Cargoplane Documentation

Release 1.1.0

Onica Group

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Contents


cargoplane
aws

CHAPTER 1

What is this?

Cargoplane is a toolset to help you quickly *transport message cargo* between webapp clients and a backend running in the AWS cloud.

Unlike other solutions, this one does not rely on a 3rd party (just you and AWS) and is entirely serverless. Also unlike some alternatives, you application controls what topics each client has access to subscribe to and which topics they may publish to.

Cargoplane is written in Typescript, but transpiled to Javascript. The Lambda code is compatible with Node.js 8 and 10. The client code is ES5, and so will work in any remotely modern browser.

This repository is developed and maintained by the Onica Cloud Native Development Practice.

This collection is part of Onica's commitment to give back to the open source community. Find this and other Onica open source repositories on GitHub.

CHAPTER 2

Example Uses

Chat The classic example for this is a chat ability between web site visitors and company support. In fact, a simple version of this serves as the *demo*.

Push notifications Web app users can be notified of events that have occurred in the cloud.

Data Refresh The classic problem with web apps is knowing when the data showing in the browser is outdated. Cargoplane was originally built to solve this problem. When data is changed by one user, a message can be published (by that client or by a Lambda processing the change) to subscribing clients that a change has happened. The other clients then know to refresh their content from the cloud. (Only small data changes should be sent directly through Cargoplane.)

CHAPTER 3

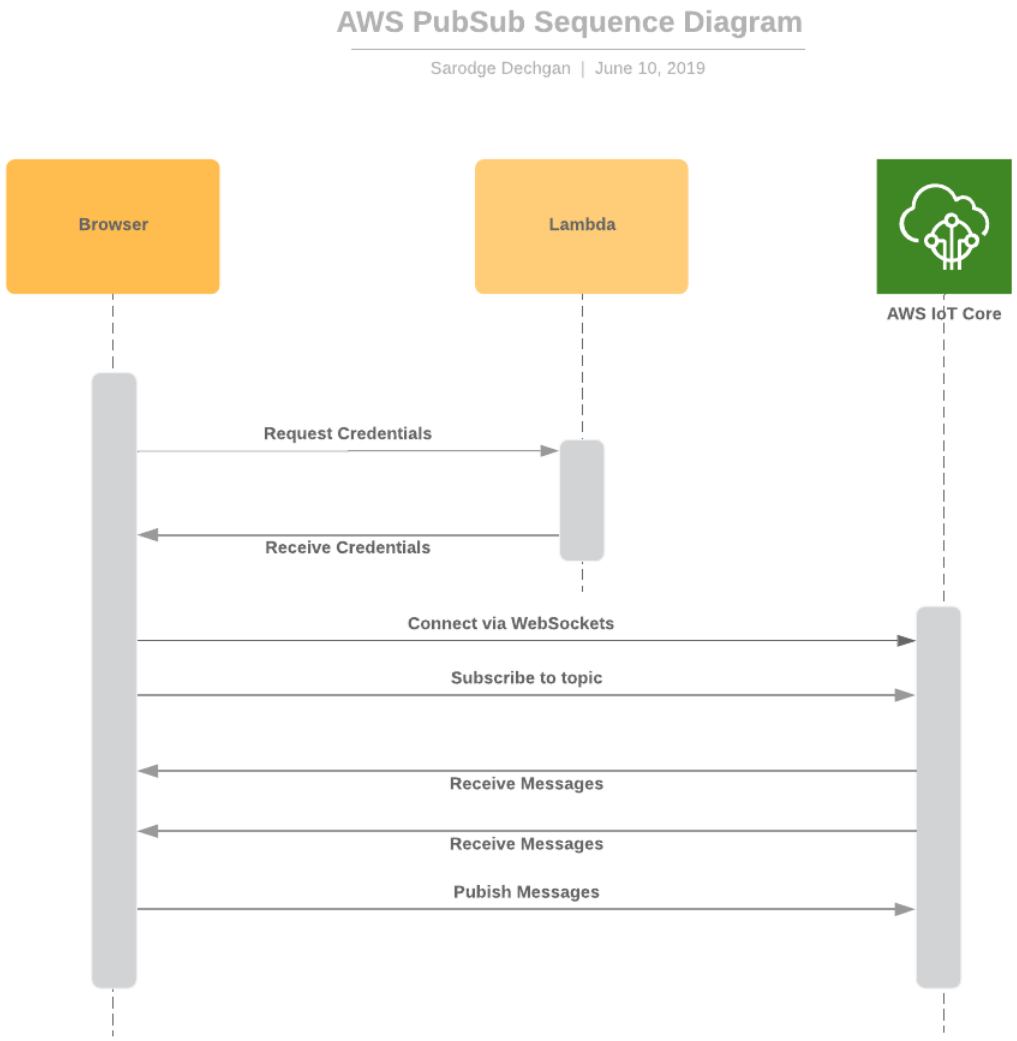
Content

3.1 Architecture and Design

3.1.1 Communication Flows

1. **Client to Client:** Web app clients can subscribe and publish to the same topics, allowing direct communications between them.
2. **Cloud to Client:** Your cloud code (ex: Lambdas) can easily publish to topics subscribed to by clients.
3. **Client to Cloud?** Generally, existing mechanisms such as API Gateway are better for this. However, it is possible to subscribe Lambdas to topics.
4. **Cloud to Cloud?** Only use Cargoplane this way if the cloud subscriber is in addition to web clients. For pure cloud to cloud, there are better options available within AWS such as SNS.

3.1.2 Design



In order to achieve the subscribe, publish, and receive capabilities there are two modules:

- cloud: Lambda to give the correct credentials.
- client: Browser client to send and receive messages.

Here are the steps:

1. Call AWS Lambda to get AWS IoT credentials and endpoint
2. Make MQTT Connection to AWS IoT with credentials

From there, you can:

1. Subscribe to topics and receive messages
2. Publish messages to topics

3.2 Cloud

Cargoplane consists of a *cloud* package and a *client* package, which must be used together in a solution.

The Cargoplane cloud package is for use in an AWS Lambda.

3.2.1 Install

```
npm i @cargoplane/cloud
```

3.2.2 Infrastructure

Cargoplane is powered by AWS IoT Core. The first time credentials are created in a region for your AWS account, the IoT endpoint is created and registered in DNS. This can take a few minute to create and still longer to DNS propagate. Rather than having your application fail on the first attempt, you can pre-create the endpoint:

1. Login to AWS Console
2. Ensure you are in the desired region
3. Navigate to the "IoT Core" Service
4. Click "Get Started" button. (If you see one.)
5. Click on "Settings" in the left nav-pane, and check on the status of your "Custom endpoint".

The cloud-side of Cargoplane can be used to publish messages, but it's primary purpose is to provide credentials for a client app. To do this, you must create an IAM role and a Lambda via API Gateway that uses this role to build credentials.

IAM Role

A role is needed to serve as the starting point for creating credentials for clients. The credentials created from this role will give clients limited access to connect, subscribe, publish and receive messages via AWS IoT. The actual credentials created for a client will be further limited by account, region, and topic.

```
IoTRole:
  Type: 'AWS::IAM::Role'
  Properties:
    RoleName: mycargoplaneapp-role-dev
    AssumeRolePolicyDocument:
      Version: 2012-10-17
      Statement:
        - Effect: Allow
          Principal:
            AWS: !Join
              - ':'
              - - 'arn:aws:iam'
                - ''
                - !Ref 'AWS::AccountId'
                - root
          Action: 'sts:AssumeRole'
    Policies:
      - PolicyName: mycargoplaneapp-role-dev-policy
        PolicyDocument:
```

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```
          Version: 2012-10-17
          Statement:
            Effect: Allow
            Action:
              - 'iot:Connect'
              - 'iot:Subscribe'
              - 'iot:Publish'
              - 'iot:Receive'
            Resource: 'arn:aws:iot:us-east-1:*:*'
```

You should of course replace the `RoleName` and `PolicyName` with appropriate names, best parameterized. Also, the final resource region needs to be changed if not `us-east-1` or to be parameterized.

Example: Cloud Demo Serverless Framework template

Lambda

Example: Cloud Demo Lambda handler

The Lambda needs the following additional policies in order to create client credentials, and to publish to topics:

```
- Effect: "Allow"
  Action:
    - iot:DescribeEndpoint
    - iot:Connect
    - iot:Publish
  Resource: "*"
- Effect: "Allow"
  Action:
    - 'sts:AssumeRole'
  Resource:
    Fn::GetAtt:
      - IoTRole
      - Arn
```

3.2.3 CargoplaneCloud class

Coding is managed by the class CargoplaneCloud. Simply create a new instance like so:

```
import {CargoplaneCloud, CargoplaneCredentialRequest} from '@cargoplane/cloud';
const cargoplane = new CargoplaneCloud();
```

Then use one of the public methods to either create credentials for a client app, or to publish a message.

createCredentials

```
async createCredentials(request:  CargoplaneCredentialRequest):
Promise<CargoplaneCredential>
```

Example Usage:

```
let credRequest: CargoplaneCredentialRequest = {
    roleName: "mycargoplaneapp-role-dev",
```

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```
    pubTopics: [
        "chattopic/general"
    ],
    subTopics: [
        "chattopic/*"
    ]
}

let credentials = await new CargoplaneCloud().createCredentials(credRequest);
```

publish

`async publish(topic: string, message?: any): Promise<void>`

Example Usage:

```
await cargoplane.publish(topic, message);
```

3.3 Client

Cargoplane consists of a *cloud* package and a *client* package, which must be used together in a solution.

This Cargoplane client package is used in your web application.

3.3.1 Install

```
npm i @cargoplane/client aws-iot-device-sdk rxjs
```

Install with Angular

If integrating with Angular, some changes are needed to make the aws-iot package, which is intended for a Node.js environment, to work in a browser.

```
npm i @angular-builders/custom-webpack --save-dev
```

Add the file `./webpack-custom.config.ts` to the project's root folder with the following:

```
module.exports = {
  node: {
    fs: 'empty',
    tls: 'empty',
    path: 'empty'
  }
};
```

Similarly, if you use the default Karma unit test running, add the following in `karma.conf.js` as another property passed to `config.set`:

```
webpack: {
  node: {
    fs: 'empty',
```

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```
    tls: 'empty',
    path: 'empty'
  }
}
```

See also AWS Javascript SDK with Angular for other possible changes that may be needed.

3.3.2 CargoplaneClient class

The `CargeplaneClient` client is your API to integrate with Cargoplane. It must be used as a singleton. (If you have dependency injection, use that.)

Please see the *demos* for examples to follow.

connect

Connects/reconnects to Cargoplane Cloud with the given credentials.

`connect(credential: CargoplaneCredential, emitEventMsBeforeExpiration?: number): Observable<Event>`

The `credential` must be retrieved from the companion Lambda in the cloud package calling `CargoplaneCloud#createCredentials`.

`connect` will return a stream of Events about the connection. Check the Event `type` field for what happened. Unless otherwise stated, Cargoplane will log these events and manage them automatically.

- `type === 'connected'`: Connection has completed.
- `type === 'disconnected'`: Connection has been dropped.
- `type === 'offline'`: Network is offline.
- `type === 'expiring'`: The current credentials are expiring (or has already). Use this to trigger your application to obtain new credentials to call `connect` with again. Subscriptions are automatically re-applied upon reconnect. You can control how early the expiration warning comes by optionally passing in a value for `emitEventMsBeforeExpiration`. The default is one minute.
- `type === 'clock-resume'`: If the computer sleeps or the browser tab is suspended, this will be emitted when processing resumes. *Messages may have been lost while suspended* - you may need to take action to account for this. If the credentials expired during the suspension, a separate `expiring` event will follow this.
- `type === 'error'`: There was an error with the connection. (Cargoplane will try to reconnect if needed.)

disconnect

Disconnect and clear all subscriptions. (Ex: upon user logout)

`disconnect(): void`

isOnline

Is the service currently connected to the cloud?

If network access is lost, it will automatically attempt to reconnect when network access is restored provided that the credentials have not expired.

```
isOnline():  boolean
```

observe

Obtain an RxJs Observable of a topic.

This call will automatically subscribe to the topic if this is the first request to observe it.

```
observe(topic:  string):  Observable<any>
```

publish

Publish a message to a topic.

```
publish(topic:  string, message?:  any):  void
```

3.4 Demo

The demo directory contains a simple chat application to show how to use Cargoplane. It consists of:

1. A Serverless Framework based cloud stack.
2. An Angular webapp client.
3. A React webapp client.

3.5 Apache License

Version 2.0

Date January 2004

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CHAPTER 4

Why Cargoplane?

Onica's early OSS releases have had aviation themed names; this may or may not have something to do with the CTO being a pilot. Nobody really knows.

Cargoplane is visualized as a means to transport (fly) cargo (information) from one point to another. There isn't much more to it than that.

Also, the name was available. That was a big factor.