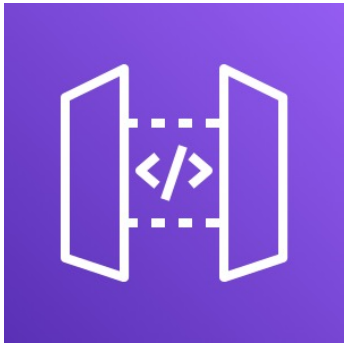
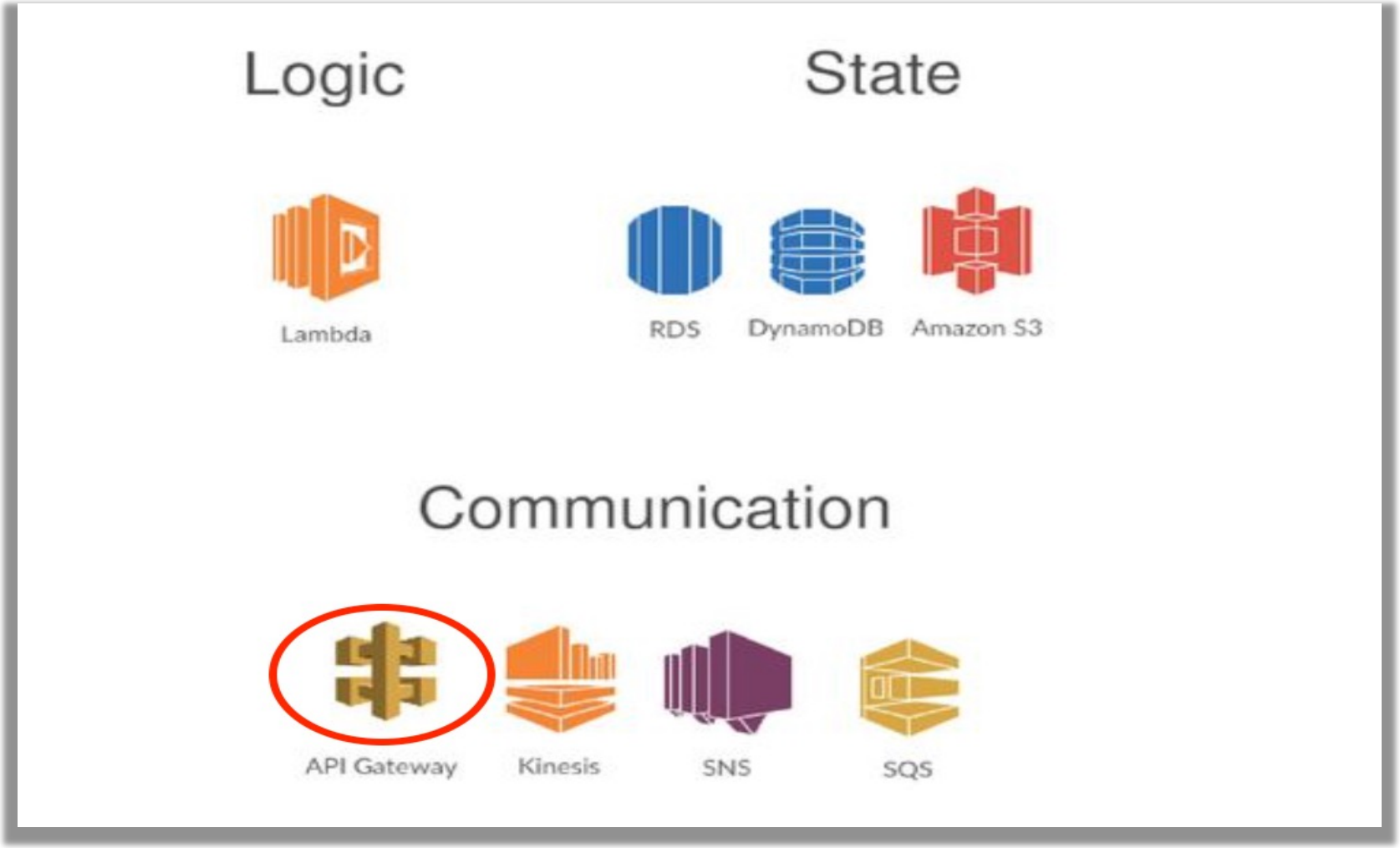
Serverless Web APIs

(Continued)

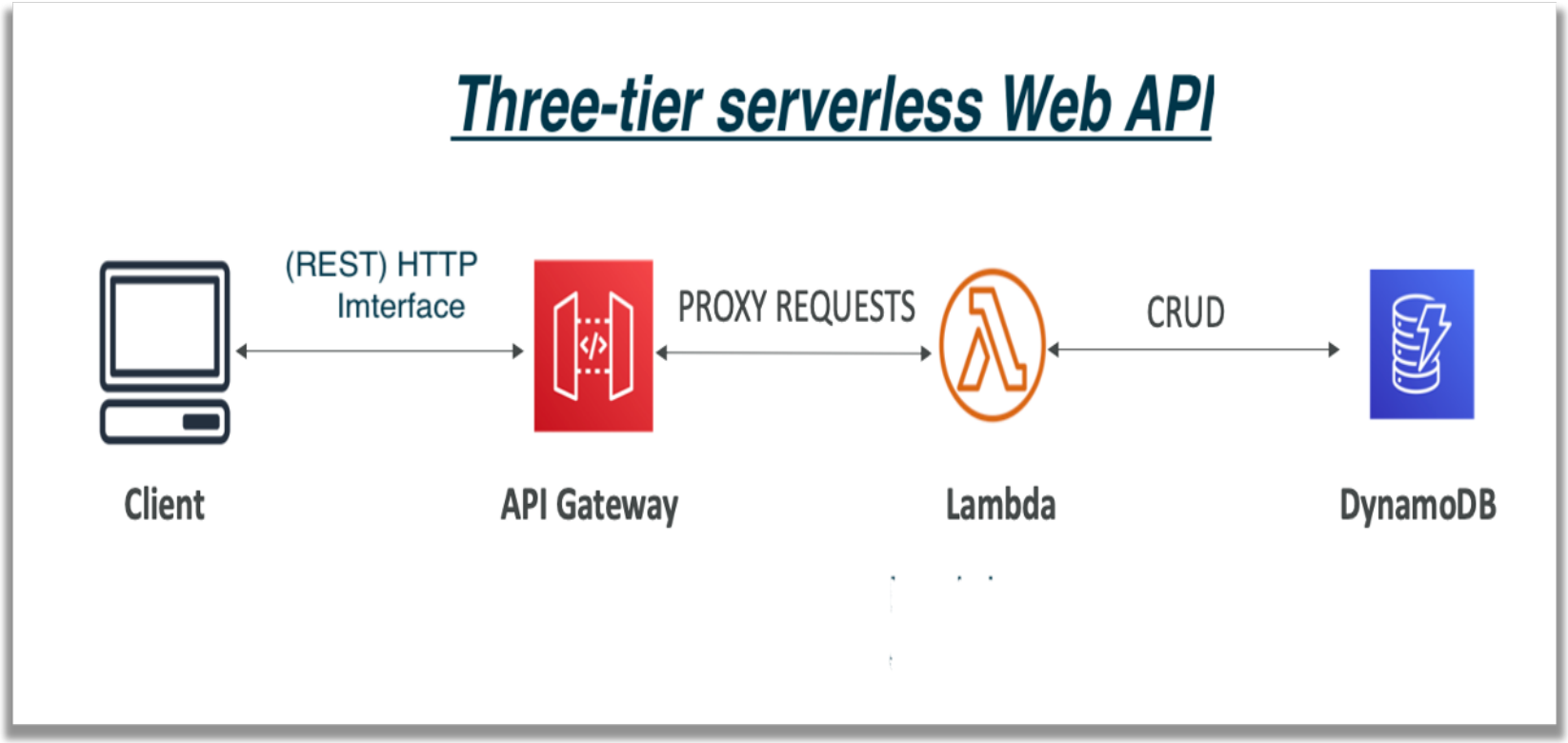


API Gateway

Components of a Serverless app



API Gateway


Three-tier serverless Web API
(REST) HTTP
Imterface
PROXY REQUESTS
CRUD
Client
API Gateway
Lambda
DynamoDB

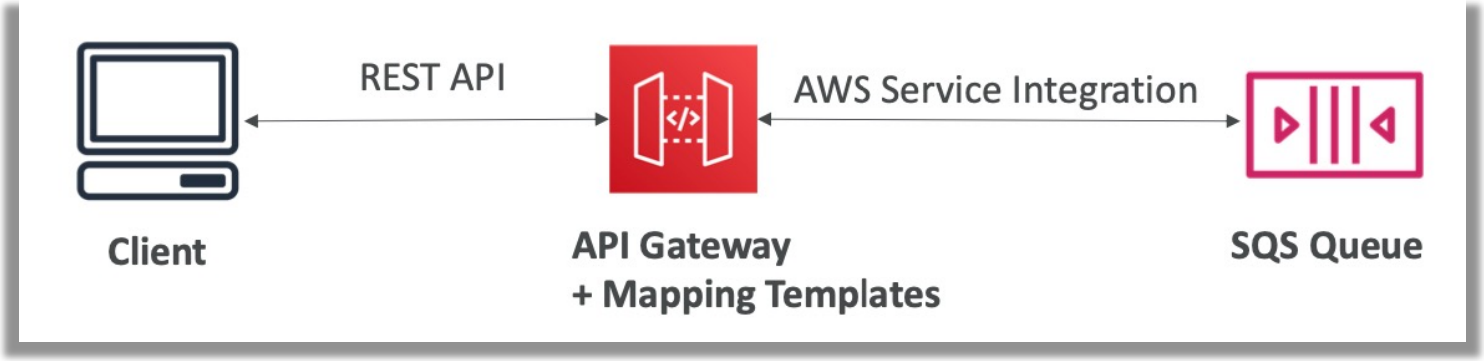
API Gateway

- **A fully managed (aka Serverless) service for Web APIs.**
- **Creating REST API endpoints.**
- Support for the WebSocket Protocol.
- Handle API versioning (v1, v2...).
- Handle different environments (dev, test, prod).
- Handle security (Authentication and Authorization).
- Create API keys; handles request throttling.
- Swagger / Open API import to quickly define APIs.
- Transform and validate requests and responses.
- Generate SDK and API specifications.
- Cache API responses.
- **Supports DDos protection.**

API Gateway - Integration Types

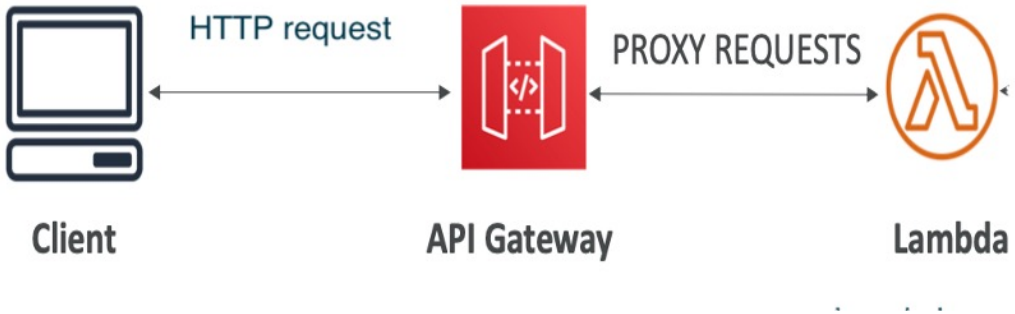
- **Integration Type MOCK:**
  - **API Gateway returns a response without sending the request to the backend.**

- **Integration Type HTTP / AWS (AWS Services)**
  - **You must configure both the integration request and integration response.**
  - **Setup data mapping using mapping templates for the request & response.**



API Gateway - IntegrationTypes

- **Integration Type AWS_PROXY (Lambda Proxy):**
  - **incoming request from the client is the input to Lambda.**
  - **No mapping template.**
  - **HTTP headers, query string parameters are passed as arguments.**

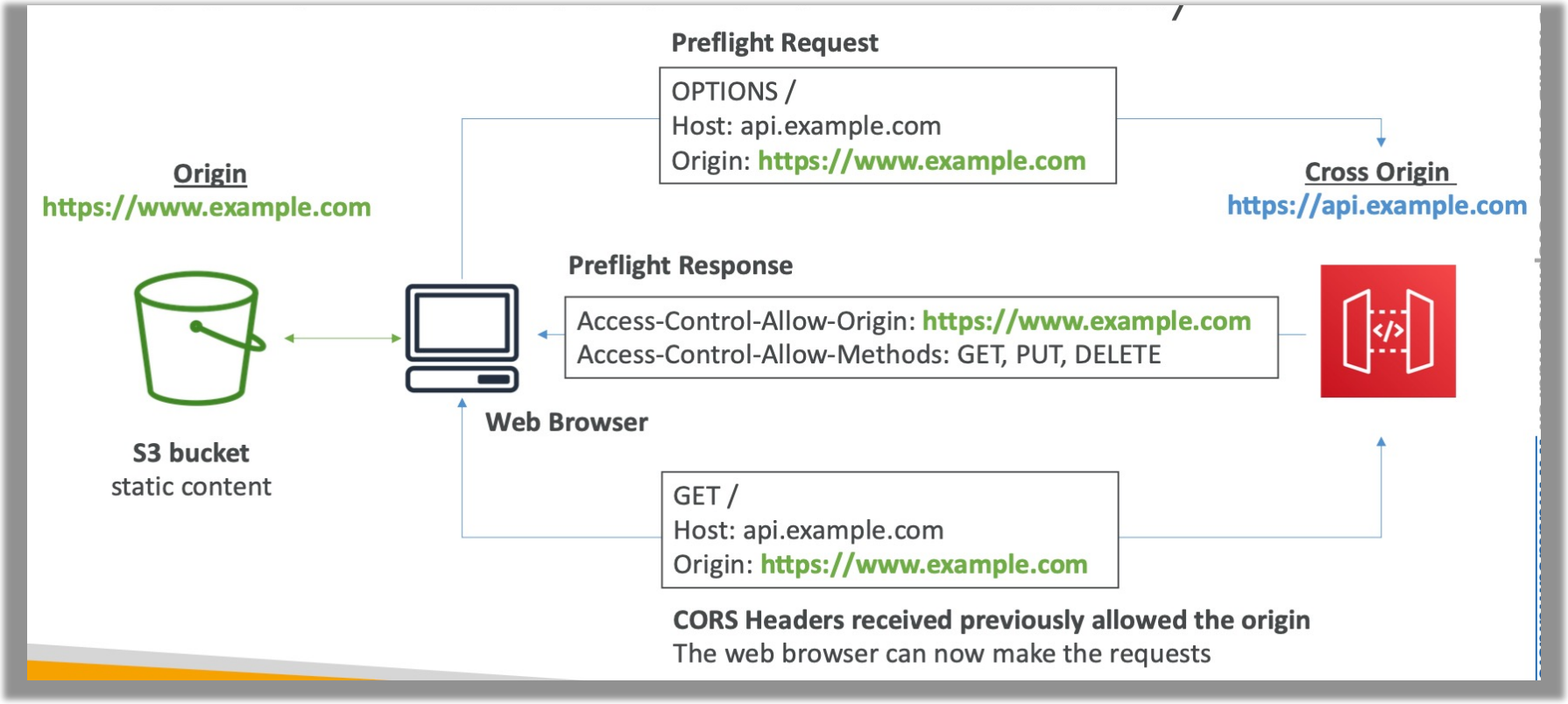


API Gateway - Integration Types

- **Integration Type HTTP_PROXY**
  - **No mapping template.**
  - **The HTTP request is passed to the backend.**
  - **The HTTP response from the backend is forwarded by API Gateway.**
  - **Cheaper, more lightweight than AWS_PROXY**

API Gateway - CORS

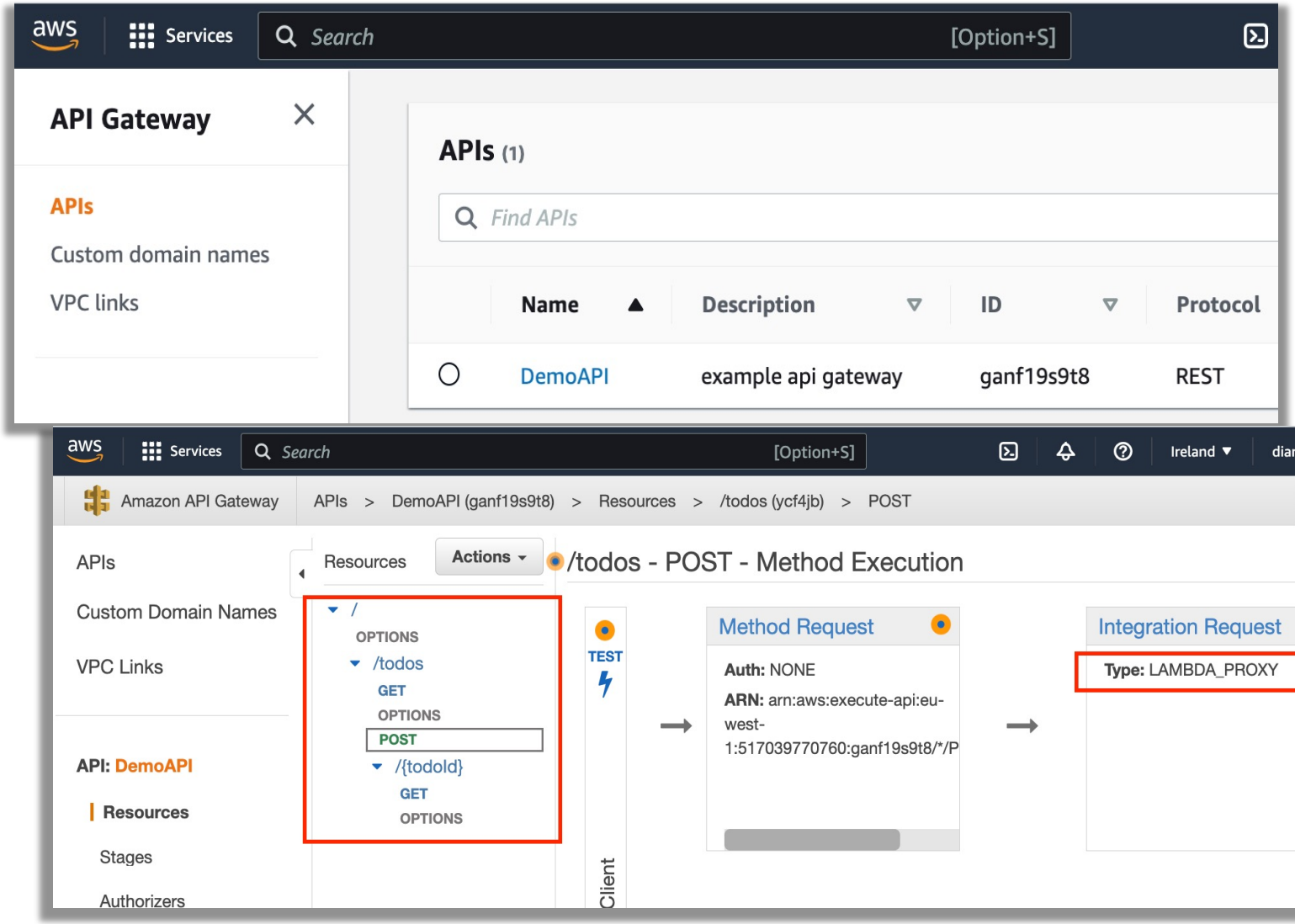
- CORS must be enabled when you receive API calls from another domain



API Gateway -Example

- **Objective – Web API for managing TODOs.**
- **Two Endpoints**
  - **/todos**
    - **GET – Read all todos**
    - **POST – Add new TODO**
  - **/todos/{todoID}**
    - **GET – Read specifi TODO**

API Gateway - Example

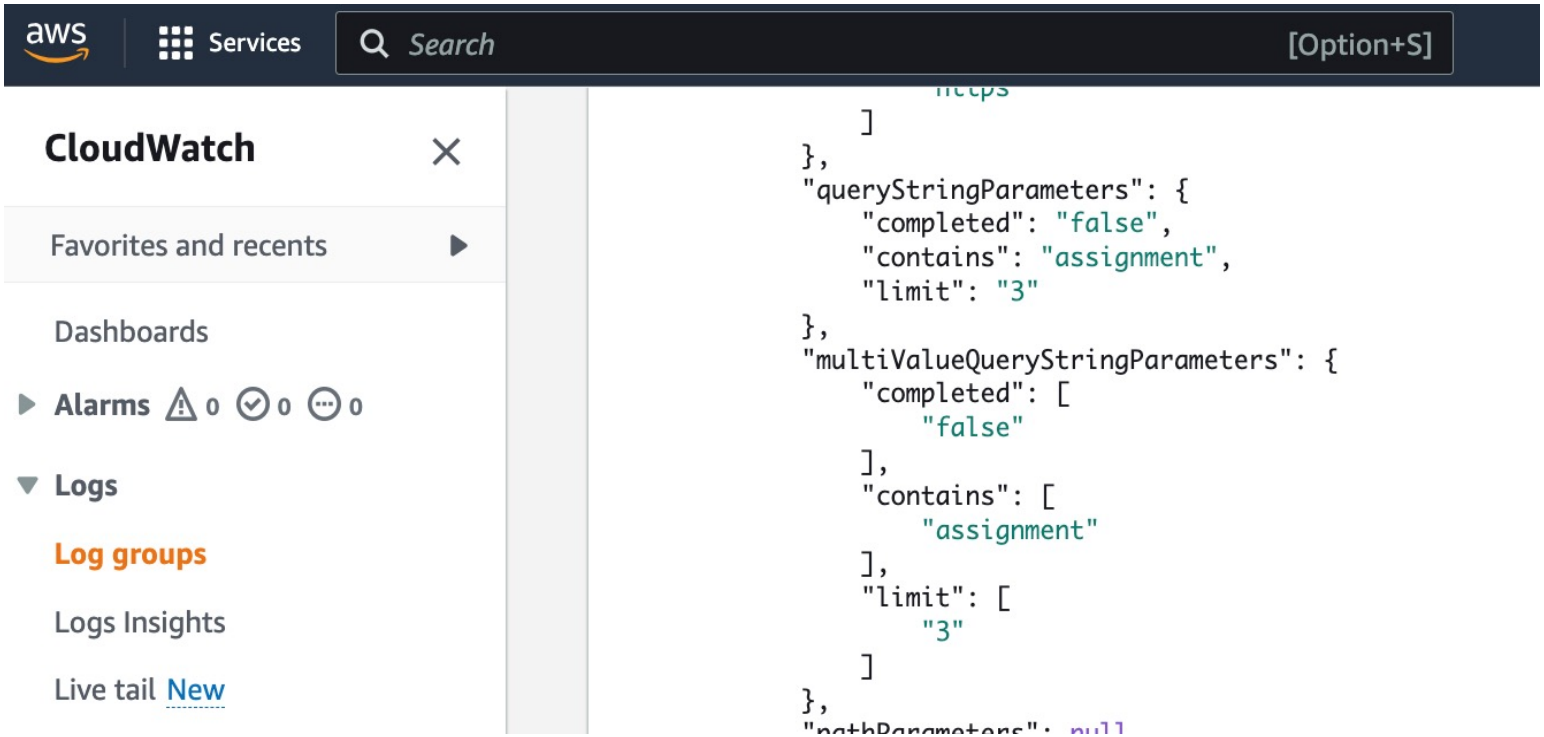


```
// Lambda backend functionality

const RESTEndpointFn = new NodejsFunction(this, "RESTEndpointFn", ....);

// API Gateway configuration

const api = new RestApi(this, "DemoAPI", {
  description: "example api gateway",
  deployOptions: {
    stageName: "dev",
  },
  defaultCorsPreflightOptions: {
    allowMethods: ["OPTIONS", "GET", "POST", "PUT", "PATCH", "DELETE"],
    allowOrigins: ["*"],
  },
});

const todosEndpoint = api.root.addResource("todos");
todosEndpoint.addMethod(
  "GET",
  new LambdaIntegration(RESTEndpointFn, { proxy: true }) // AWSIntegration
);
todosEndpoint.addMethod(
  "POST",
  new LambdaIntegration(RESTEndpointFn, { proxy: true }) // AWSIntegration
);

const todoDetailsEndpoint = todosEndpoint.addResource("{todoId}");
todoEndpoint.addMethod(
  "GET",
  new LambdaIntegration(RESTEndpointFn, { proxy: true })
);
```

CDK stack to create REST Web API, using API Gateway service

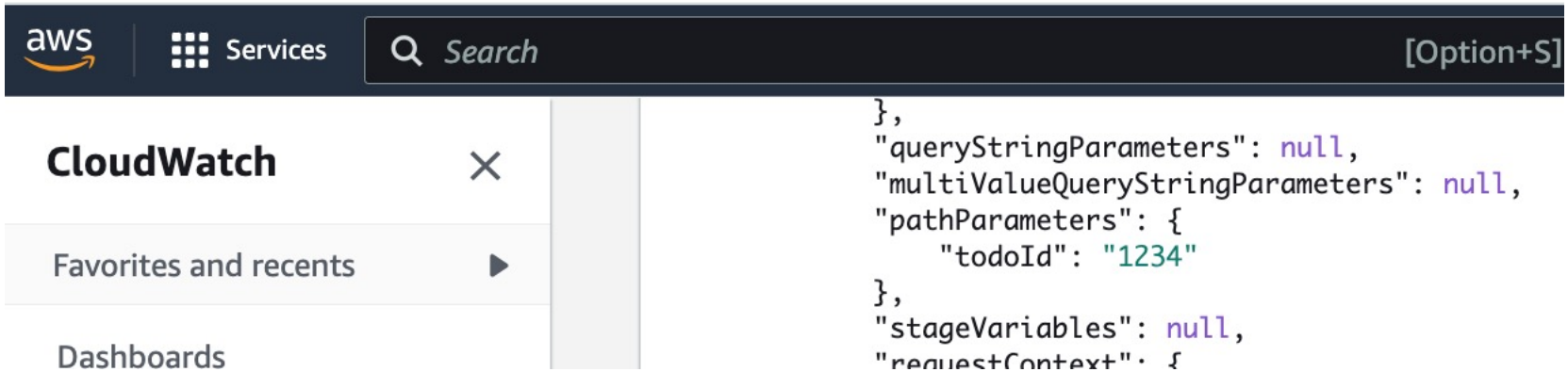
API Gateway - Example

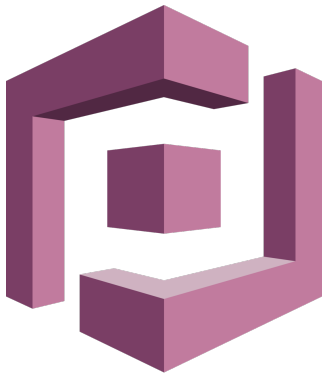
- **The query string**
- `https://ganf19s9t8.execute-api.eu-west-1.amazonaws.com/dev/todos?contains=assignment&completed=false&limit=3`



API Gateway - Example

- **Path parameters/variables.**
- `https://ganf19s9t8.execute-api.eu-west-1.amazonaws.com/dev/todos/1234`





Amazon Cognito

Components of a Serverless app

Amazon Cognito

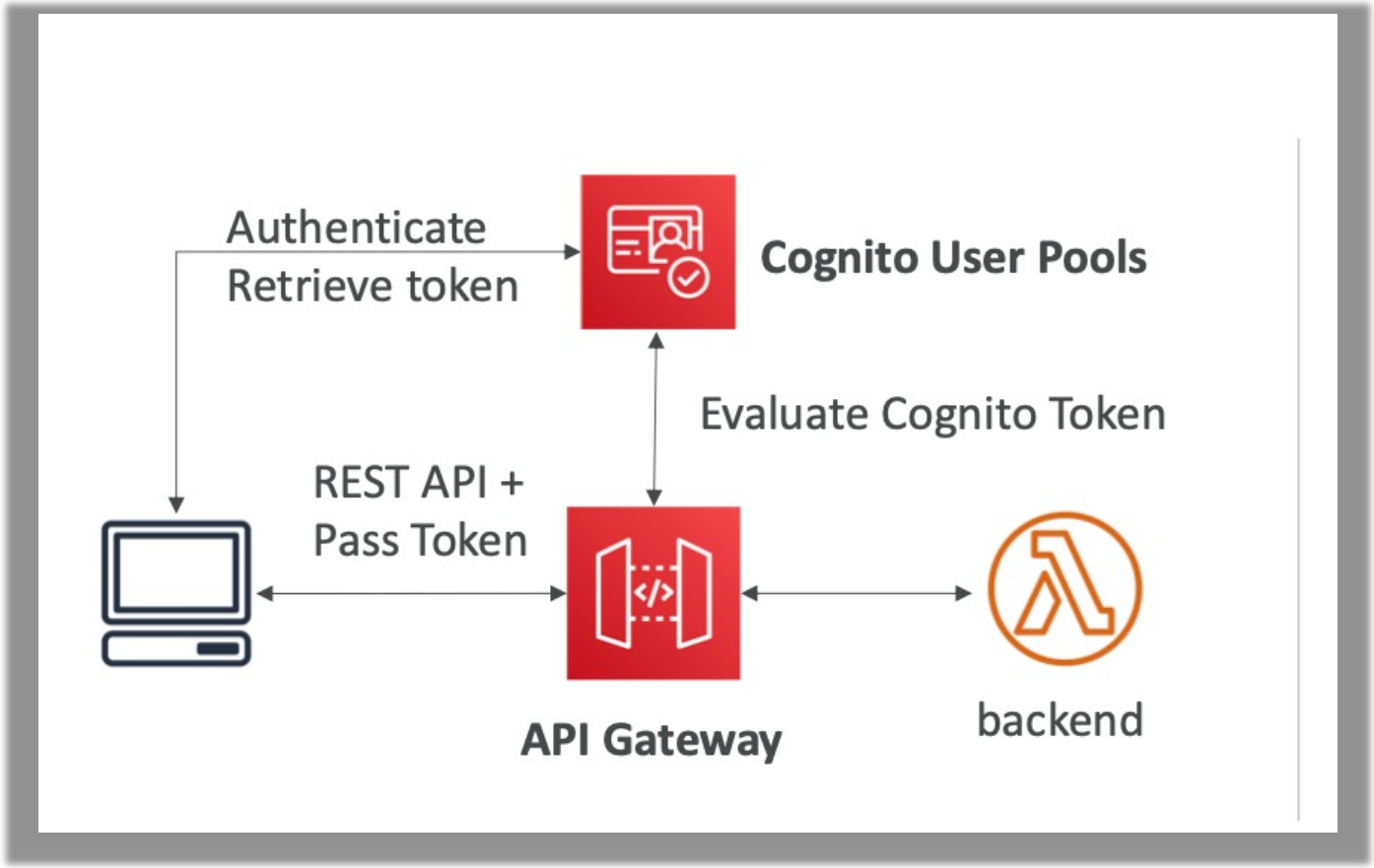
- We want to give users an identity so that they can interact with our application.
- Cognito User Pools:
  - Sign in functionality for app users.
  - Integrate with API Gateway & Application Load Balancer.
- Cognito Identity Pools (Federated Identity):
  - Provide AWS credentials to users so they can access AWS resources directly.
  - Integrate with Cognito User Pools as an identity provider.

- Cognito vs IAM: "hundreds of users", "mobile users".

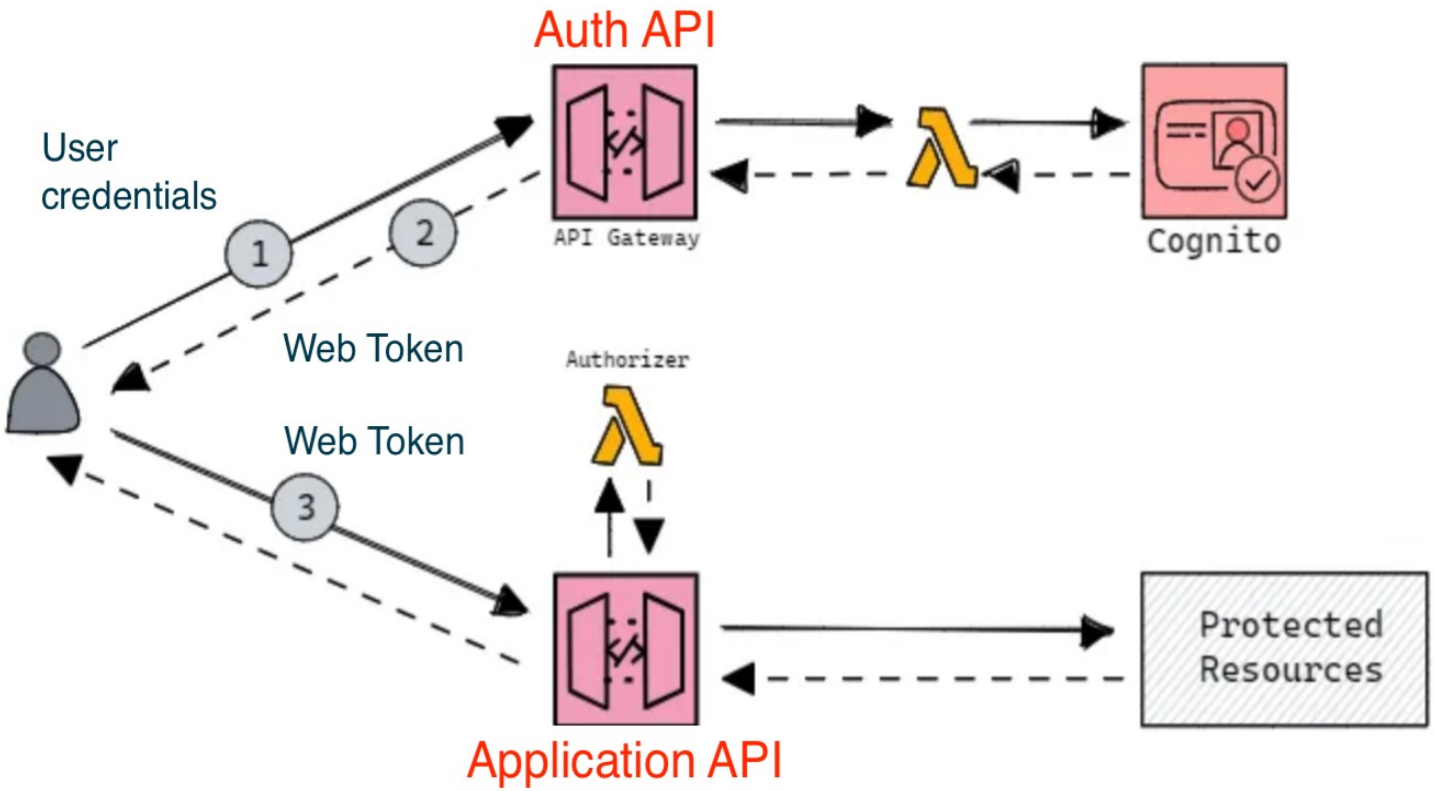
Cognito User Pool

- Creates a serverless database of user for your web & mobile apps.
- Simple login: Username (or email) / password combination.
- Password reset.
- Email & Phone Number Verification.
- Multi-factor authentication (MFA).
- Federated Identities: Facebook, Google...
- Feature: block users if their credentials are compromised elsewhere
- Include JSON Web Token (JWT) in Login response.

Cognito User Pool

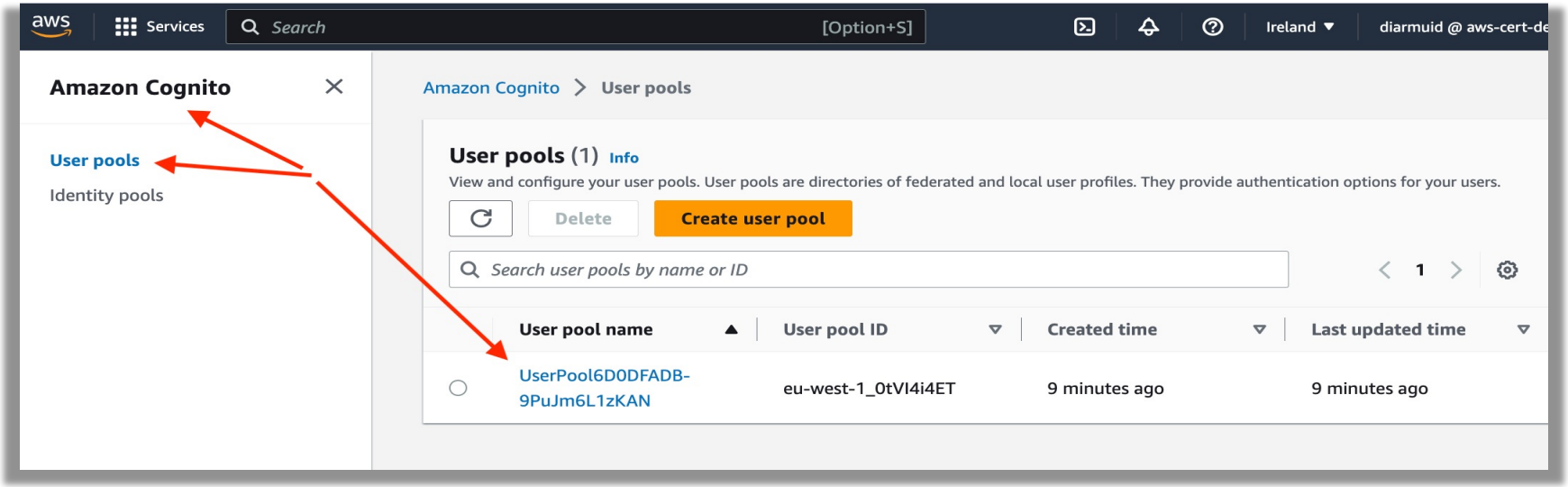


Example

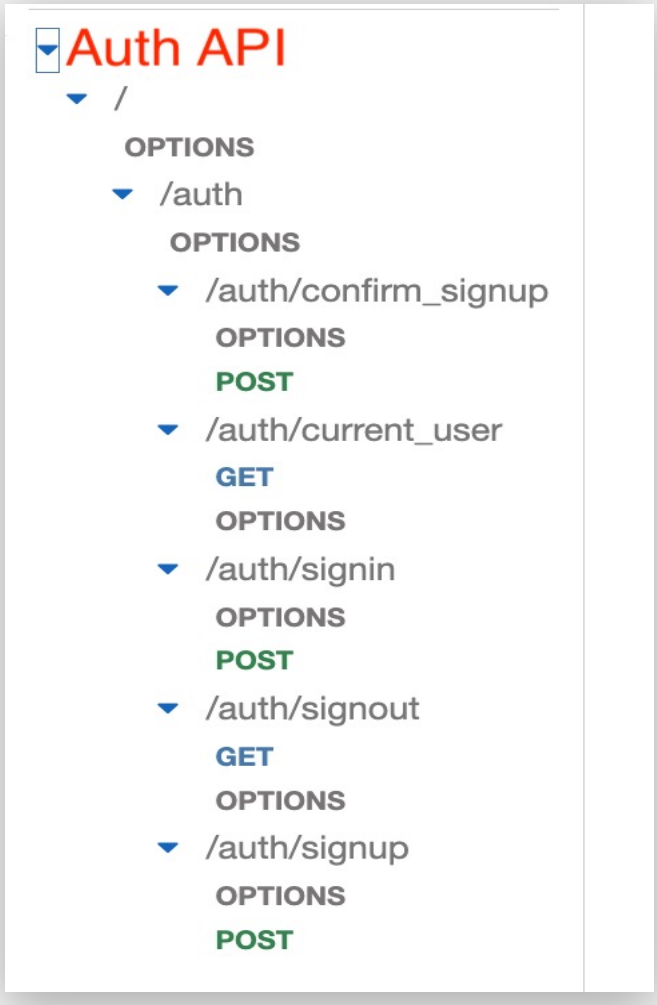

Auth API
User
credentials
1
2
API Gateway
Cognito
Web Token
Authorizer
Web Token
3
Protected
Resources
Application API

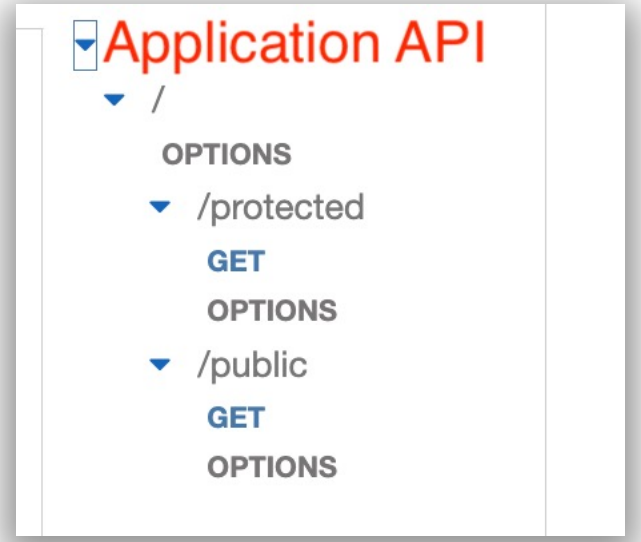
Example – User Pool

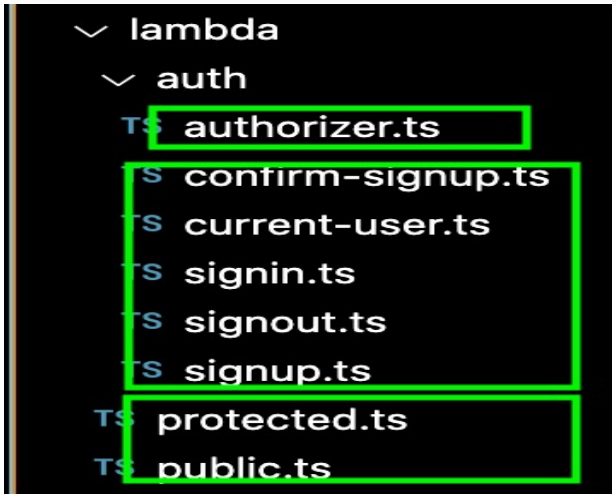
```
110  // CDK setup
111  const userPool = new UserPool(this, 'UserPool', {
112    signInAliases: { username: true, email: true },
113    selfSignUpEnabled: true,
114    removalPolicy: RemovalPolicy.DESTROY,
115  });
116
117  const appClient = userPool.addClient('AppClient', {
118    authFlows: { userPassword: true },
119  });
```



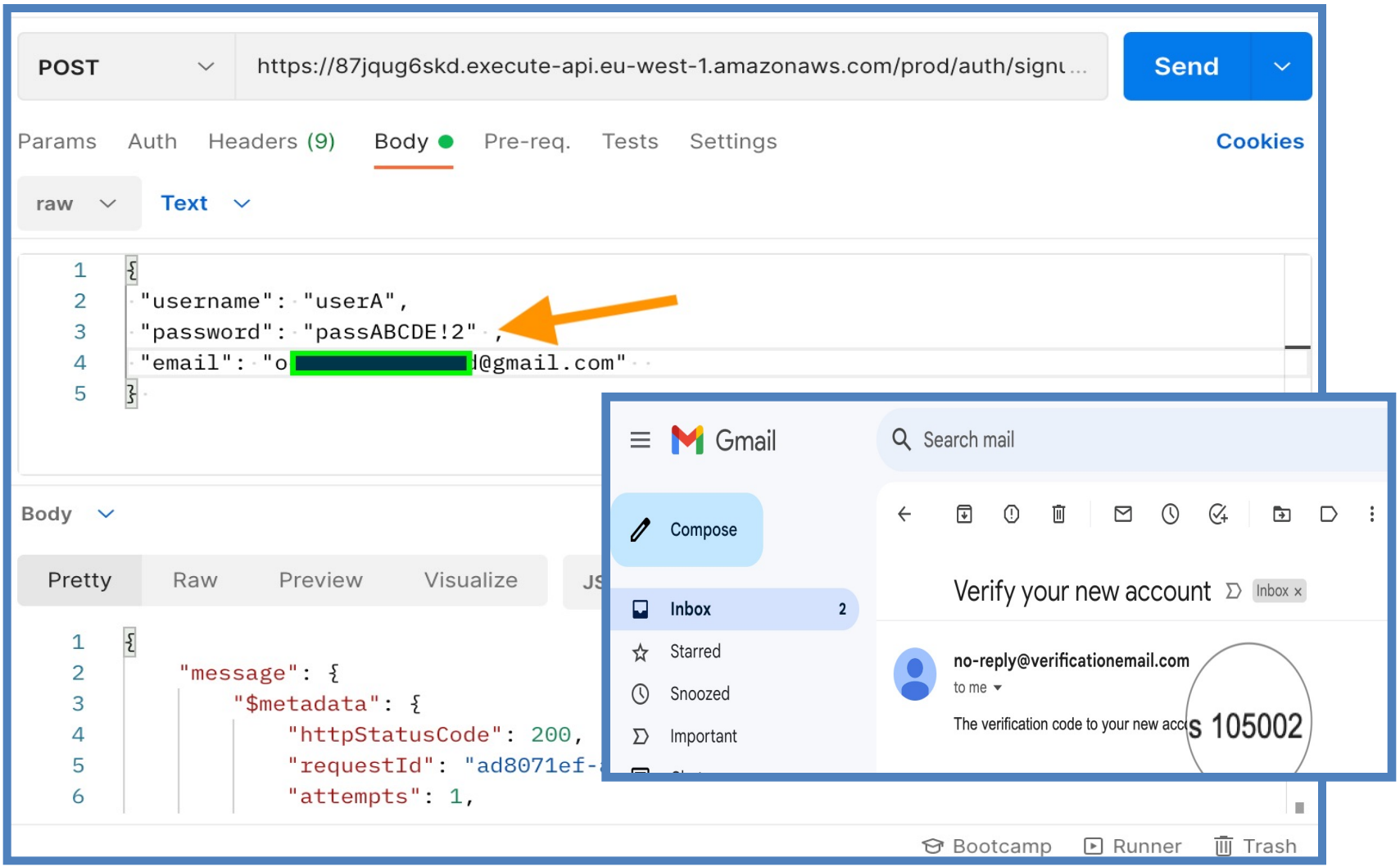
Example – APIs







Example – SignUp

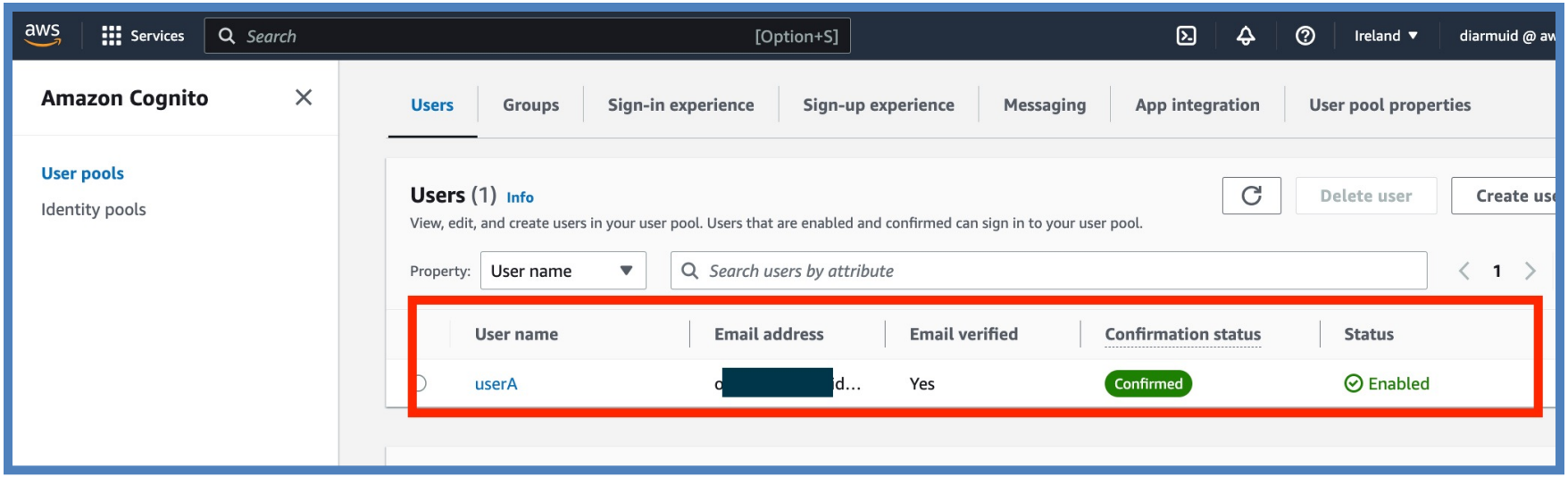


Example – SignUp

```
130  const client = new CognitoIdentityProviderClient({ region: "eu-west-1" });
131
132  export const handler: APIGatewayProxyHandlerV2 = async (event) => {
133
134    const { username, email, password }: eventBody = JSON.parse(event.body);
135
136    const params: SignUpCommandInput = {
137      ClientId: process.env.CLIENT_ID!,
138      Username: username,
139      Password: password,
140      UserAttributes: [{ Name: "email", Value: email }],
141    };
142
143    try {
144      const command = new SignUpCommand(params);
145      const res = await client.send(command);
146      return {
147        statusCode: 200,
148        body: JSON.stringify({
149          message: res,
150        }),
151      };
152    } catch (err) {....}
153  };
```

Example – Confirm SignUp

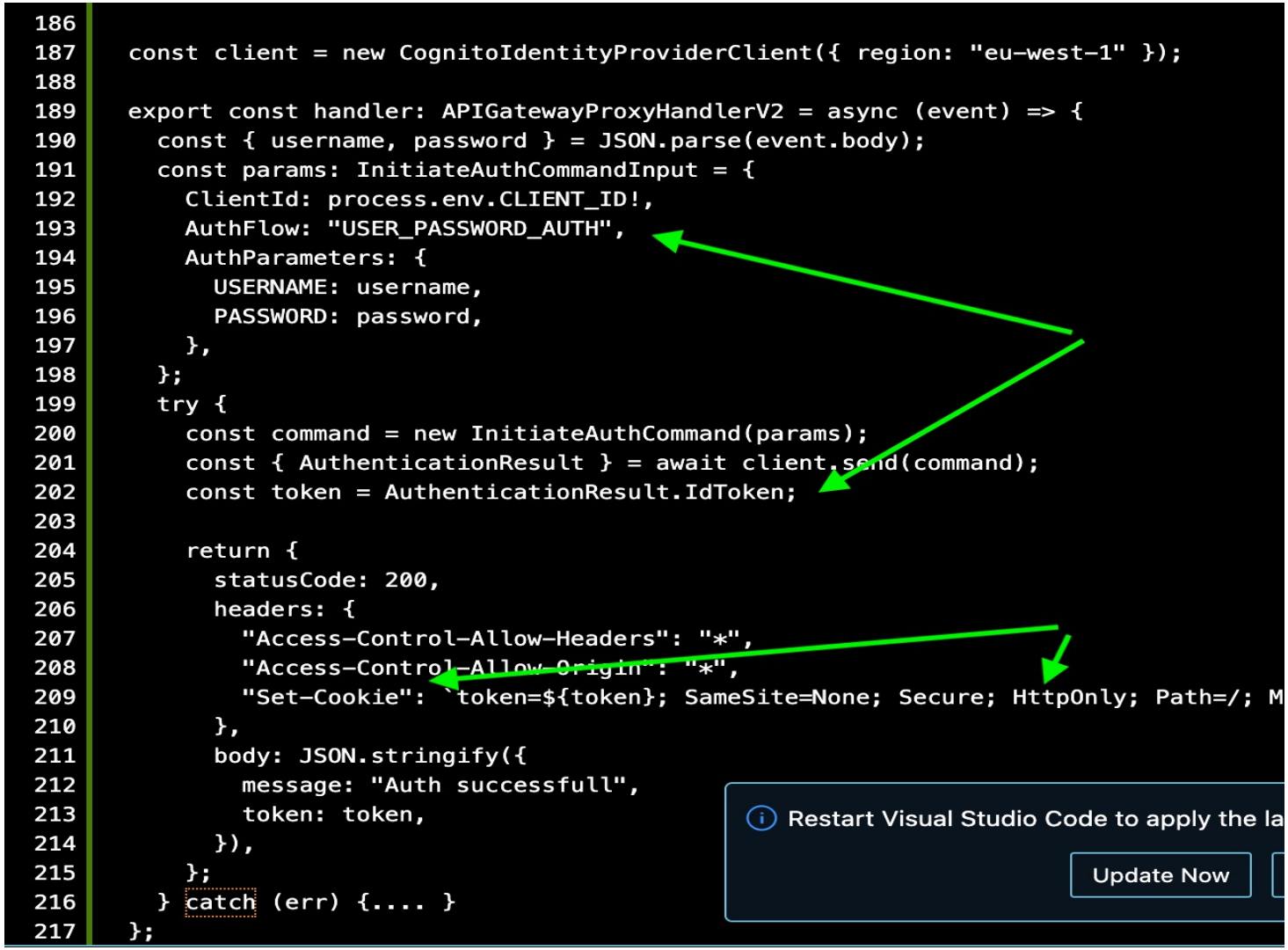
Example – Confirm SignUp



Example – Confirm SignUp

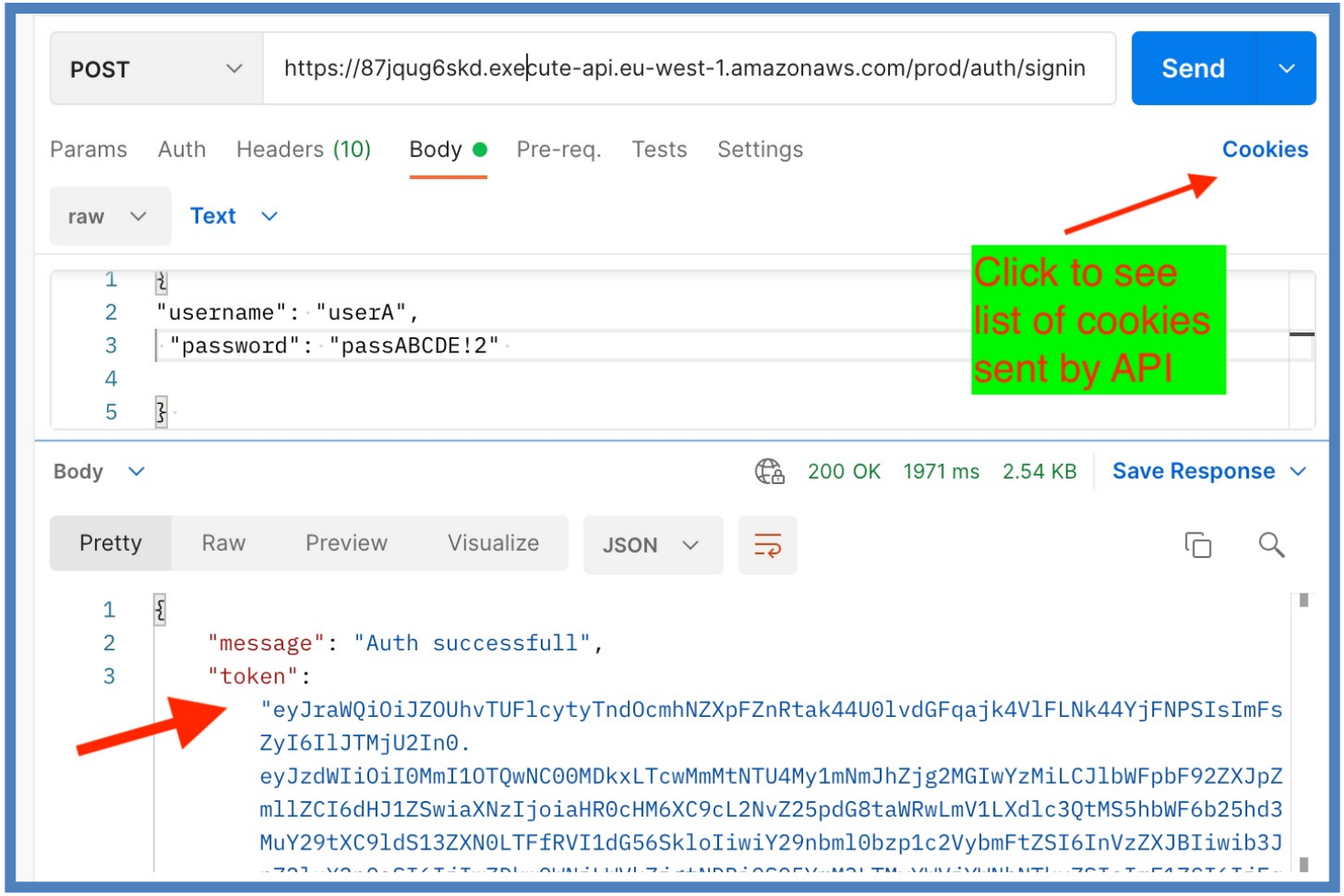
```
157  const client = new CognitoIdentityProviderClient({ region: "eu-west-1" });
158
159  type eventBody = { username: string; code: string };
160
161  export const handler: APIGatewayProxyHandlerV2 = async (event) => {
162
163    const { username, code }: eventBody = JSON.parse(event.body);
164
165    const params: ConfirmSignUpCommandInput = {
166      ClientId: process.env.CLIENT_ID!,
167      Username: username,
168      ConfirmationCode: code,
169    };
170
171    try {
172      const command = new ConfirmSignUpCommand(params);
173      const res = await client.send(command);
174
175      return {
176        statusCode: 200,
177        body: JSON.stringify({
178          message: `User ${username} successfully confirmed`,
179          confirmed: true,
180        }),
181      };
182    } catch (err) { ...}      You, 1 second ago • Uncommitted changes
183  };
```

Example – SignIn

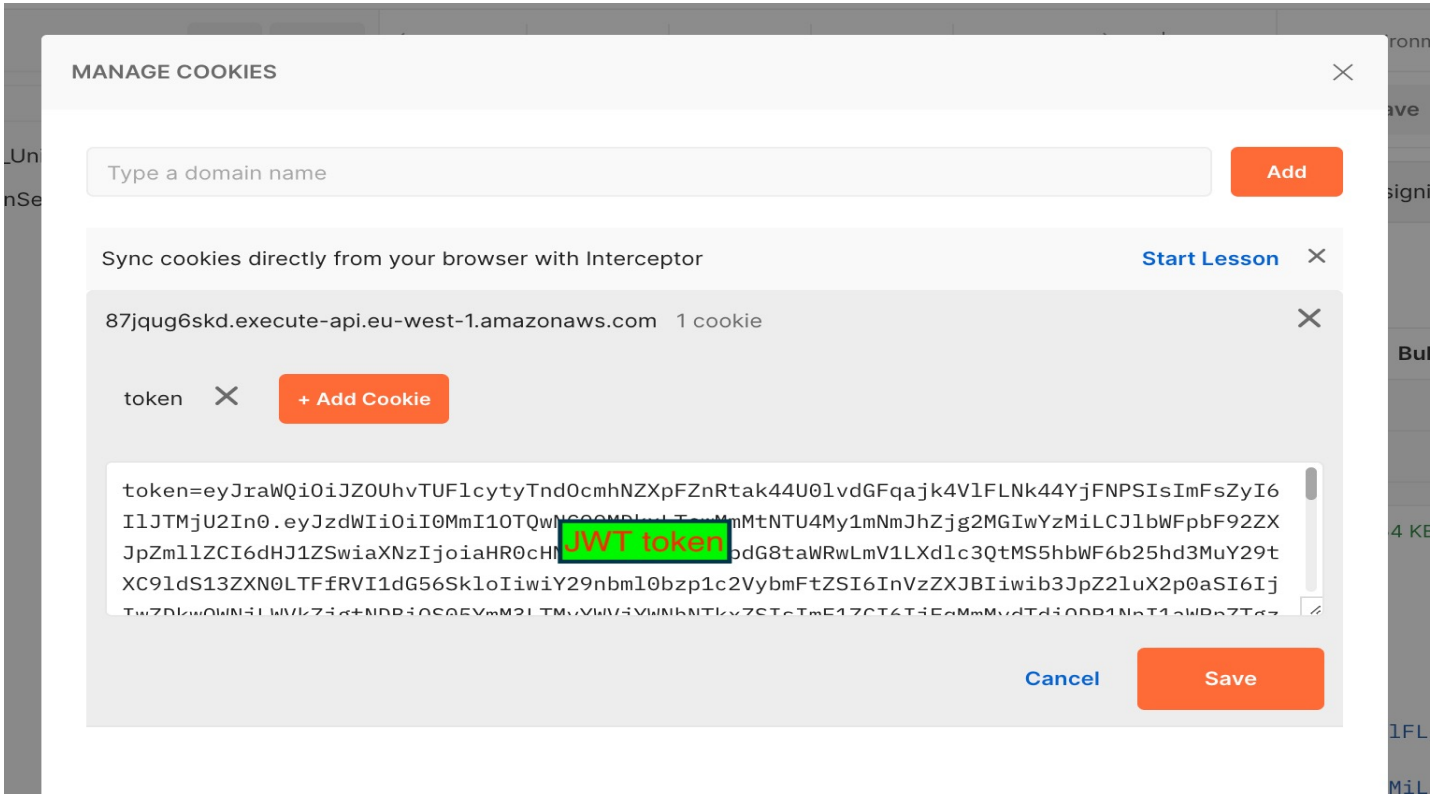


```
186
187  const client = new CognitoIdentityProviderClient({ region: "eu-west-1" });
188
189  export const handler: APIGatewayProxyHandlerV2 = async (event) => {
190    const { username, password } = JSON.parse(event.body);
191    const params: InitiateAuthCommandInput = {
192      ClientId: process.env.CLIENT_ID!,
193      AuthFlow: "USER_PASSWORD_AUTH",
194      AuthParameters: {
195        USERNAME: username,
196        PASSWORD: password,
197      },
198    };
199    try {
200      const command = new InitiateAuthCommand(params);
201      const { AuthenticationResult } = await client.send(command);
202      const token = AuthenticationResult.IdToken;
203
204      return {
205        statusCode: 200,
206        headers: {
207          "Access-Control-Allow-Headers": "*",
208          "Access-Control-Allow-Origin": "*",
209          "Set-Cookie": `token=${token}; SameSite=None; Secure; HttpOnly; Path=/; M
210        },
211        body: JSON.stringify({
212          message: "Auth successfull",
213          token: token,
214        }),
215      };
216    } catch (err) {.... }
217  };
```

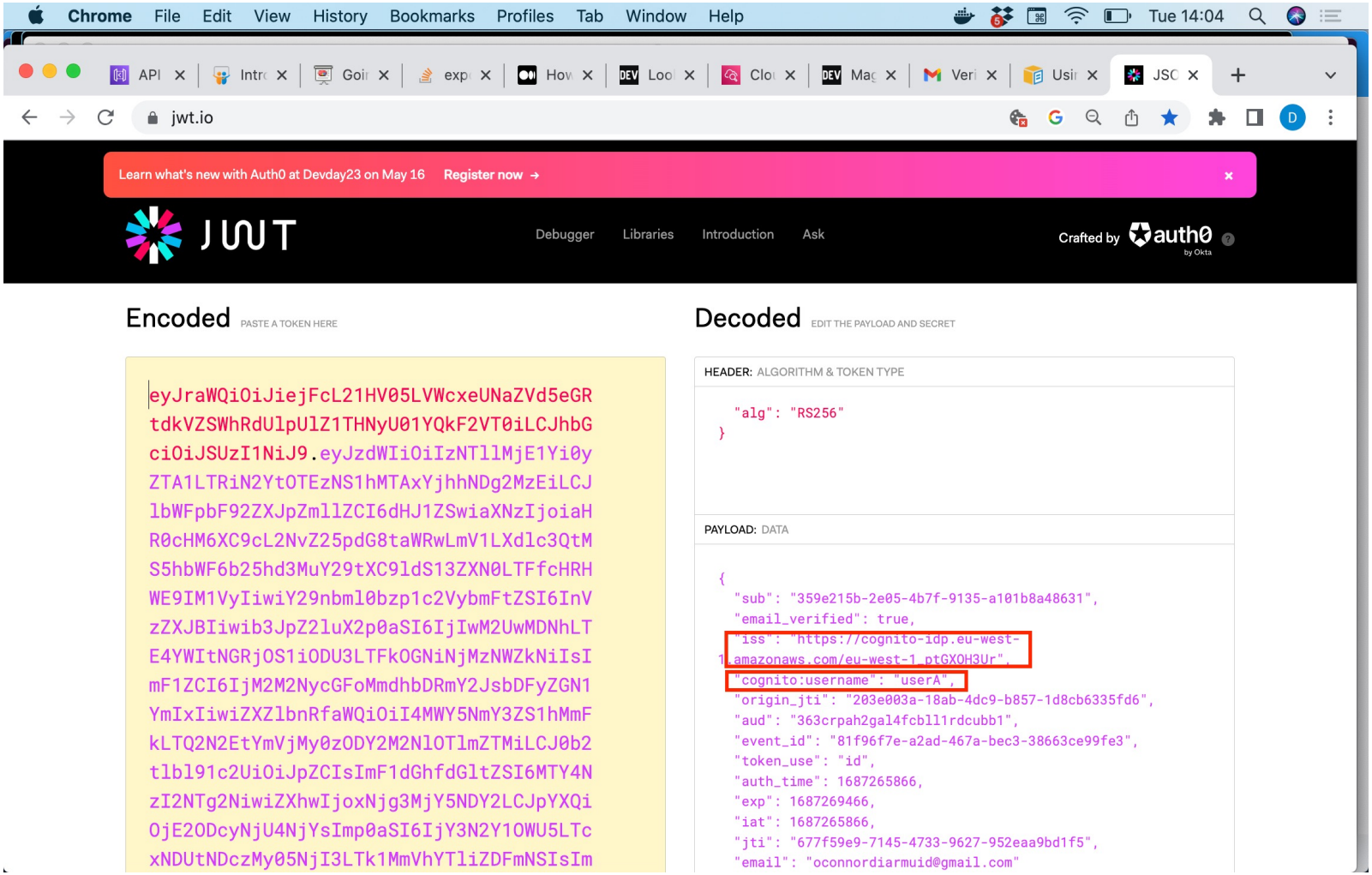
Example – SignIn request / response



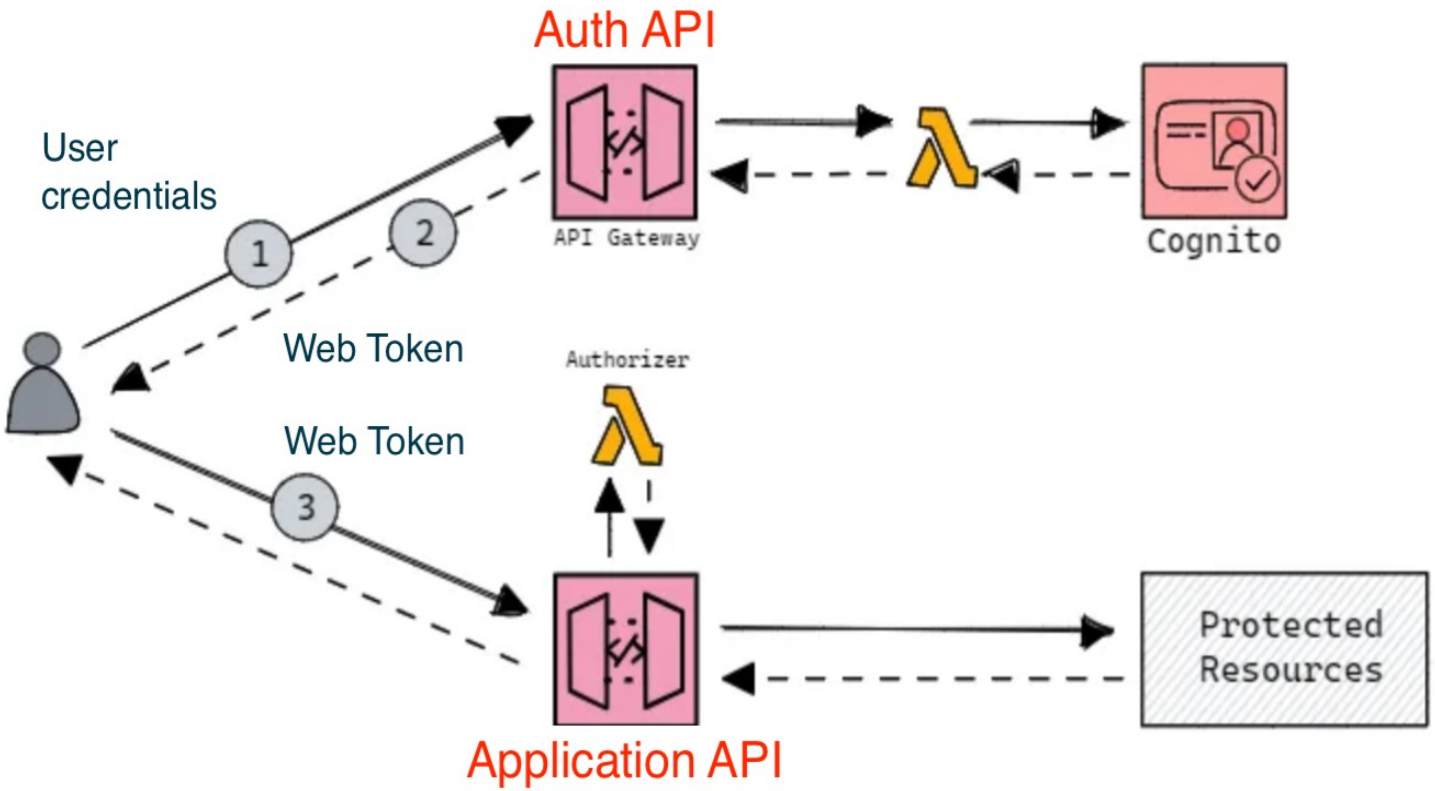
Example – SignIn JWT response



Example –JWT token decoding



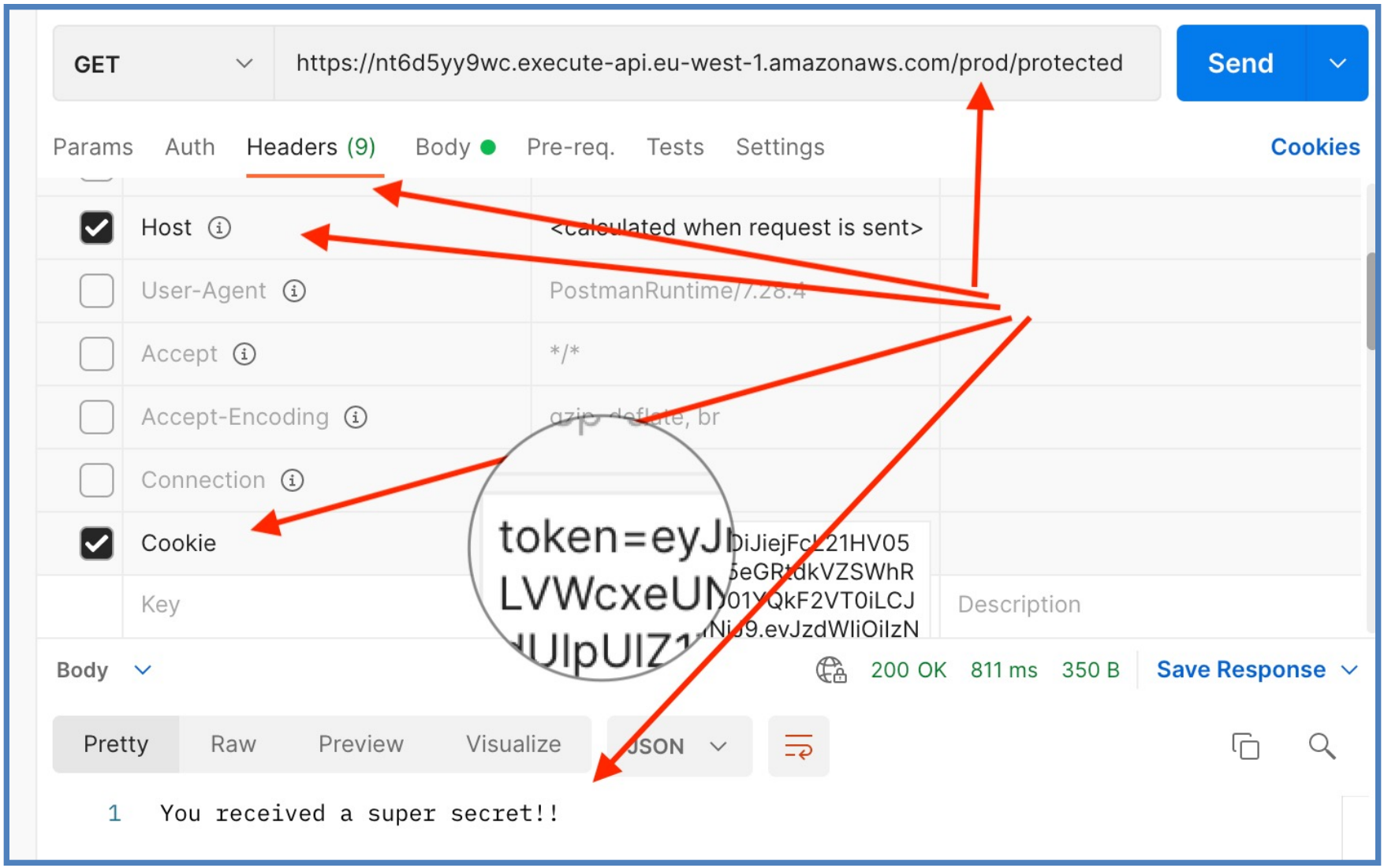
Example


Auth API
User
credentials
1
2
API Gateway
Cognito
Web Token
Authorizer
Web Token
3
Protected
Resources
Application API

Example – App API infrastructure

```
230  const api = new RestApi(this, "App Api", .....);
231
232  const protectedRes = api.root.addResource("protected");
233  const publicRes = api.root.addResource("public");
234
235  const protectedFn = new NodejsFunction(this, "ProtectedFn", ....);
236  const publicFn = new NodejsFunction(this, "PublicFn", ....);
237
238  const authorizerFn = new NodejsFunction(this, "AuthorizerFn", .....);
239
240  const requestAuthorizer = new RequestAuthorizer(this, "RequestAuthorizer", {
241    identitySources: [IdentitySource.header("cookie")],
242    handler: authorizerFn,
243    resultsCacheTtl: Duration.minutes(0),
244  });
245
246  protectedRes.addMethod("GET", new LambdaIntegration(protectedFn), {
247    authorizer: requestAuthorizer,
248    authorizationType: AuthorizationType.CUSTOM,
249  });
250
251  publicRes.addMethod("GET", new LambdaIntegration(publicFn));
252
```

Example – Protected route request



Example –Request Authorizer

- Steps performed by authorizer:
  1. Parse value of HTTP Request Cookie header into a Map data structure for convenience.
  2. Find 'token' key in Map.
  3. If it's missing,
     - Return an IAM policy Denying use of the app API.
  4. Verify the token - Decode and check user exists in the User pool.
  5. If successful verification:
     - Return IAM policy that Allows execution of the app API.

     Else
     - Return policy Denying execution of the app API.