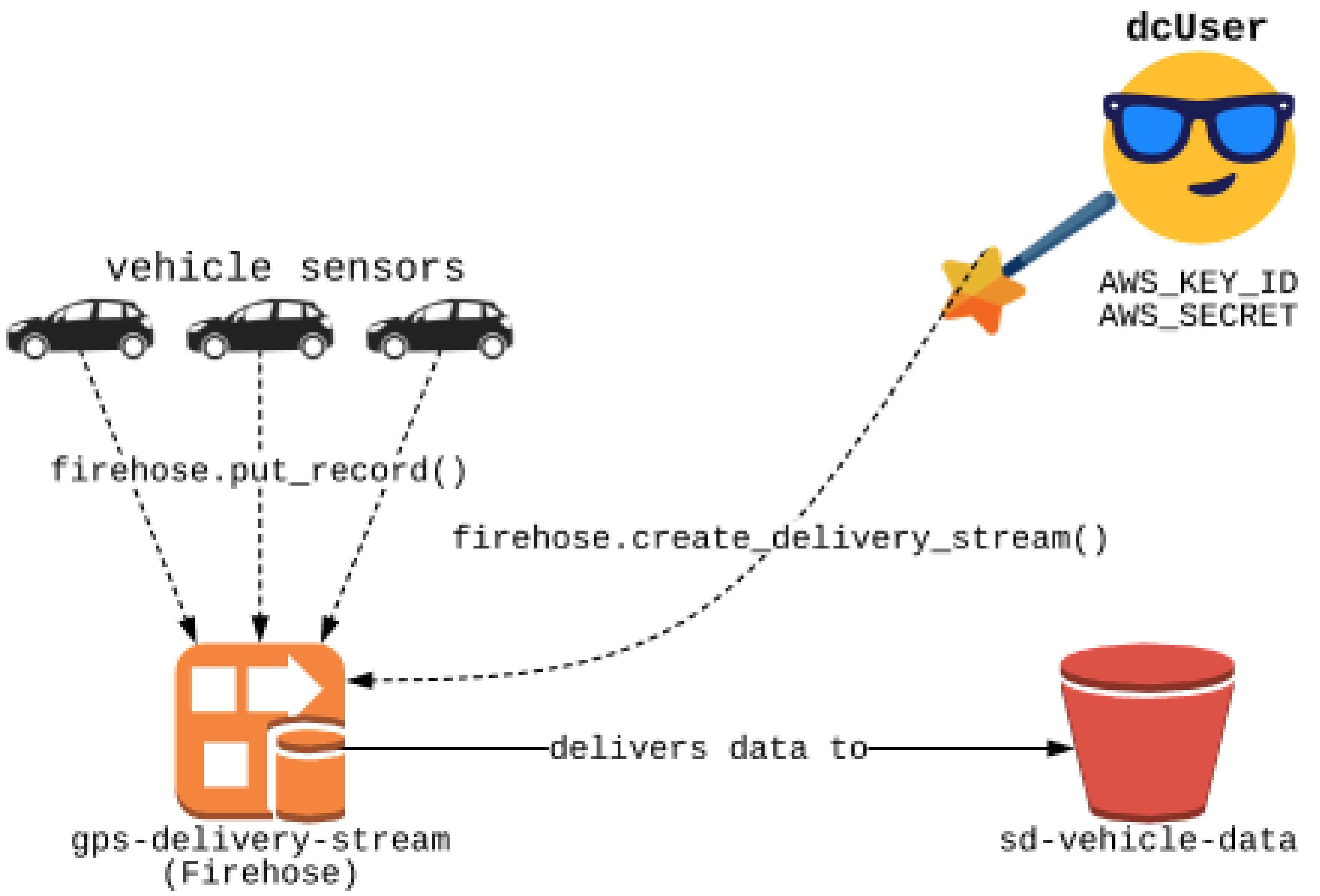
Add user to group
Copy permissions from existing user
Attach existing policies directly
Create policy
Filter policies

KinesisFirehose

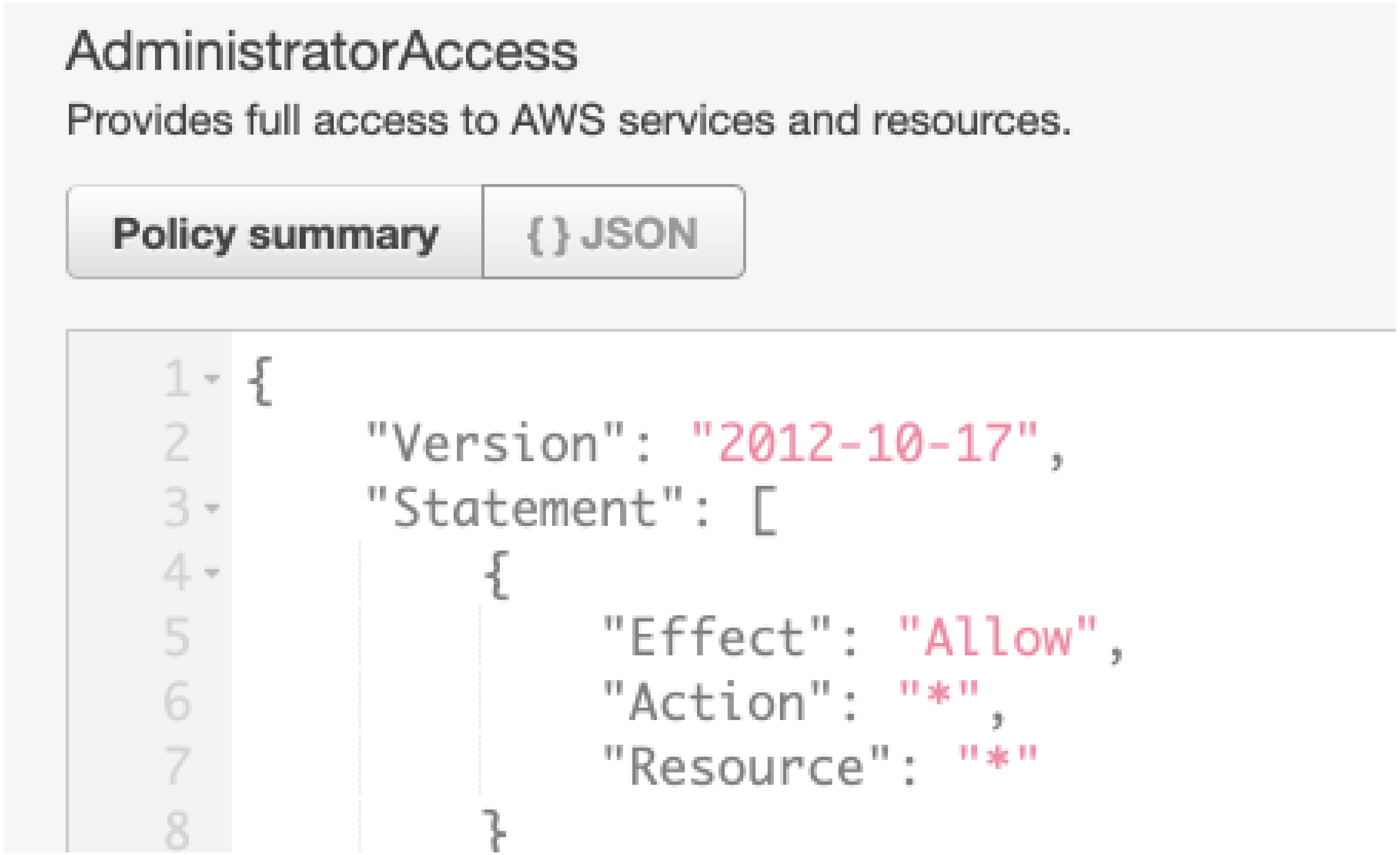
Showing 2 results

	Policy name	Type	Used as
☐	AmazonKinesisFirehoseFullAccess	AWS managed	Permissions policy (1)
☐	AmazonKinesisFirehoseReadOnlyAccess	AWS managed	*None*

New powers


dcUser
AWS_KEY_ID
AWS_SECRET
vehicle sensors
firehose.put_record()
firehose.create_delivery_stream()
delivers data to
gps-delivery-stream
(Firehose)
sd-vehicle-data

A note on security

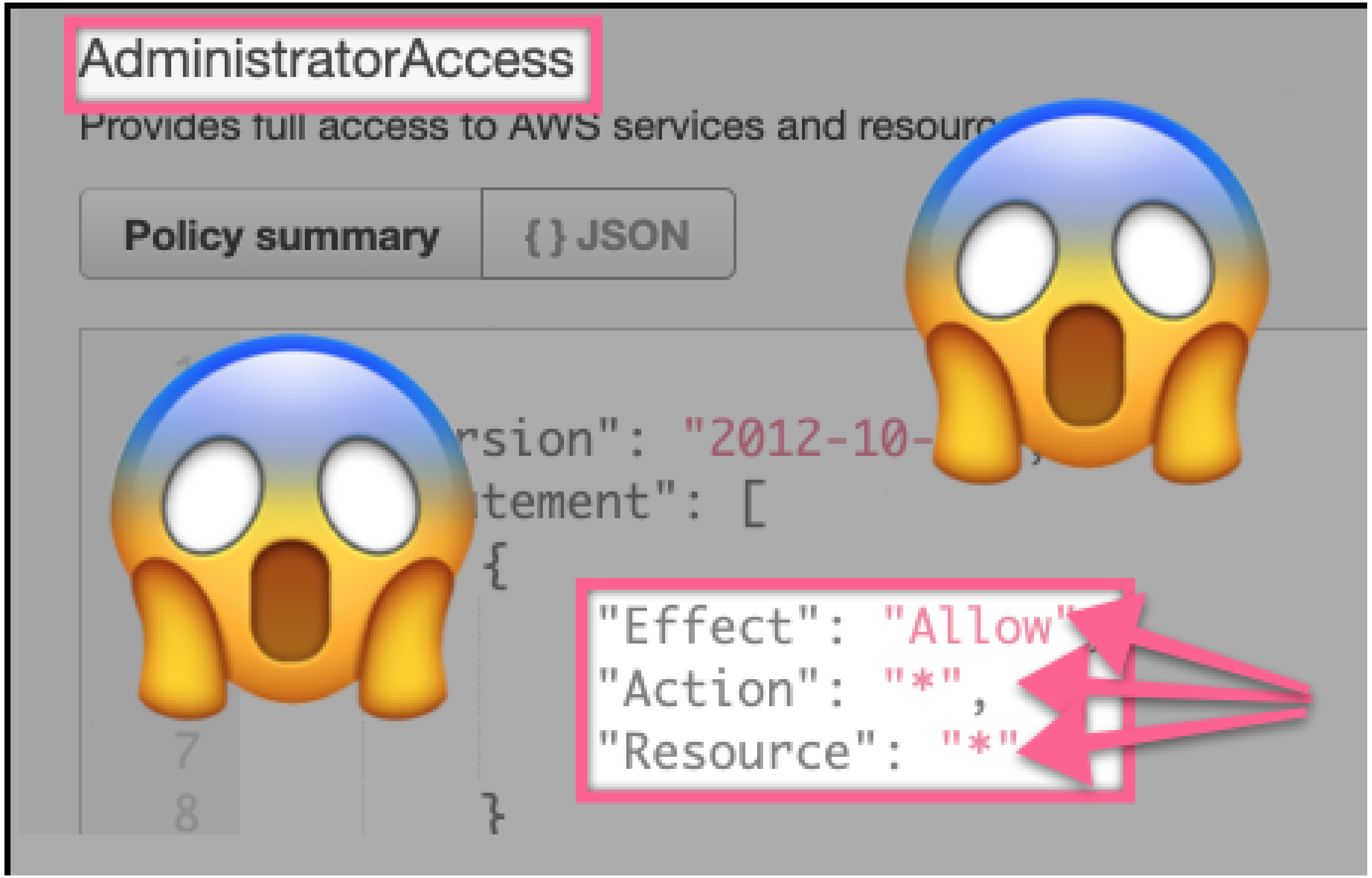


AdministratorAccess

Provides full access to AWS services and resources.

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Allow",
            "Action": "*",
            "Resource": "*"
        }
```

A note on security



AdministratorAccess

Provides full access to AWS services and resourc

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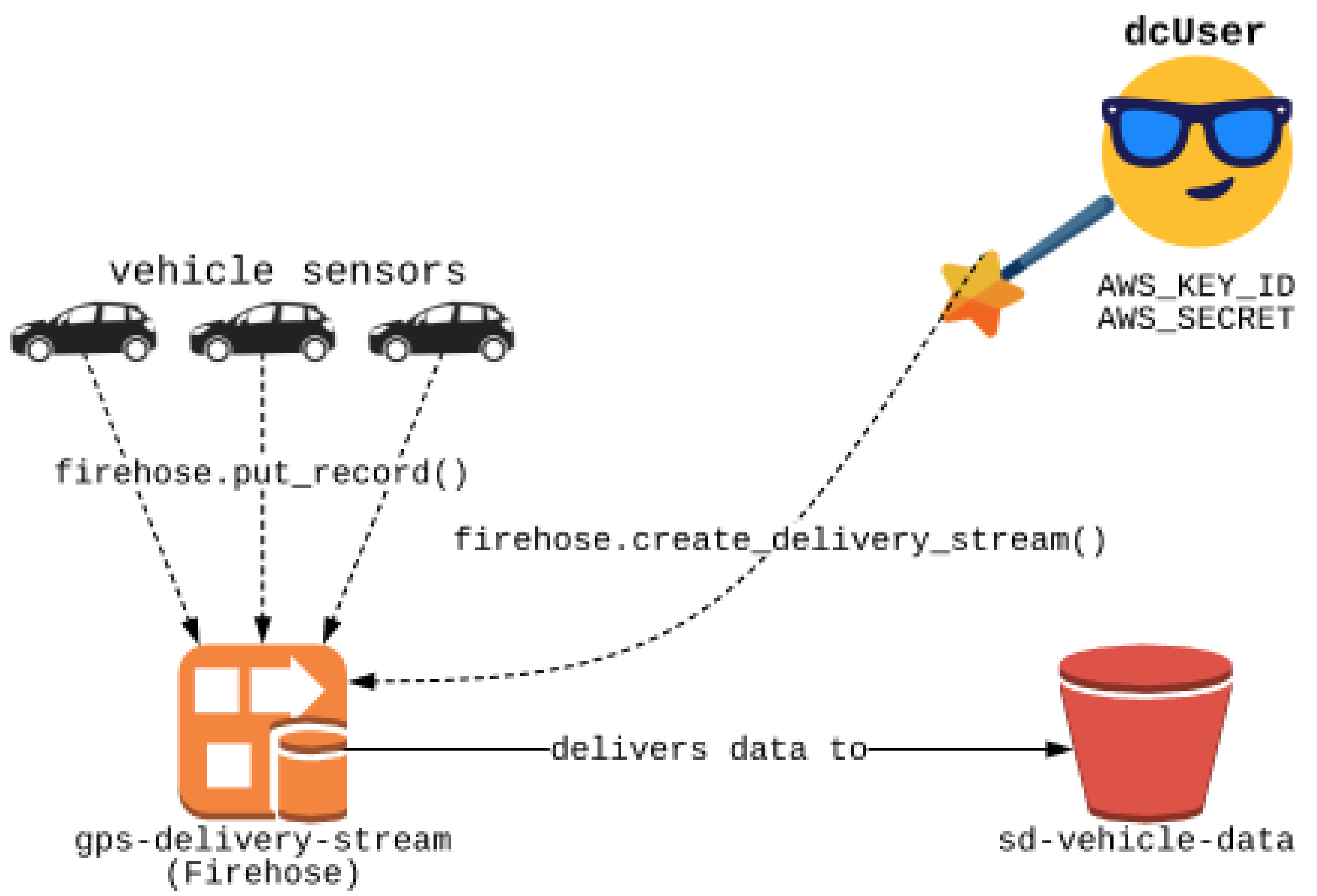
  tement": [
    {
      "Effect": "Allow"
      "Action": "*",
      "Resource": "*"
    }
```

New powers


dcUser
AWS_KEY_ID
AWS_SECRET
vehicle sensors
firehose.put_record()
firehose.create_delivery_stream()
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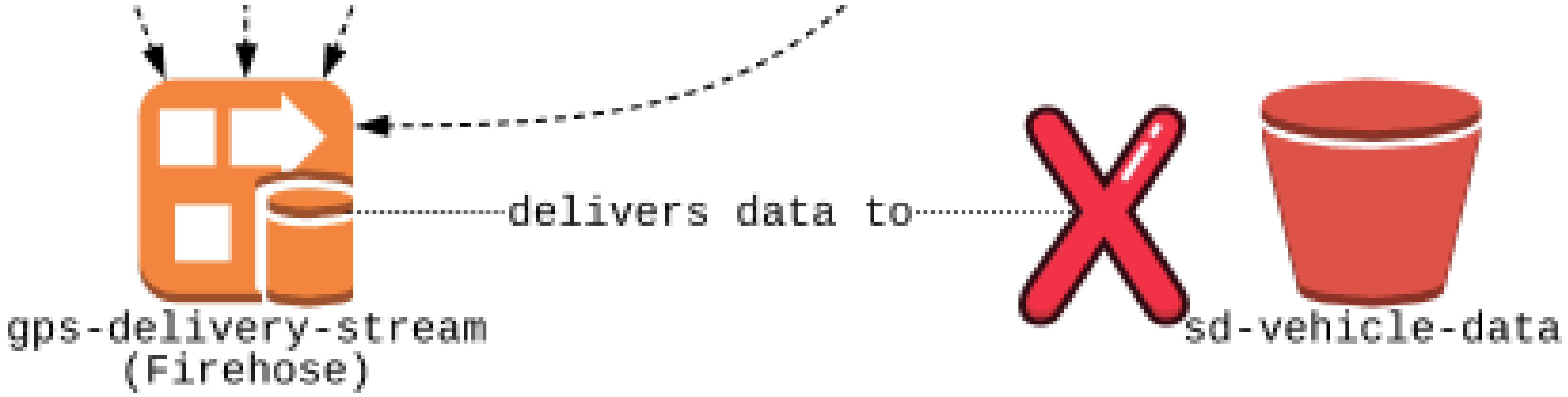
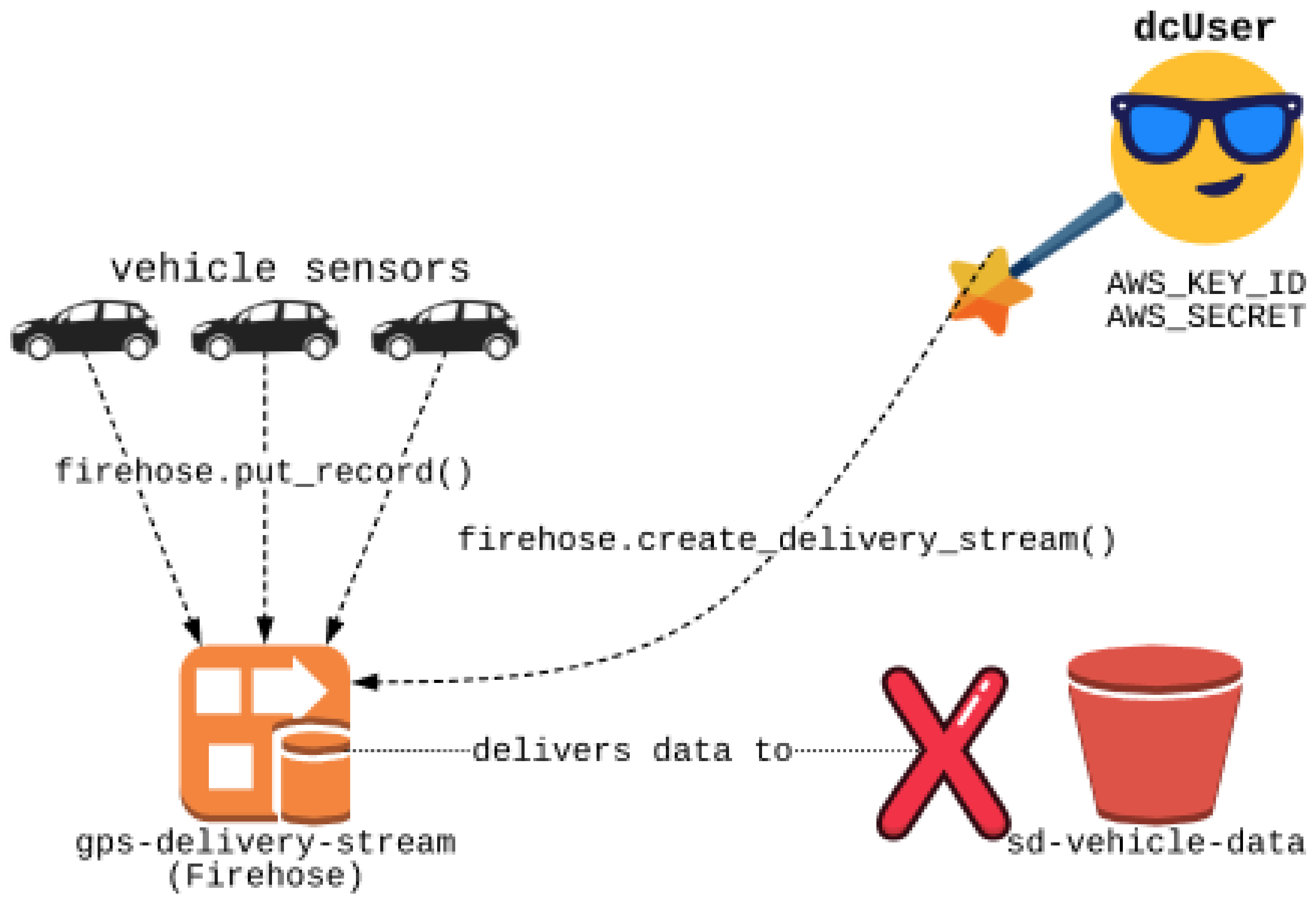
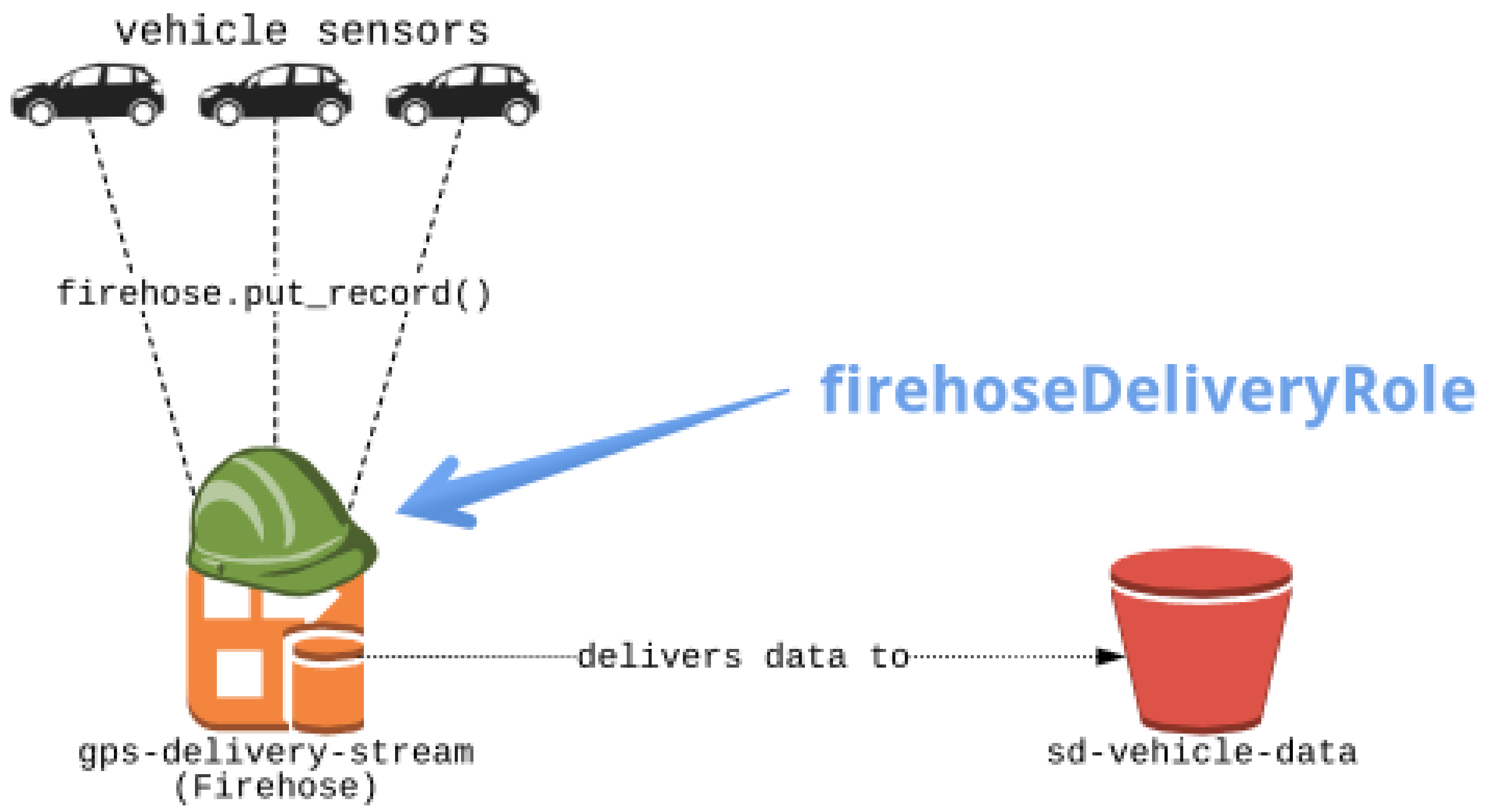
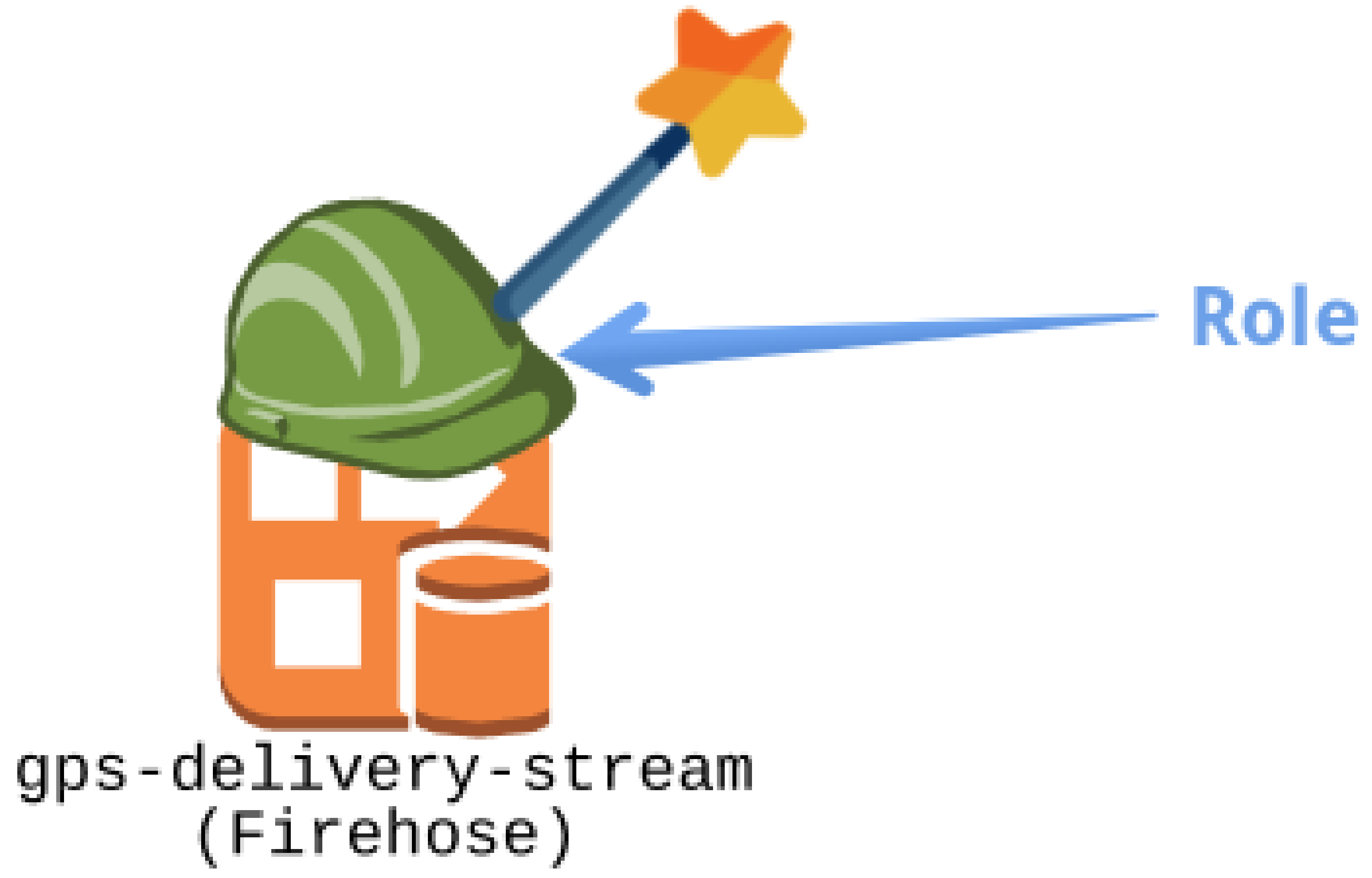
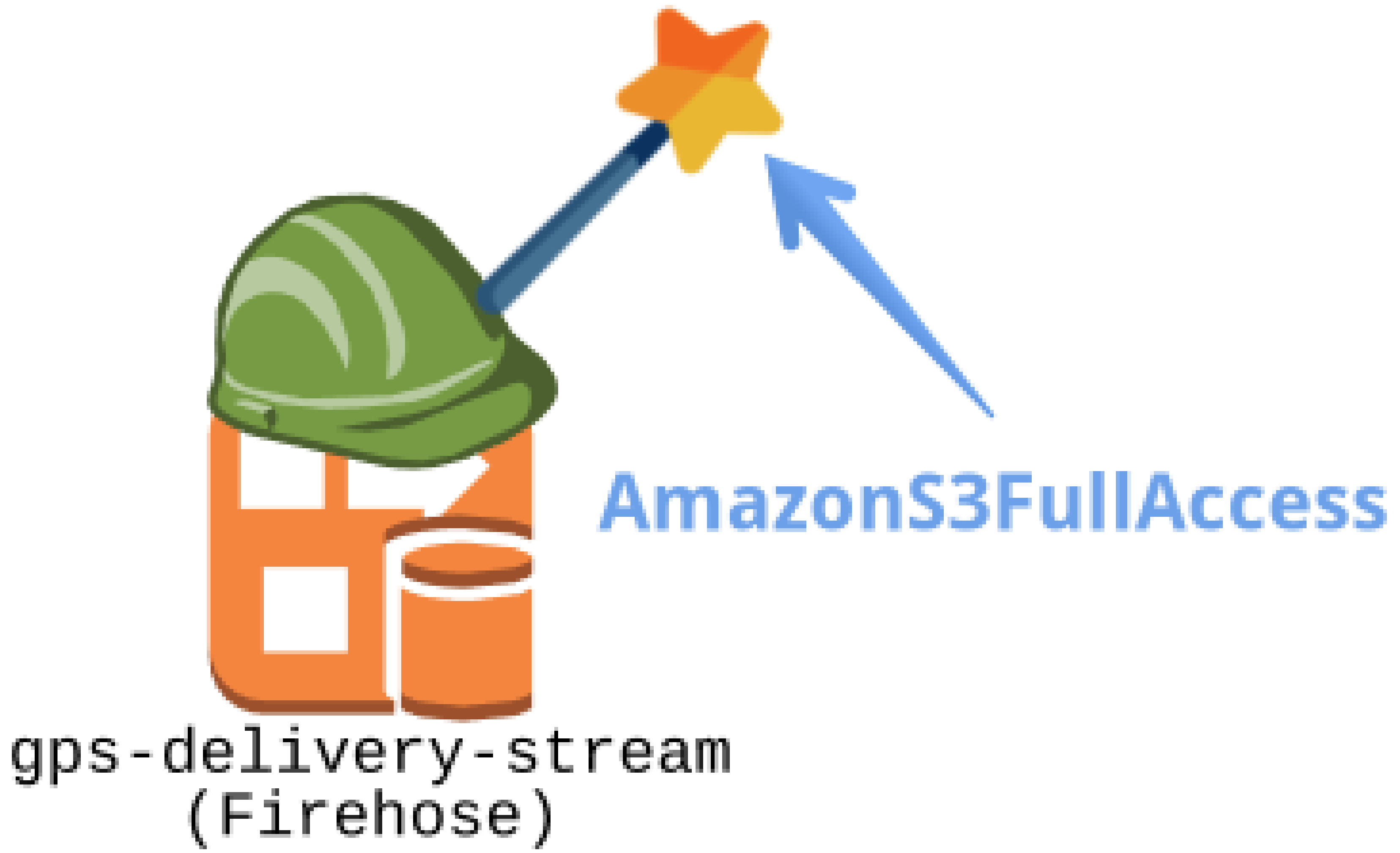

delivers data to
gps-delivery-stream (Firehose)
sd-vehicle-data

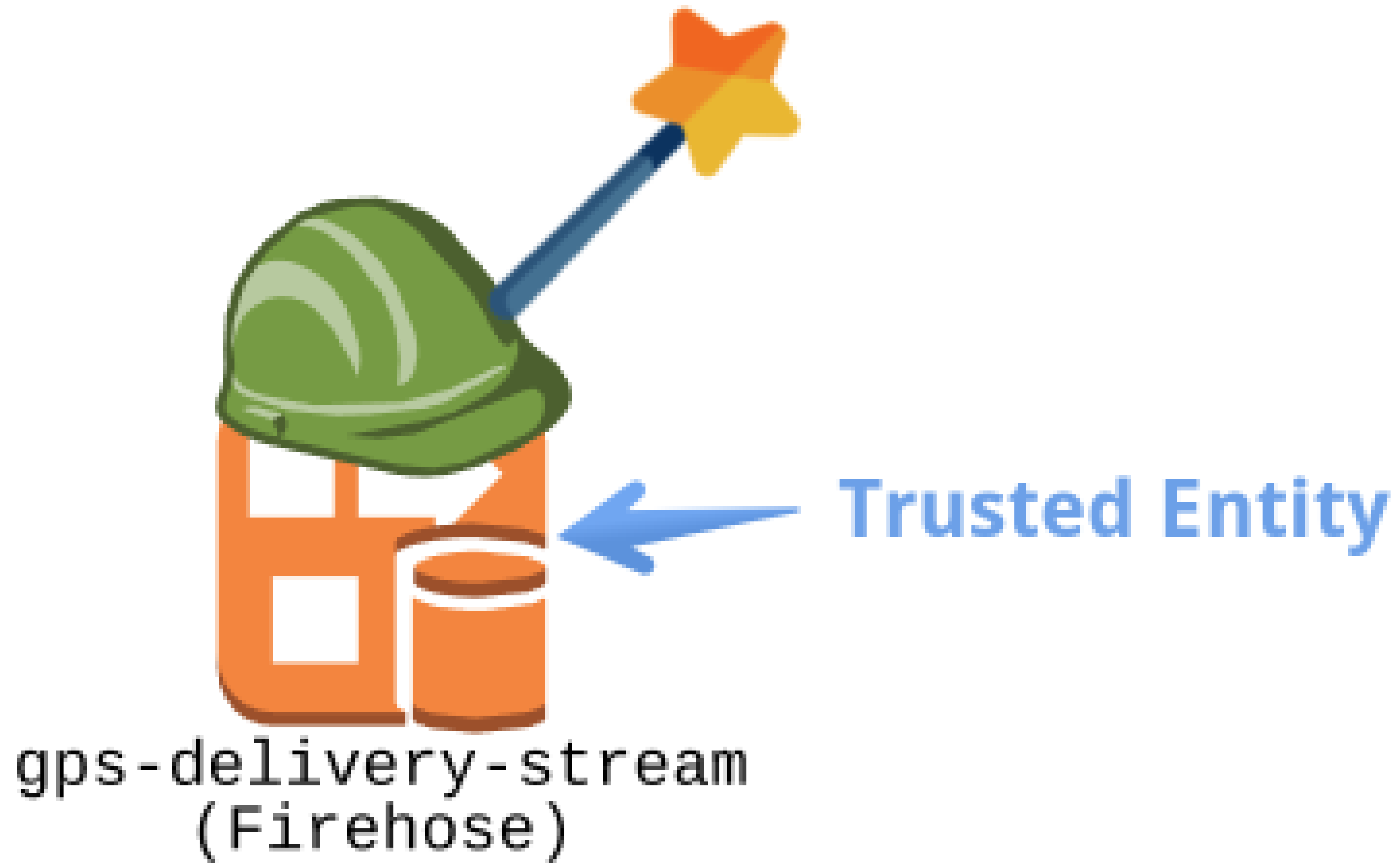
Firehose stream permissions




vehicle sensors
firehose.put_record()
firehoseDeliveryRole
delivers data to
gps-delivery-stream
(Firehose)
sd-vehicle-data


Role
gps-delivery-stream
(Firehose)


AmazonS3FullAccess
gps-delivery-stream
(Firehose)

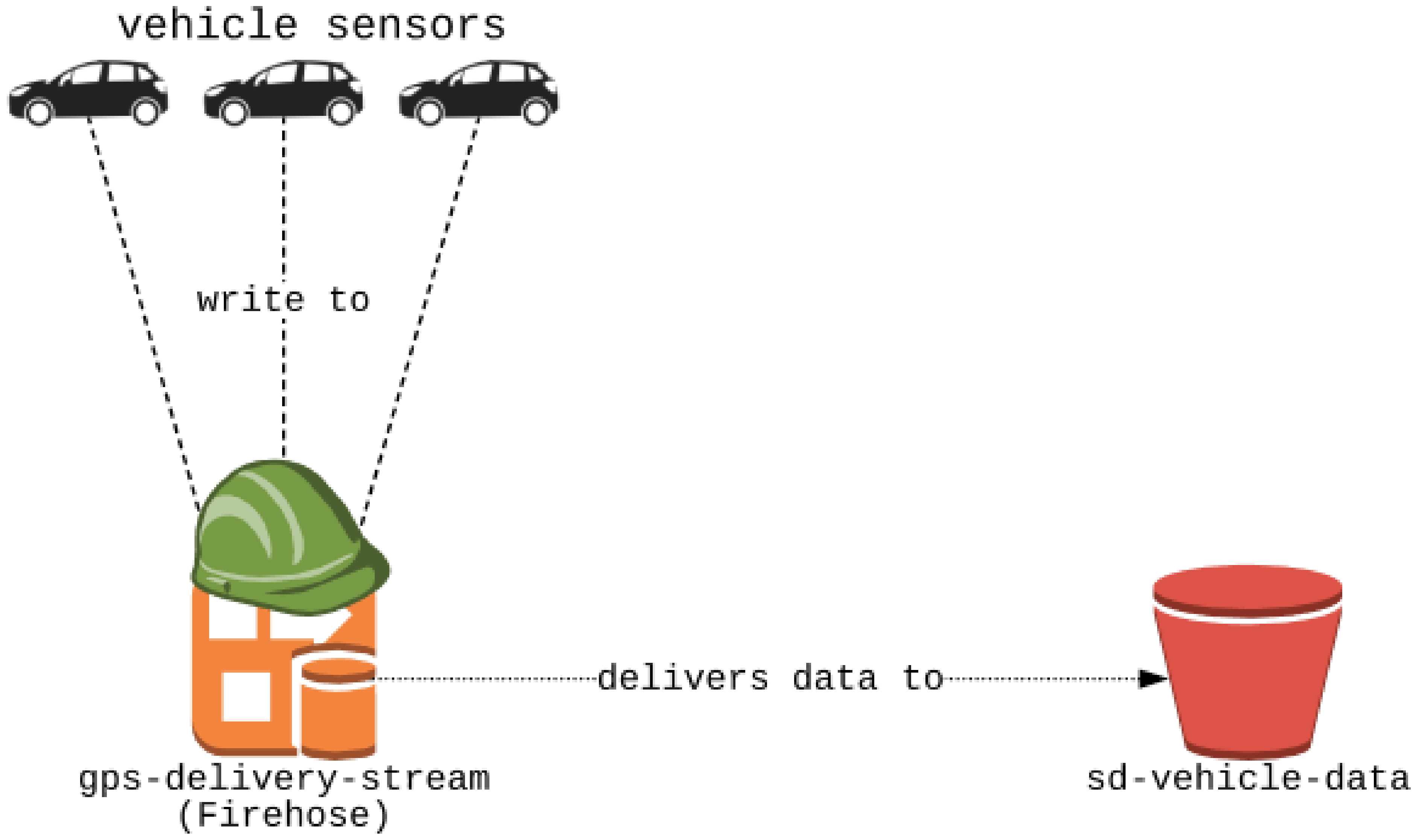

Trusted Entity
gps-delivery-stream
(Firehose)

Roles vs users

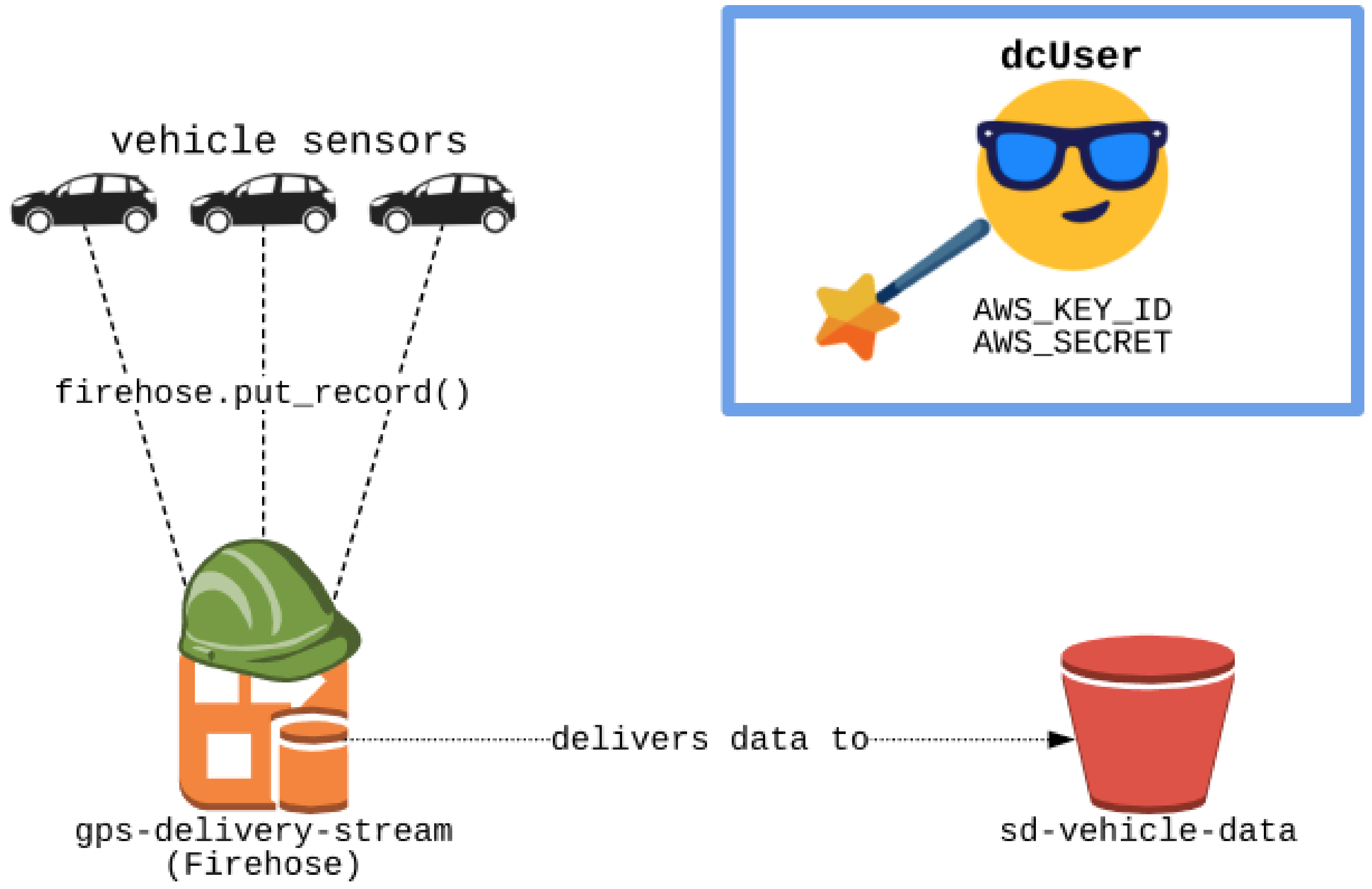
- Live in IAM
- Have permissions policies
- **Only attach to other services**
- **Do not have keys nor login**

- Live in IAM
- Have permissions policies
- **Can act on their own**
- **Can have keys or login**

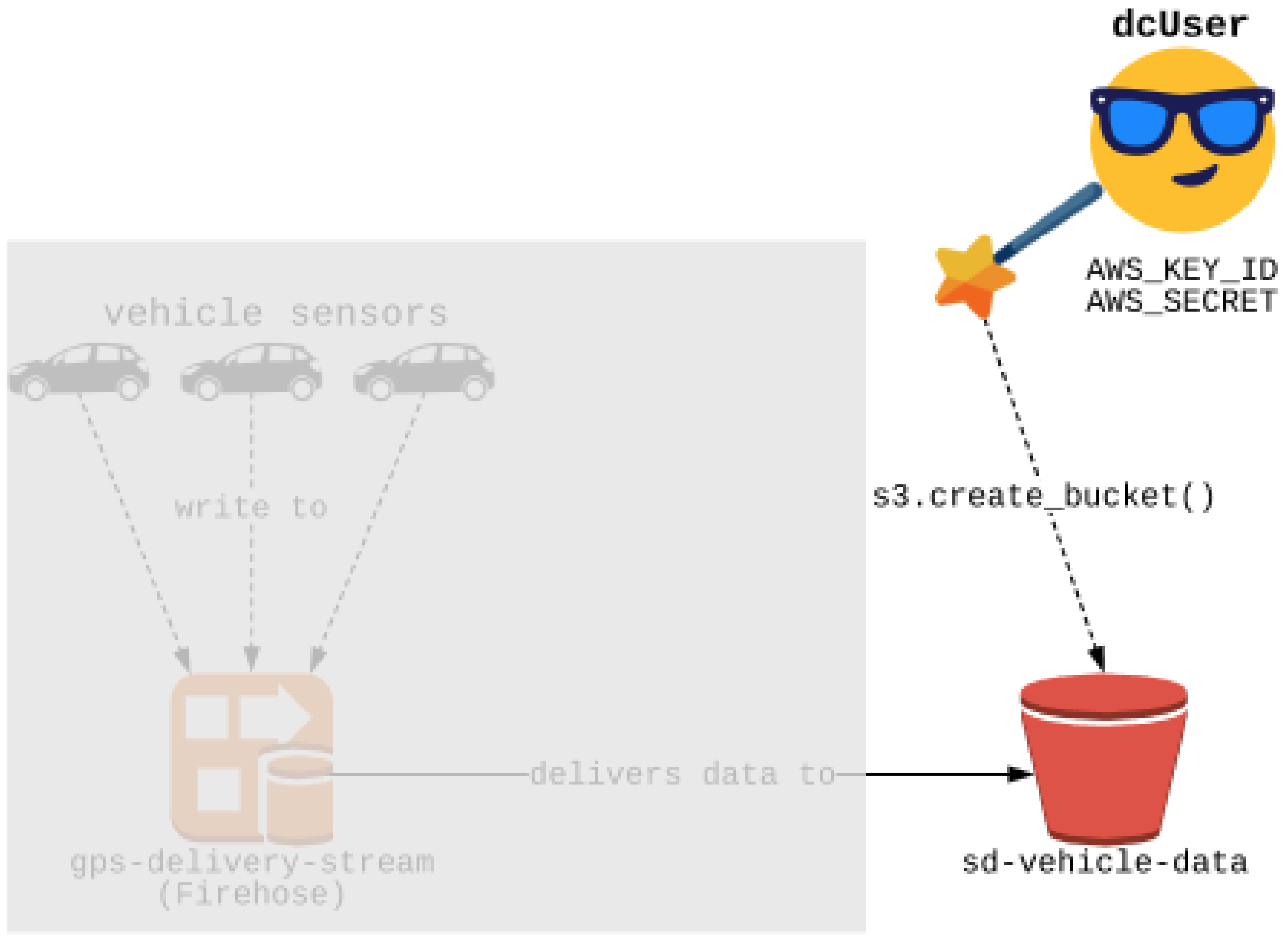
Review - end goal



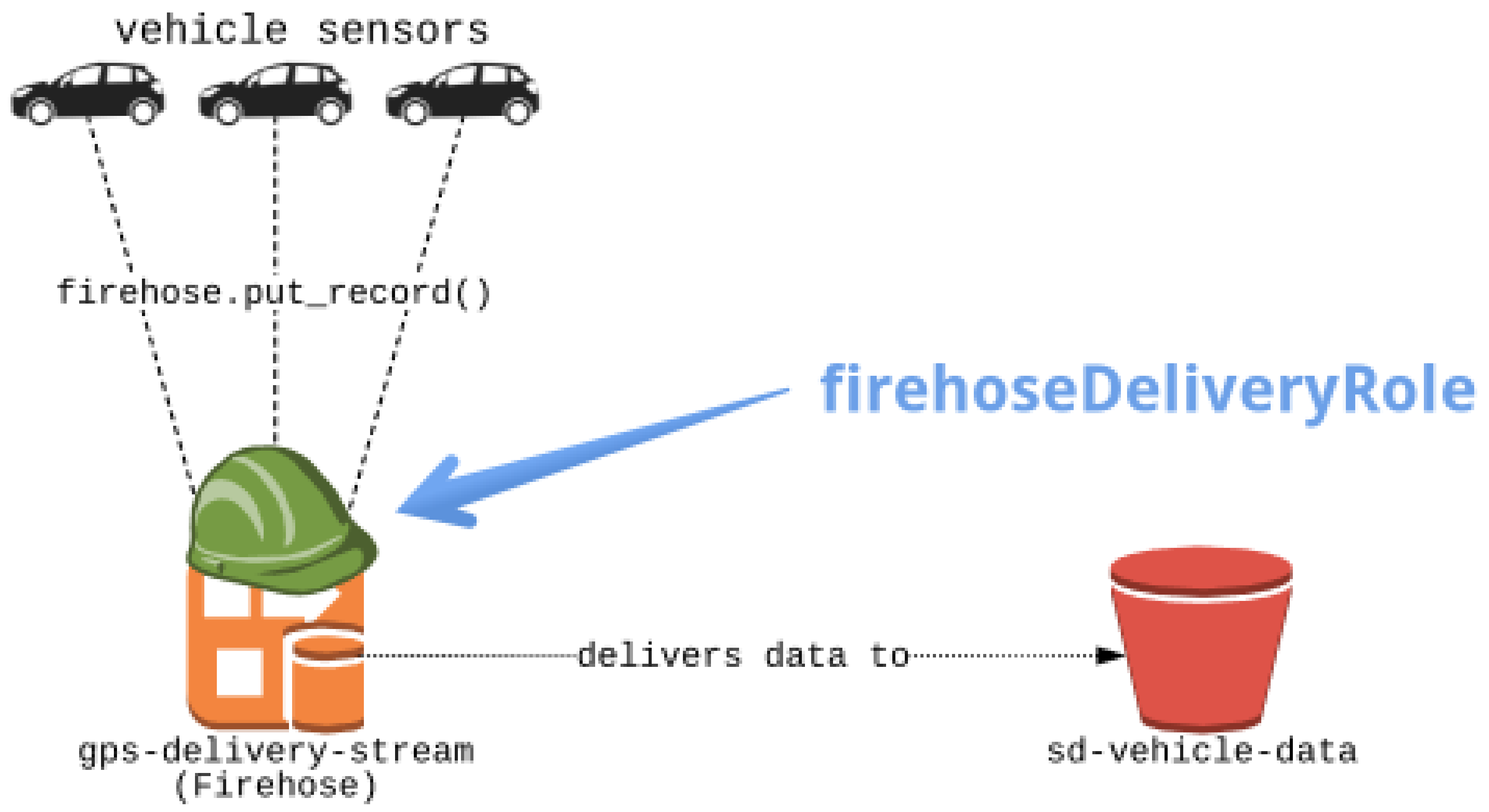
Review


vehicle sensors
firehose.put_record()
gps-delivery-stream
(Firehose)
delivers data to
sd-vehicle-data
dcUser
AWS_KEY_ID
AWS_SECRET

Review


dcUser
AWS_KEY_ID
AWS_SECRET
s3.create_bucket()
vehicle sensors
write to
delivers data to
gps-delivery-stream
(Firehose)
sd-vehicle-data

Review


vehicle sensors
firehose.put_record()
firehoseDeliveryRole
delivers data to
gps-delivery-stream
(Firehose)
sd-vehicle-data

Let's do it!

STREAMING DATA WITH AWS KINESIS AND LAMBDA

Creating roles

STREAMING DATA WITH AWS KINESIS AND LAMBDA

Maksim Pecherskiy
Data Engineer

Let's practice!

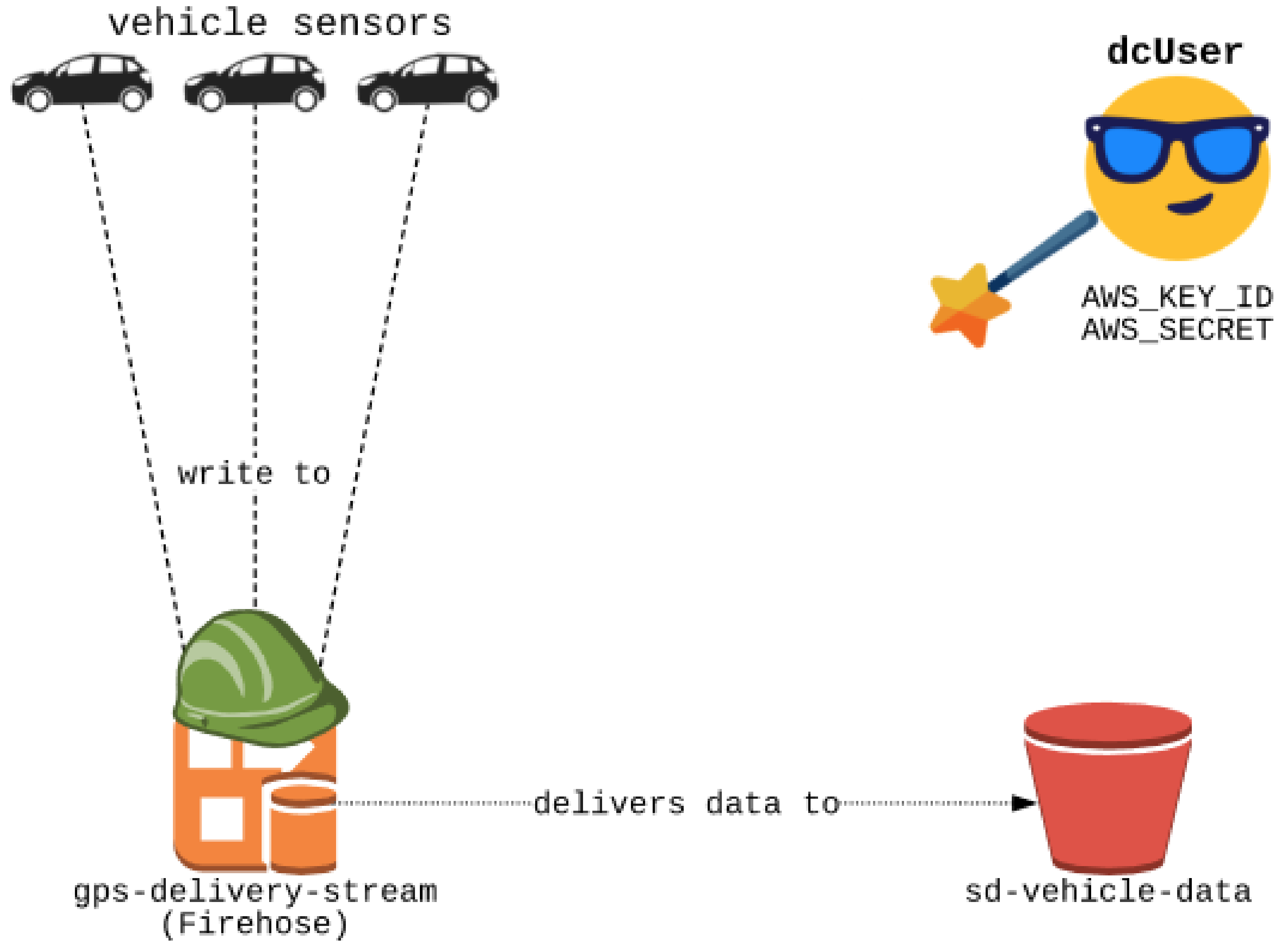
STREAMING DATA WITH AWS KINESIS AND LAMBDA

Working with the Firehose delivery stream

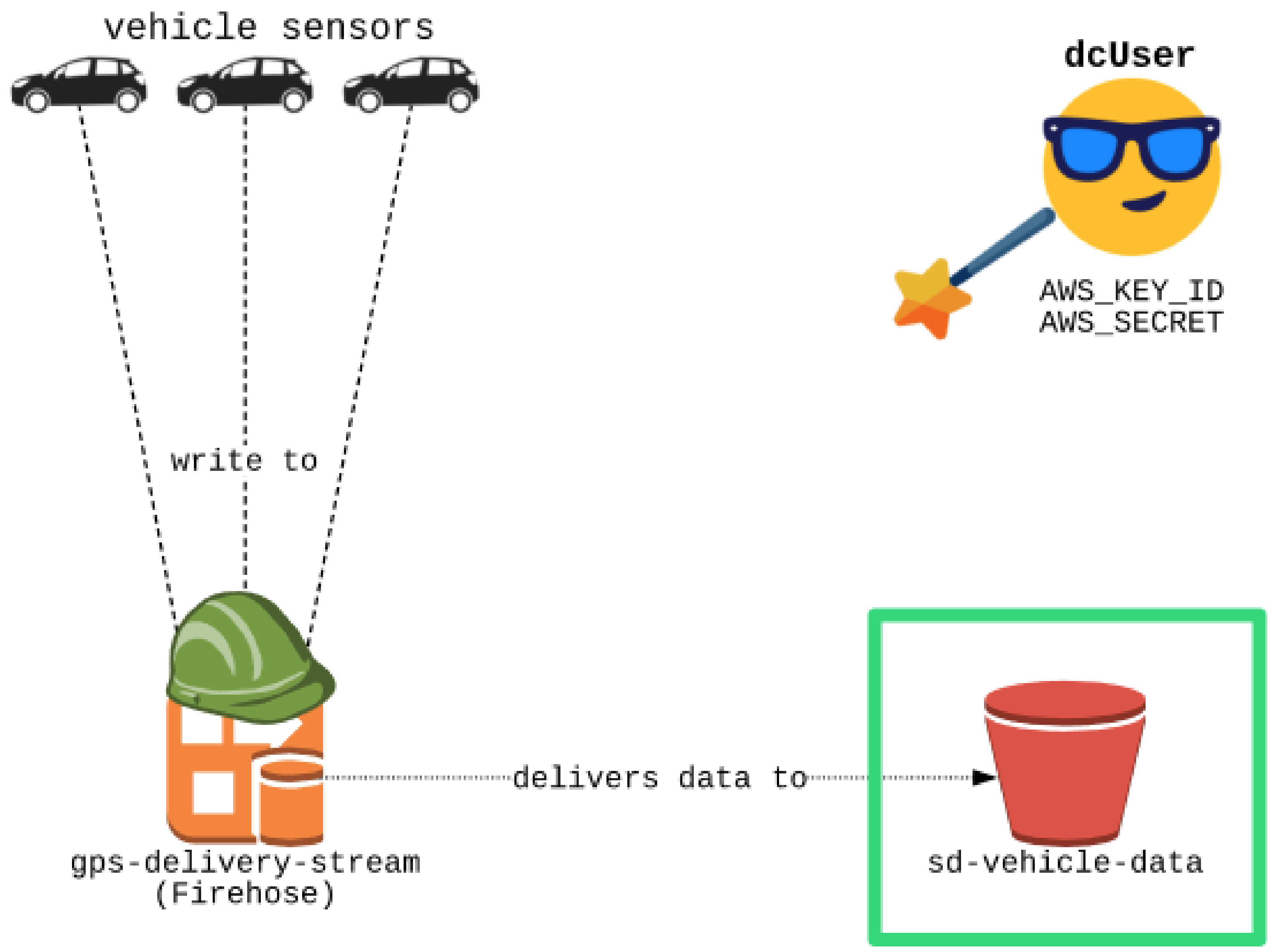
STREAMING DATA WITH AWS KINESIS AND LAMBDA

Maksim Pecherskiy
Data Engineer

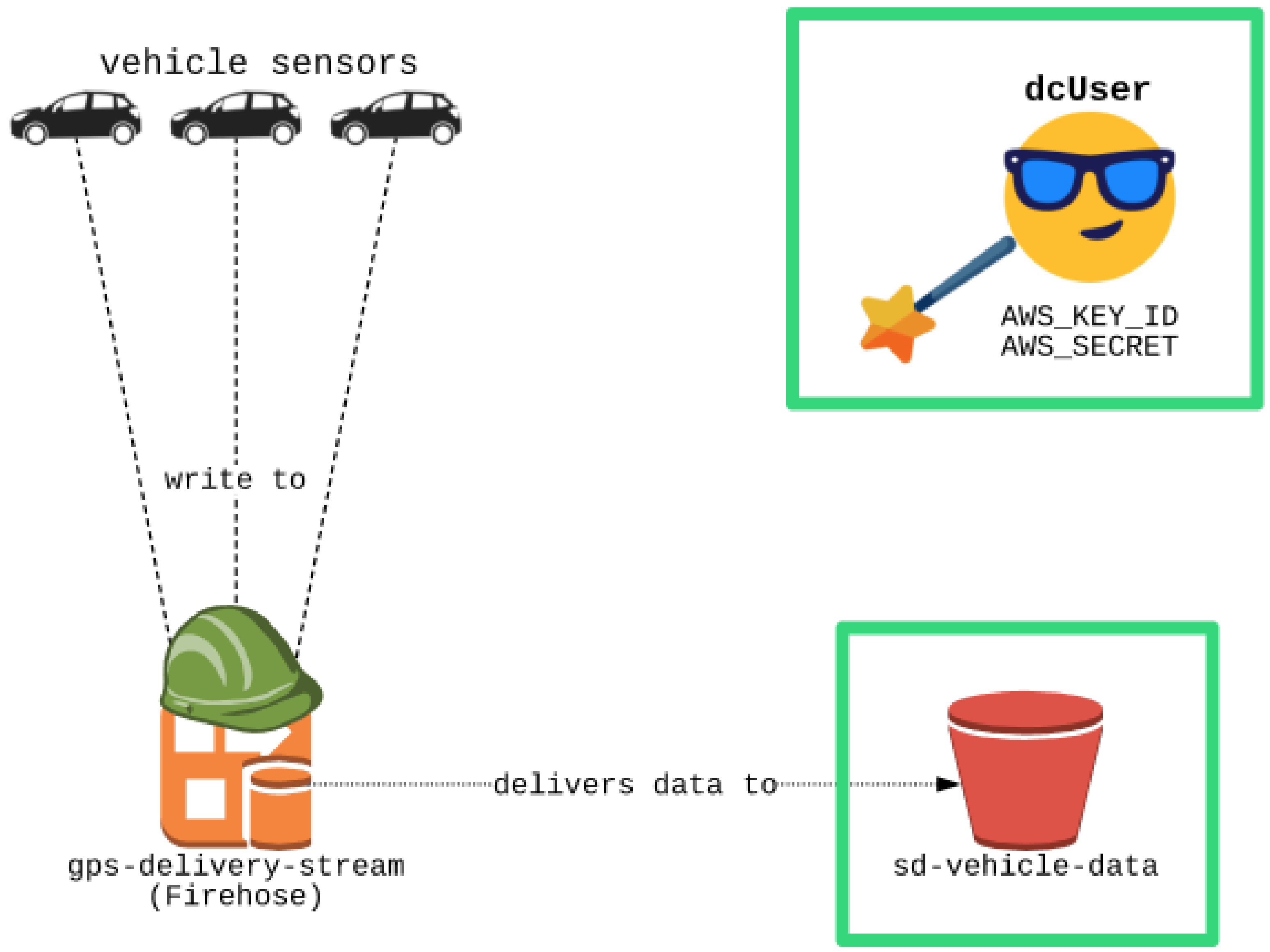
Ready to create stream



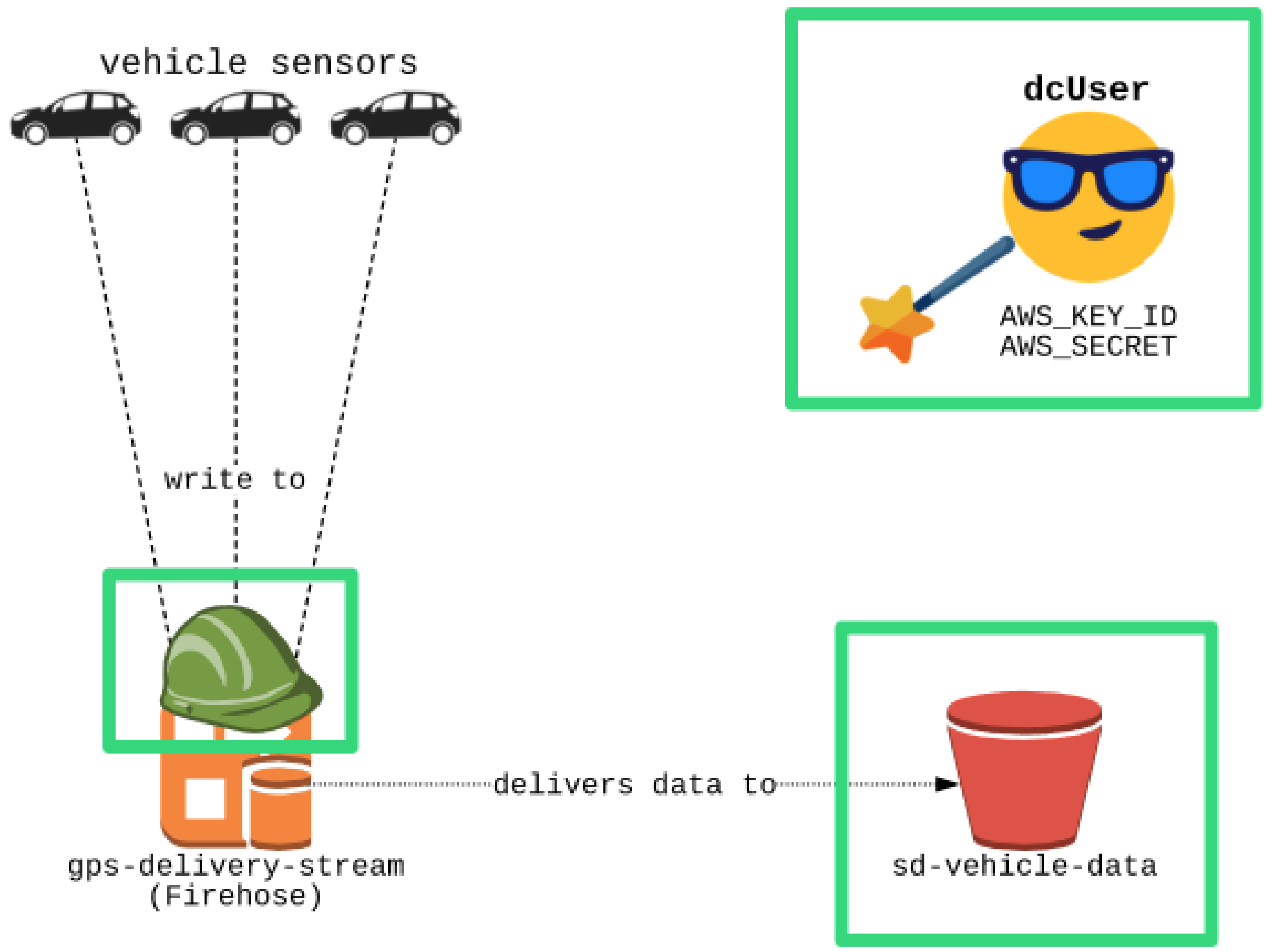
Ready to create stream



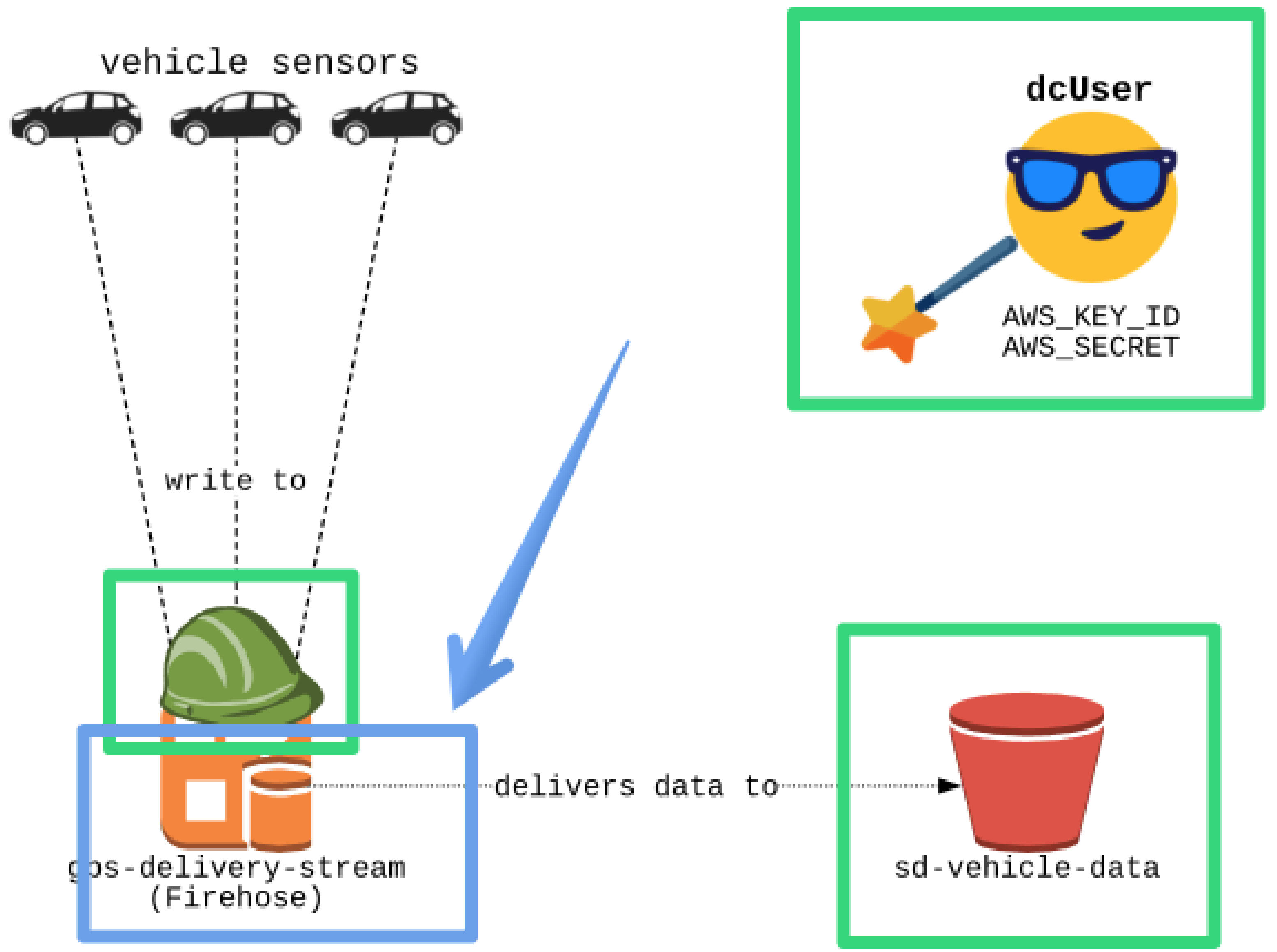
Ready to create stream



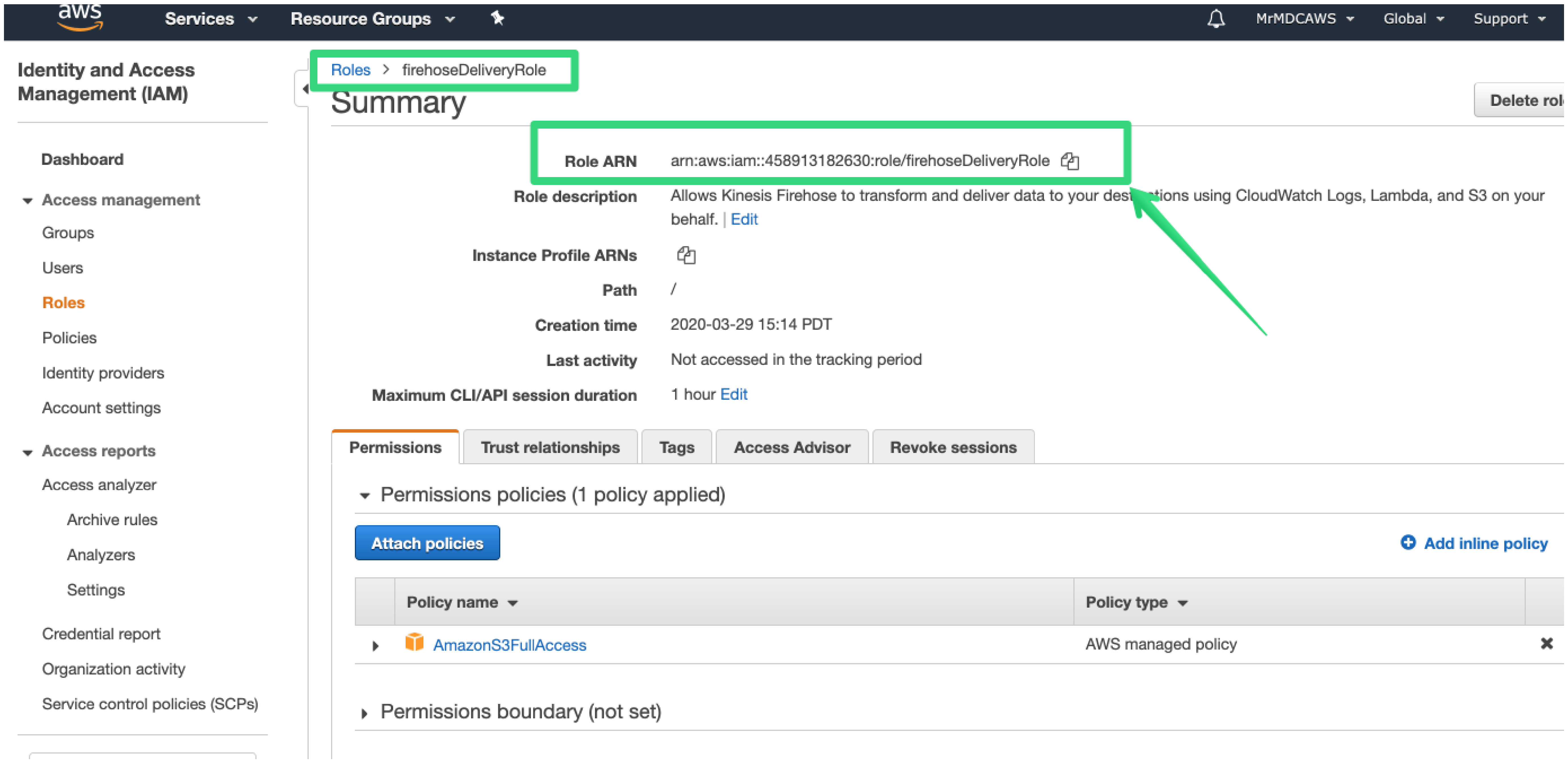
Ready to create stream



Ready to create stream



Get Role ARN



Summary

Role ARN	arn:aws:iam::458913182630:role/firehoseDeliveryRole
Role description	Allows Kinesis Firehose to transform and deliver data to your destinations using CloudWatch Logs, Lambda, and S3 on your behalf. | Edit
Instance Profile ARNs	
Path	/
Creation time	2020-03-29 15:14 PDT
Last activity	Not accessed in the tracking period
Maximum CLI/API session duration	1 hour Edit

Permissions policies (1 policy applied)

Policy name	Policy type
AmazonS3FullAccess	AWS managed policy

Permissions boundary (not set)

Initialize boto3 client

```
import boto3

firehose = boto3.client('firehose',
                        aws_access_key_id=AWS_KEY_ID,
                        aws_secret_access_key=AWS_SECRET,
                        region_name='us-east-1')
```

Create the stream!

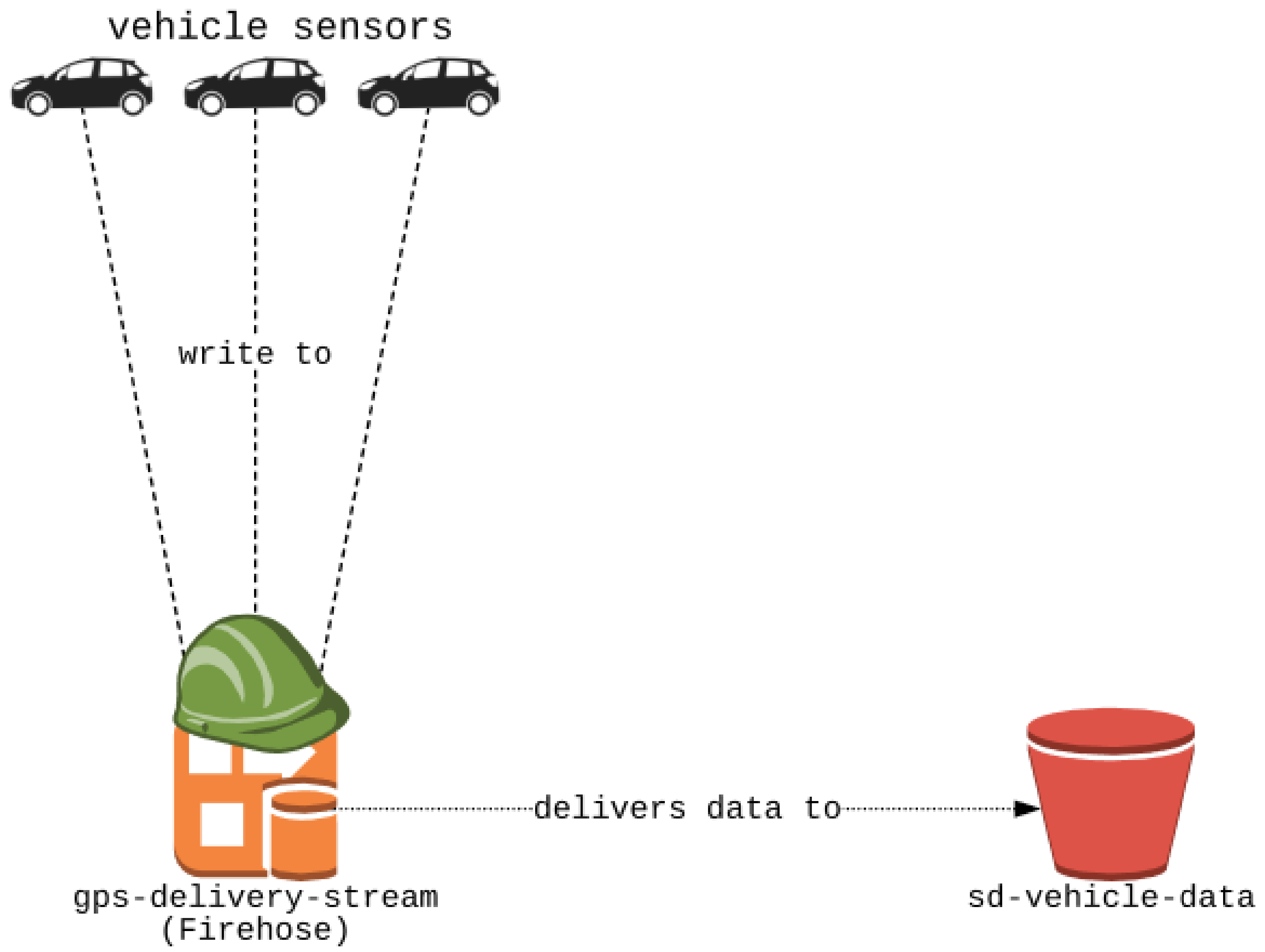
```
res = firehose.create_delivery_stream(
    DeliveryStreamName = "gps-delivery-stream",
    DeliveryStreamType = "DirectPut",
    S3DestinationConfiguration = {
        "RoleARN": "arn:aws:iam::0000000:role/firehoseDeliveryRole",
        "BucketARN": "arn:aws:s3:::sd-vehicle-data"
  }
)
```

Create stream response

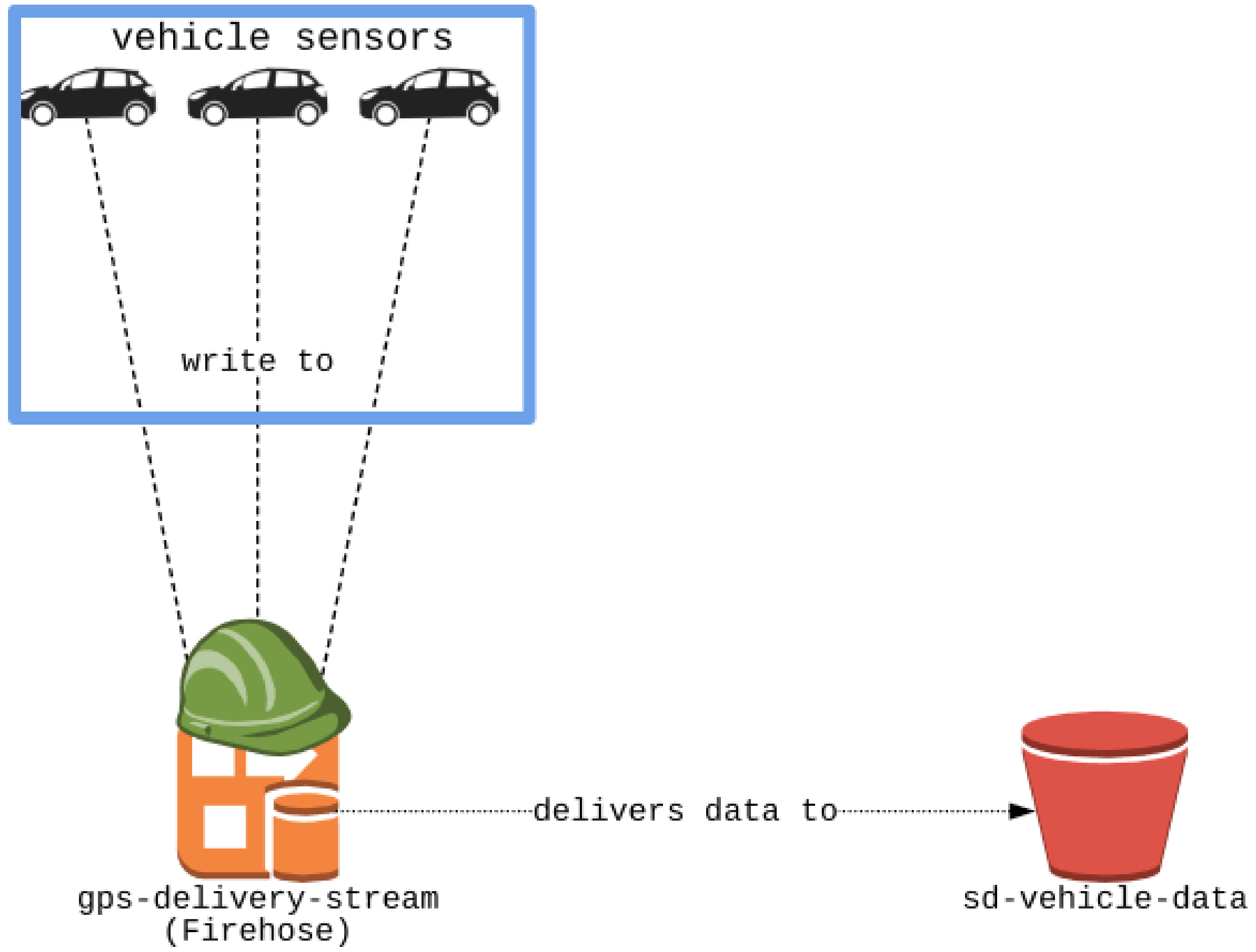
```
print(res['DeliveryStreamARN'])
```

```
# New Stream's ARN
"arn:aws:firehose:us-east-1:0000000:deliverystream/gps-delivery-stream"
```

Stream is ready

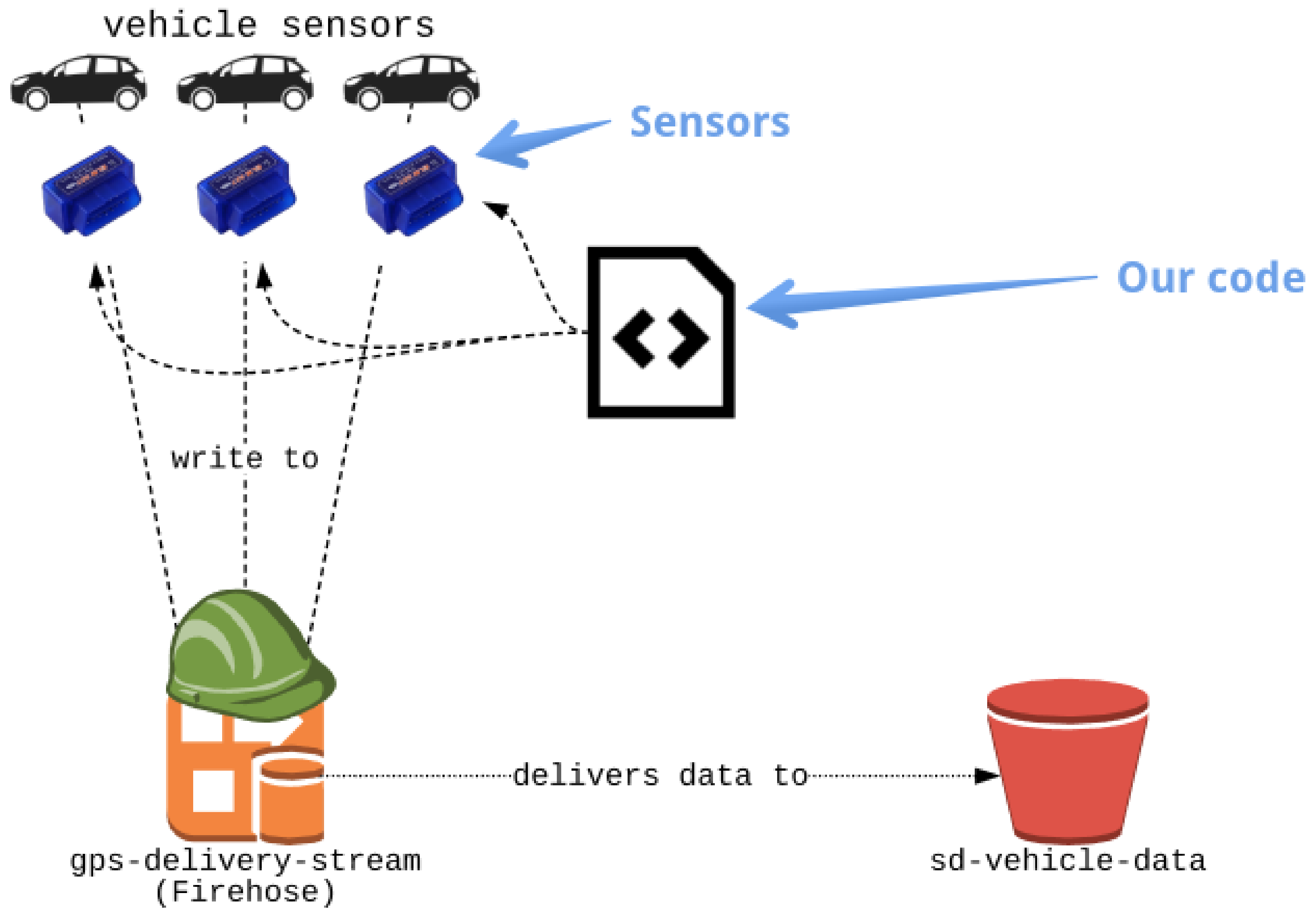


Writing to stream



Telematics hardware

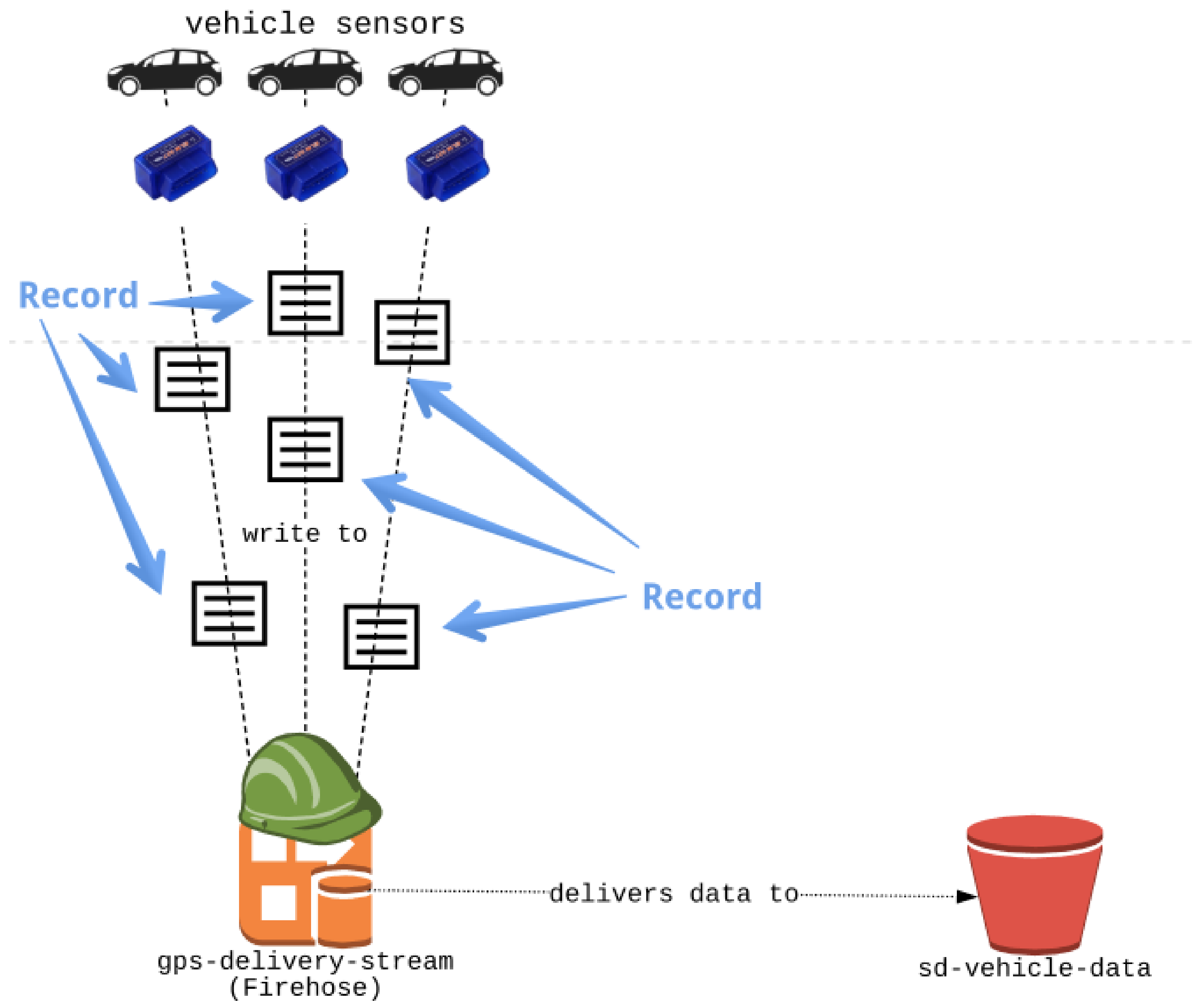
Telematics data send



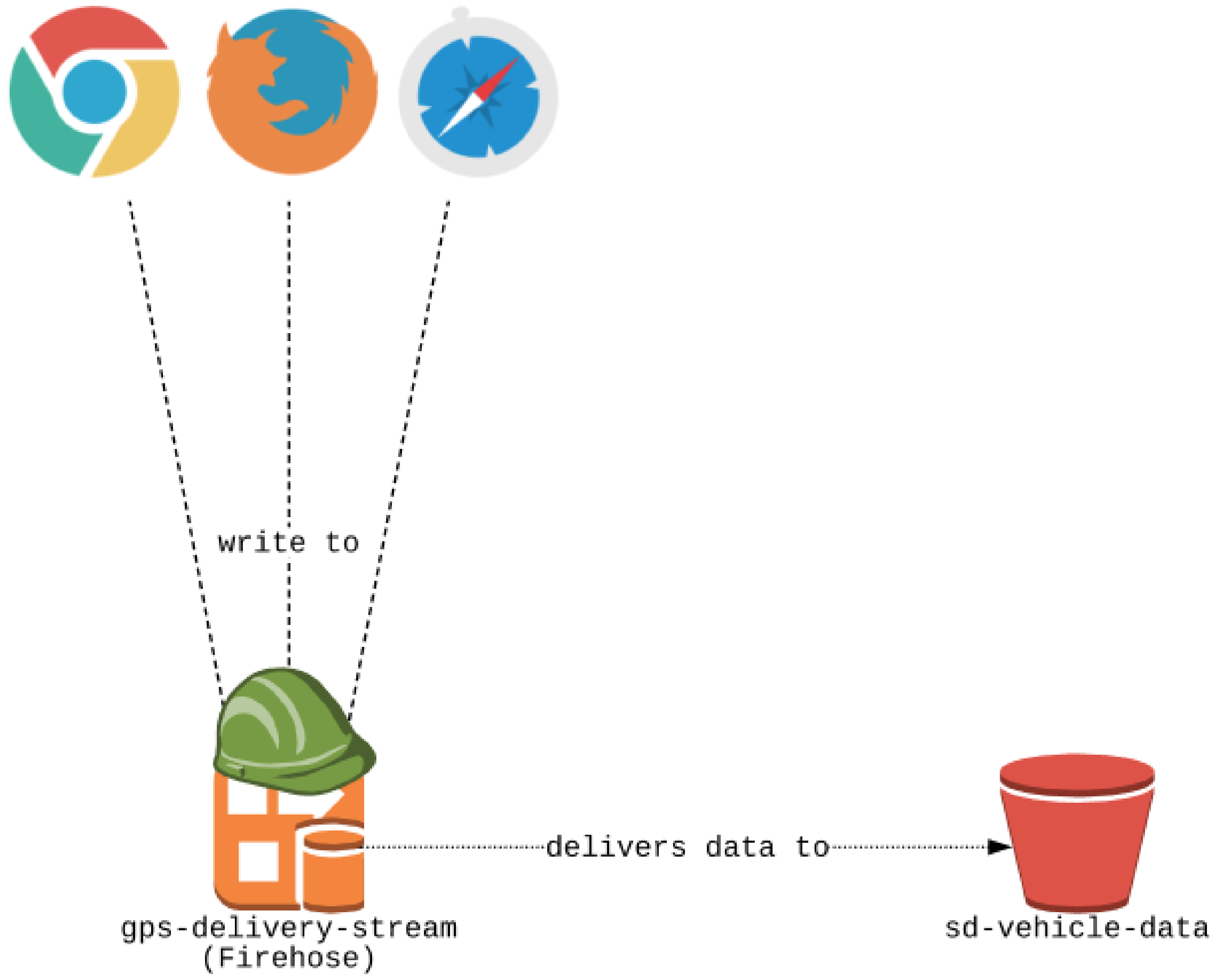
Single record

```
{
    'record_id': '939ed1d1-1740-420c-8906-445278573c7f', # <-- Unique record id
    'timestamp': '4:25:06.000', # <-- time of measurement
    'vin': '4FTEX4944AK844294', # <-- vehicle id
    'lon': 106.9447146, # <-- vehicle location longitude
    'lat': -6.3385652, # <-- vehicle location latitude
    'speed': 25 # <-- vehicle speed
}
```

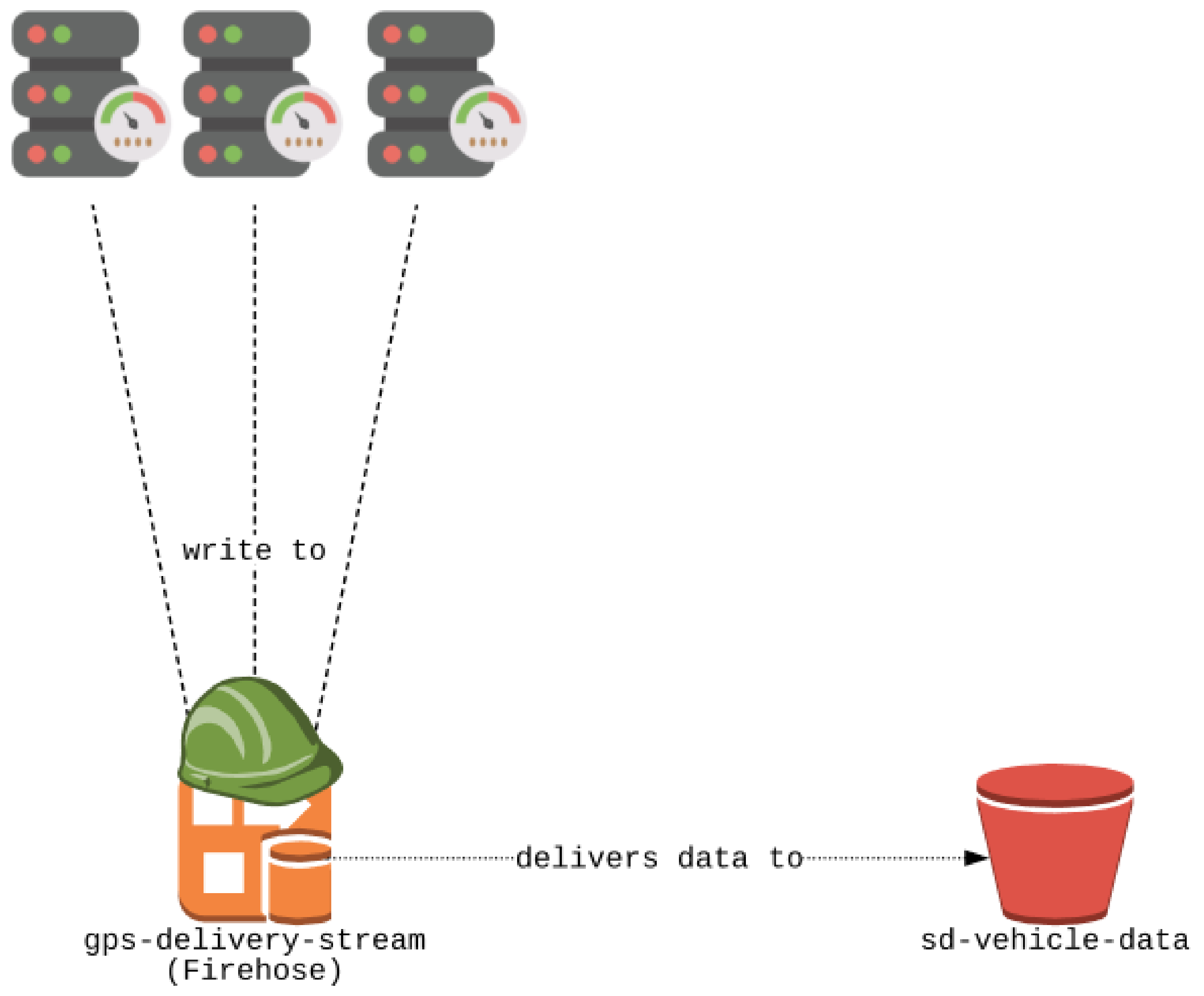
Records coming in



Another use case



Another use case



Patterns

datacamp

Sending a record

```
res = firehose.put_record(
    DeliveryStreamName='gps-delivery-stream',
    Record = {
        'Data': payload
    }
)
```

Sending a record

```
Record = {
    'Data': payload
}
```

Sending a record

What our Record Looks Like

```
record = {
 'record_id': '939ed1d1-1740-420c-8906-445278573c7f',
 'timestamp': '4:25:06.000','vin': '4FTEX4944AK844294',
 'lon': 106.9447146,'lat': -6.3385652000000001,
 'speed': 25}
```

What we want to send (one string)

```
"939ed1d1-1740-420c-8906-445278573c7f 4:25:06.000
4FTEX4944AK844294 106.9447146 -6.3385652000000001 25"
```

Sending a record

```python
payload = " ".join(
    str(value) for value in record.values()
)
```

```python
print(payload)
```

```
"939ed1d1-1740-420c-8906-445278573c7f 4:25:06.000
4FTEX4944AK844294 106.9447146 -6.338565200000001 25"
```

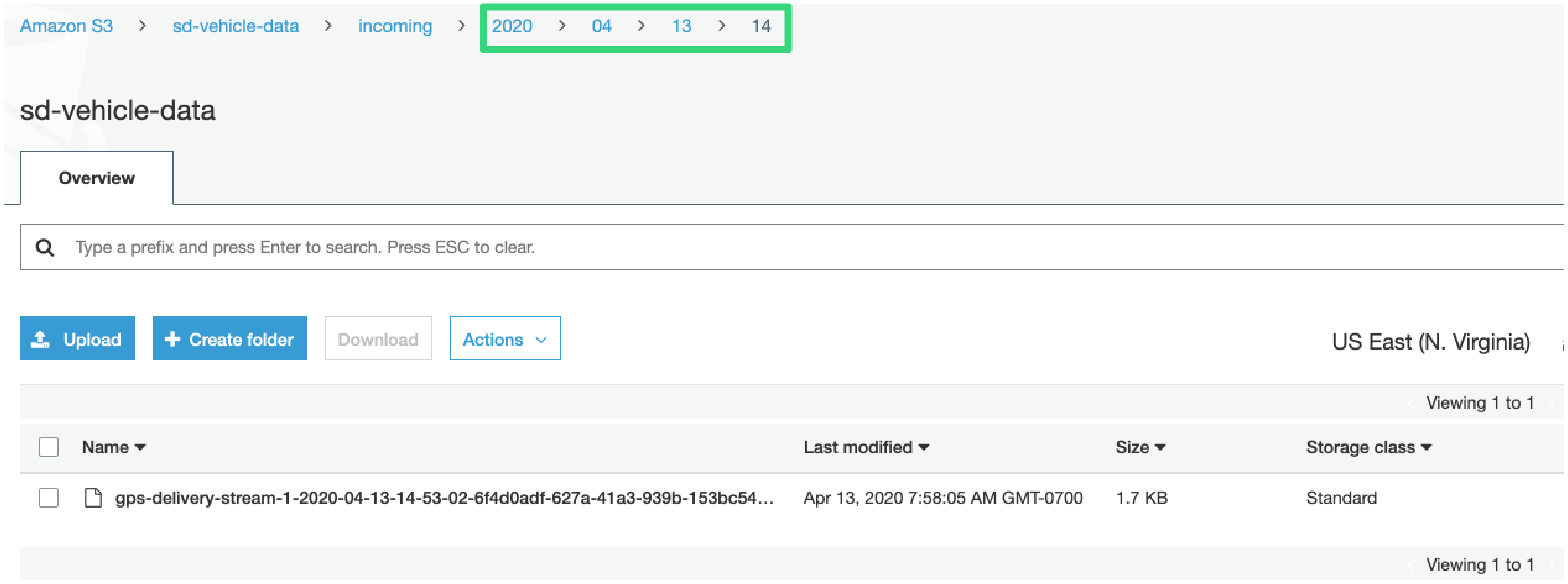
Putting it together

```
record = {
 'record_id': '939ed1d1-1740-420c-8906-445278573c7f',
 'timestamp': '4:25:06.000','vin': '4FTEX4944AK844294',
 'lon': 106.9447146,'lat': -6.338565200000001, 'speed': 25}
payload = " ".join(
    str(value) for value in record.values()
)
#"939ed1d1-1740-420c-8906-445278573c7f 4:25:06.000 4FTEX4944AK844294 106.9447146 -6.
```

Putting it together

```
res = firehose.put_record(
    DeliveryStreamName='gps-delivery-stream',
    Record = {
        'Data': payload + "\n" #<-- Line break!
    }
)
```

Created files



Amazon S3 > sd-vehicle-data > incoming > 2020 > 04 > 13 > 14

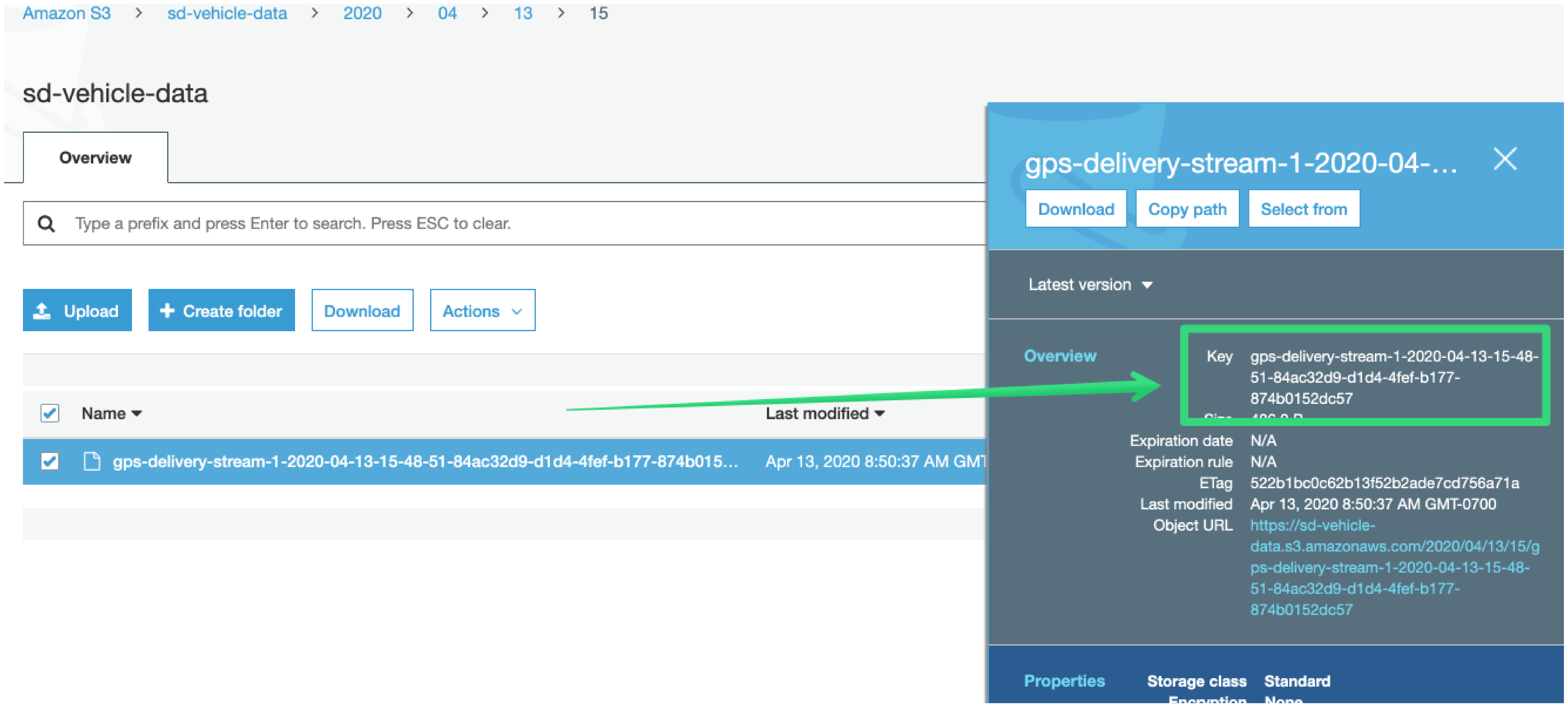
sd-vehicle-data

Name	Last modified	Size	Storage class
gps-delivery-stream-1-2020-04-13-14-53-02-6f4d0adf-627a-41a3-939b-153bc54...	Apr 13, 2020 7:58:05 AM GMT-0700	1.7 KB	Standard

Sample data

```
939ed1d1-1740-420c-8906-445278573c7f 4:25:06.000 4FTEX4944AK844294 106.9447146 -6.33856520000001 25
f29a5b3d-d0fa-43c0-9e1a-e2a5cdb8be7a 8:10:47.000 3FTEX1G5XAK844393 108.58068100000001 34.79925 37
ff8e7131-408d-463b-8d07-d016419b0656 20:26:44.000 2LAXX1C8XAK844292 114.39239199999999 36.097577 90
bc75da5f-1bf6-444c-80ad-49c180e1b8de 23:16:06.000 3FTEX1G5XAK844393 -76.6990172 2.481207 40
7bdcf779-444e-4313-83da-140461933aeb 22:28:44.000 5FTEX1MAXAK844295 -47.0145295 -21.4649238 40
```

Created files


Amazon S3 > sd-vehicle-data > 2020 > 04 > 13 > 15
sd-vehicle-data
Overview
Type a prefix and press Enter to search. Press ESC to clear.
Upload
Create folder
Download
Actions
Name
Last modified
gps-delivery-stream-1-2020-04-...
Download
Copy path
Select from
Latest version
Overview
Properties

gps-delivery-stream-1-2020-04-13-15-48-51-84ac32d9-d1d4-4fef-b177-874b015... Apr 13, 2020 8:50:37 AM GMT

Key	gps-delivery-stream-1-2020-04-13-15-48-51-84ac32d9-d1d4-4fef-b177-874b0152dc57
Expiration date	N/A
Expiration rule	N/A
ETag	522b1bc0c62b13f52b2ade7cd756a71a
Last modified	Apr 13, 2020 8:50:37 AM GMT-0700
Object URL	https://sd-vehicle-data.s3.amazonaws.com/2020/04/13/15/gps-delivery-stream-1-2020-04-13-15-48-51-84ac32d9-d1d4-4fef-b177-874b0152dc57
Storage class	Standard

Create S3 client

```python
# Create boto3 S3 client.
s3 = boto3.client('s3',
                  aws_access_key_id=AWS_KEY_ID,
                  aws_secret_access_key=AWS_SECRET,
                  region_name='us-east-1')
```

Read data into DataFrame

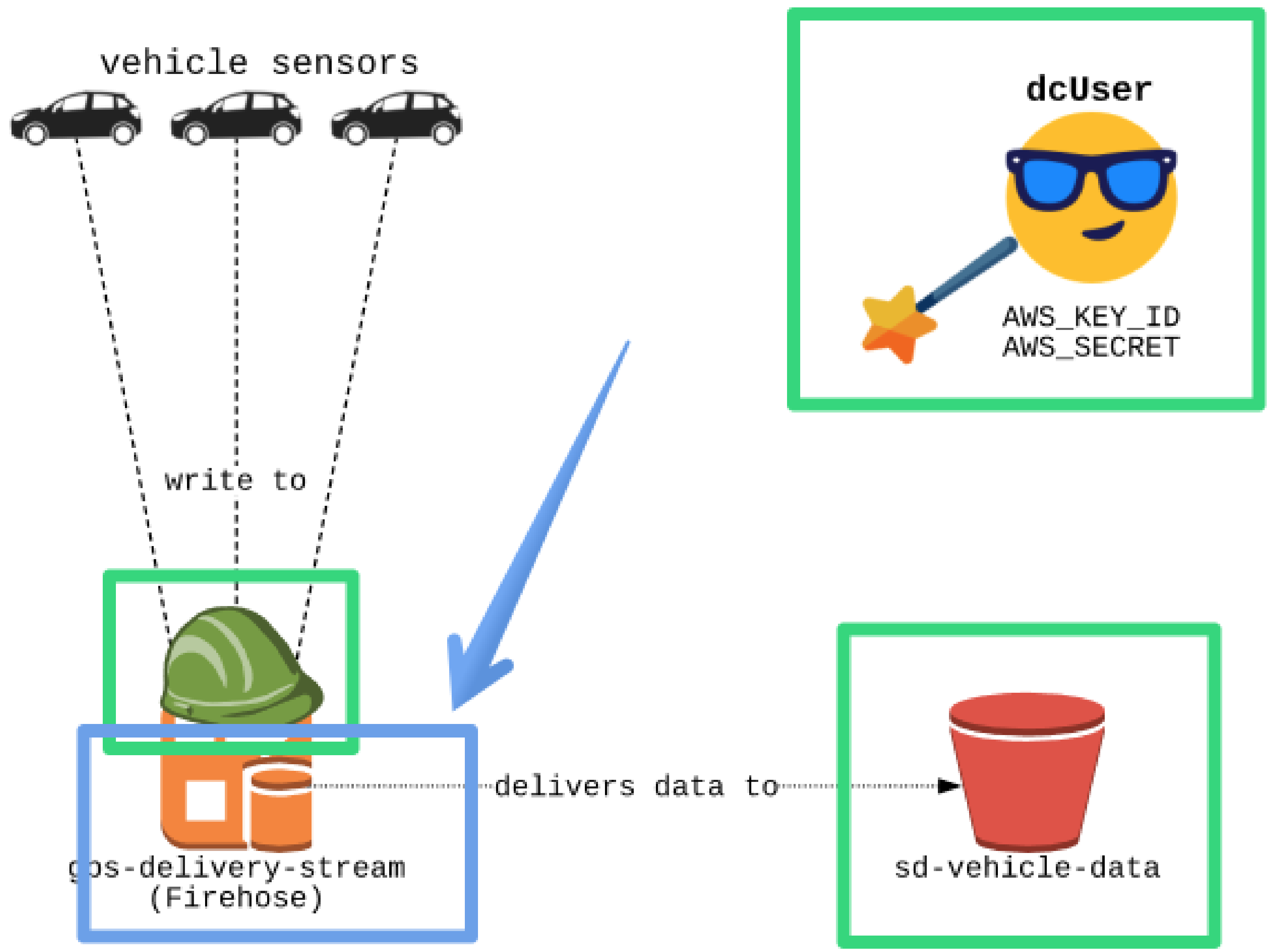
```
# Get the object from S3
obj_data = s3.get_object(Bucket='sd-vehicle-data', Key=KEY_YOU_COPIED)
```

```
# Read read the object into a DataFrame
vehicle_data = pd.read_csv(
    data['Body'],
    delimiter = " ",
    names=["record_id", "timestamp", "vin", "lon", "lat", "speed"]))
```

vehicle_data

	record_id	timestamp	vin	lon	lat	speed
0	939ed1d1...	4:25:06.000	4FTEX4944AK844294	106.945	-6.33857	25
1	f29a5b3d...	8:10:47.000	3FTEX1G5XAK844393	108.581	34.7993	37
2	ff8e7131...	20:26:44.000	2LAXX1C8XAK844292	114.392	36.0976	90
3	bc75da5f...	23:16:06.000	3FTEX1G5XAK844393	-76.699	2.48121	40
4	7bdcf779...	22:28:44.000	5FTEX1MAXAK844295	-47.0145	-21.4649	40

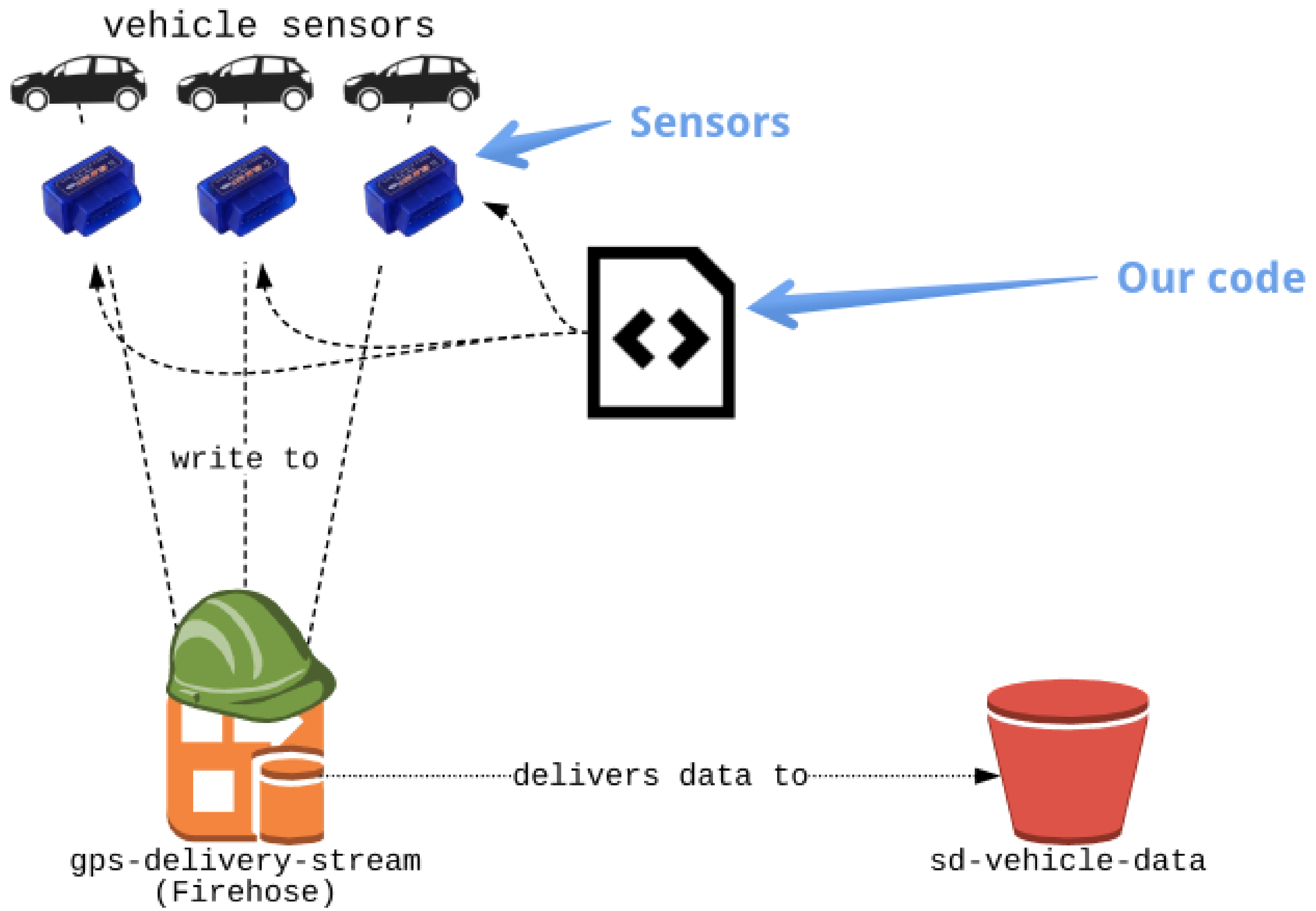
Review


vehicle sensors
write to
gps-delivery-stream
(Firehose)
delivers data to
sd-vehicle-data
dcUser
AWS_KEY_ID
AWS_SECRET

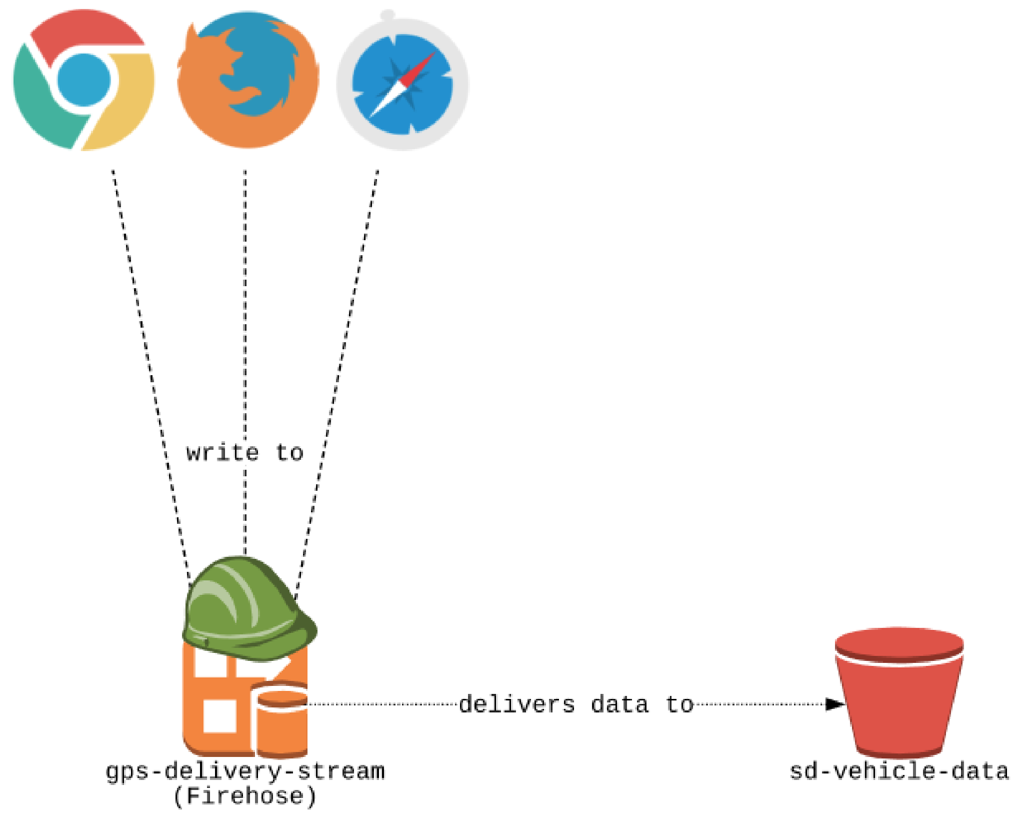
Review

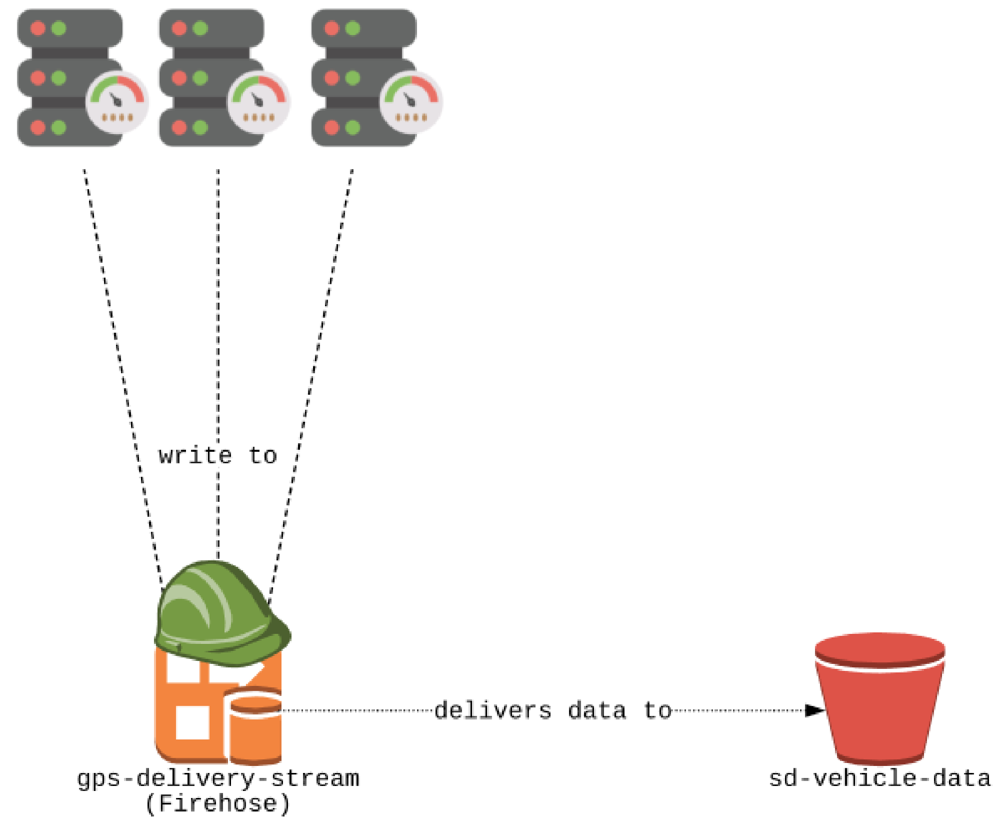
```
res = firehose.create_delivery_stream(
  DeliveryStreamName =  "gps-delivery-stream",
  DeliveryStreamType = "DirectPut",
  S3DestinationConfiguration = {
    "RoleARN": "arn:aws:iam::0000000:role/firehoseDeliveryRole",
    "BucketARN": "arn:aws:s3:::sd-vehicle-data",
  }
)
```

Review


vehicle sensors
Sensors
Our code
write to
delivers data to
gps-delivery-stream
(Firehose)
sd-vehicle-data

Review


write to
delivers data to
gps-delivery-stream
(Firehose)
sd-vehicle-data


write to
delivers data to
gps-delivery-stream
(Firehose)
sd-vehicle-data

Review

	record_id	timestamp	vin	lon	lat	speed
0	939ed1d1...	4:25:06.000	4FTEX4944AK844294	106.945	-6.33857	25
1	f29a5b3d...	8:10:47.000	3FTEX1G5XAK844393	108.581	34.7993	37
2	ff8e7131...	20:26:44.000	2LAXX1C8XAK844292	114.392	36.0976	90
3	bc75da5f...	23:16:06.000	3FTEX1G5XAK844393	-76.699	2.48121	40
4	7bdcf779...	22:28:44.000	5FTEX1MAXAK844295	-47.0145	-21.4649	40

Let's practice!

STREAMING DATA WITH AWS KINESIS AND LAMBDA