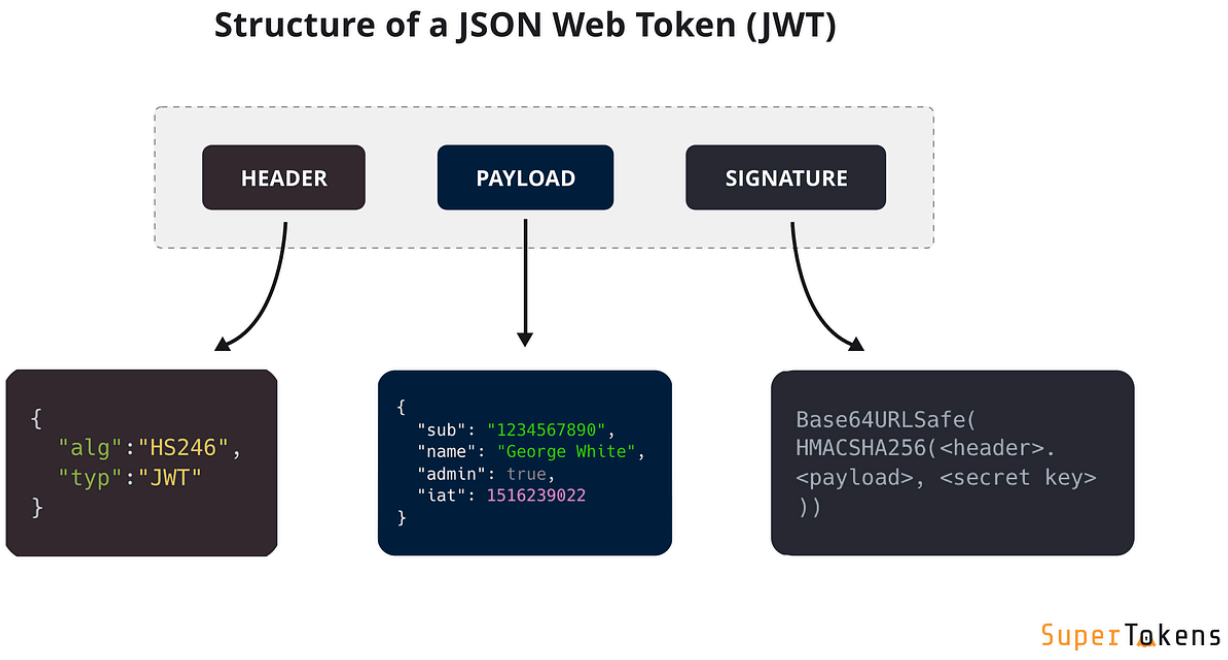
DAY 10

As we know tokens are generic authentication credentials or authorization tokens used to authenticate users or authorize access to resources in web applications.

Tokens refer to a broad category of authentication credentials, whereas JWT is a specific format or implementation of tokens.

JWT (JSON Web Token)

- **Definition:** JWT is a specific type of token format defined by the JSON Web Token standard (RFC 7519). It is a compact and self-contained means of transmitting information between parties as a JSON object.
- **Structure:** JWTs consist of three parts: header, payload, and signature. They are typically encoded and signed using cryptographic algorithms.
- **Usage:** JWTs are commonly used for authentication and authorization in web applications and APIs. They can store user claims, such as user ID, roles, permissions, and custom data, in a secure and portable format.
- **Statelessness:** JWTs are stateless, meaning the server does not need to store session information. This makes them suitable for distributed architectures and scalable systems.



JWT Structure

A JWT is composed of three sections separated by dots (`.`), following the format `header.payload.signature`.

1. **Header**: Contains metadata about the type of token and the cryptographic algorithms used to secure it. It typically consists of two parts:
    - **Typ (Type)**: Specifies the type of token, usually set to "JWT".
    - **Alg (Algorithm)**: Indicates the cryptographic algorithm used to sign the token, such as HMAC SHA256 or RSA.
2. **Payload**: Contains the claims or statements about the subject (user) and any additional data. It consists of a set of claims that represent assertions about the user, such as their identity, roles, or permissions. Claims are categorized into three types:
    - **Reserved Claims**: Predefined claims standardized by the JWT specification, such as `iss` (issuer), `sub` (subject), `aud` (audience), `exp` (expiration time), and `iat` (issued at).
    - **Public Claims**: Custom claims defined by the application developer to convey information about the user.
    - **Private Claims**: Custom claims agreed upon by parties that exchange JWTs, not registered or standardized.
3. **Signature**: Verifies the integrity of the token and ensures that it has not been tampered with during transmission. It's created by taking the encoded header, encoded payload, a secret (for HMAC algorithms), and applying the specified algorithm to generate the signature.

1 Header

```
{
  "alg": "HS256",
  "typ": "JWT"
}
```

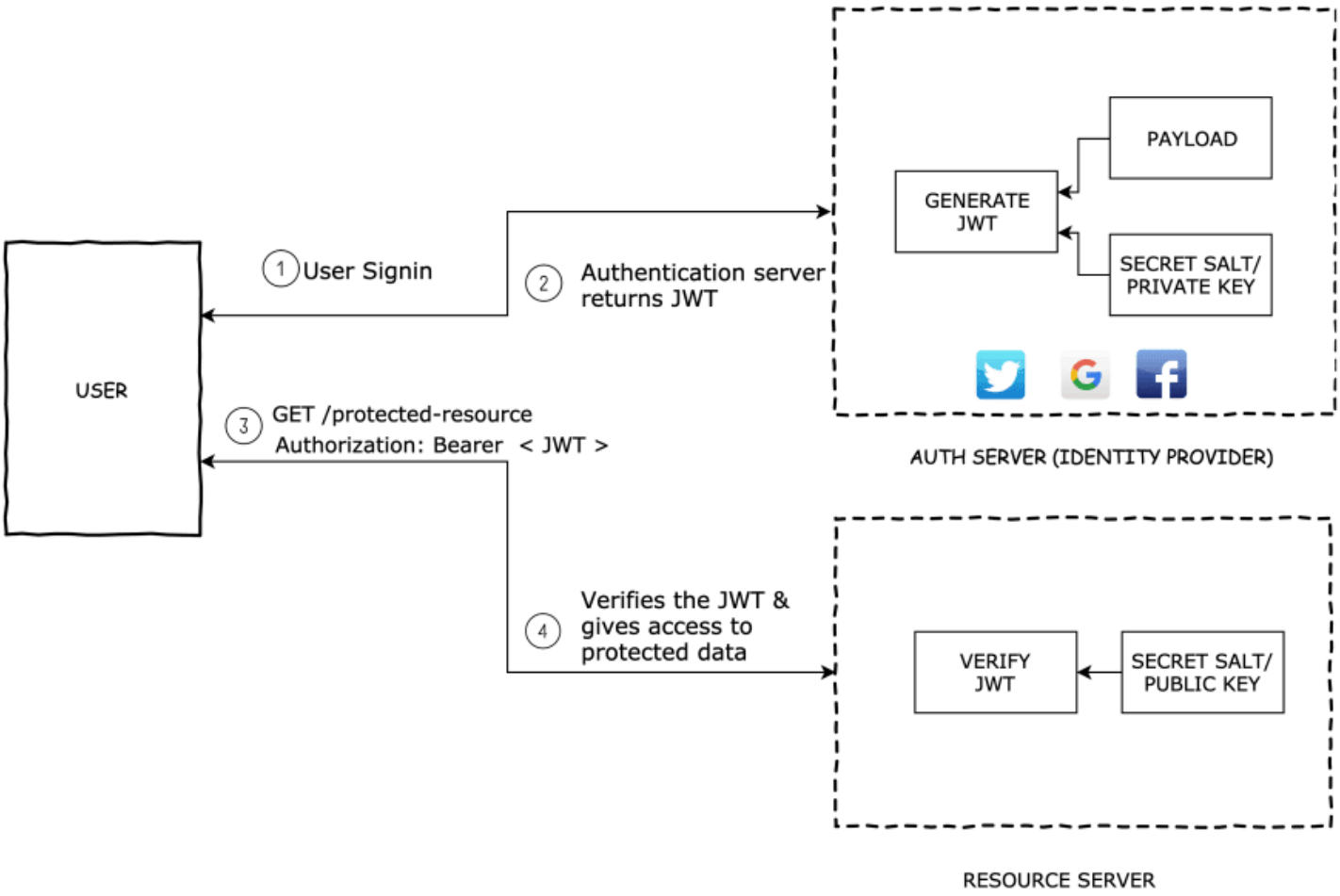
2 Payload

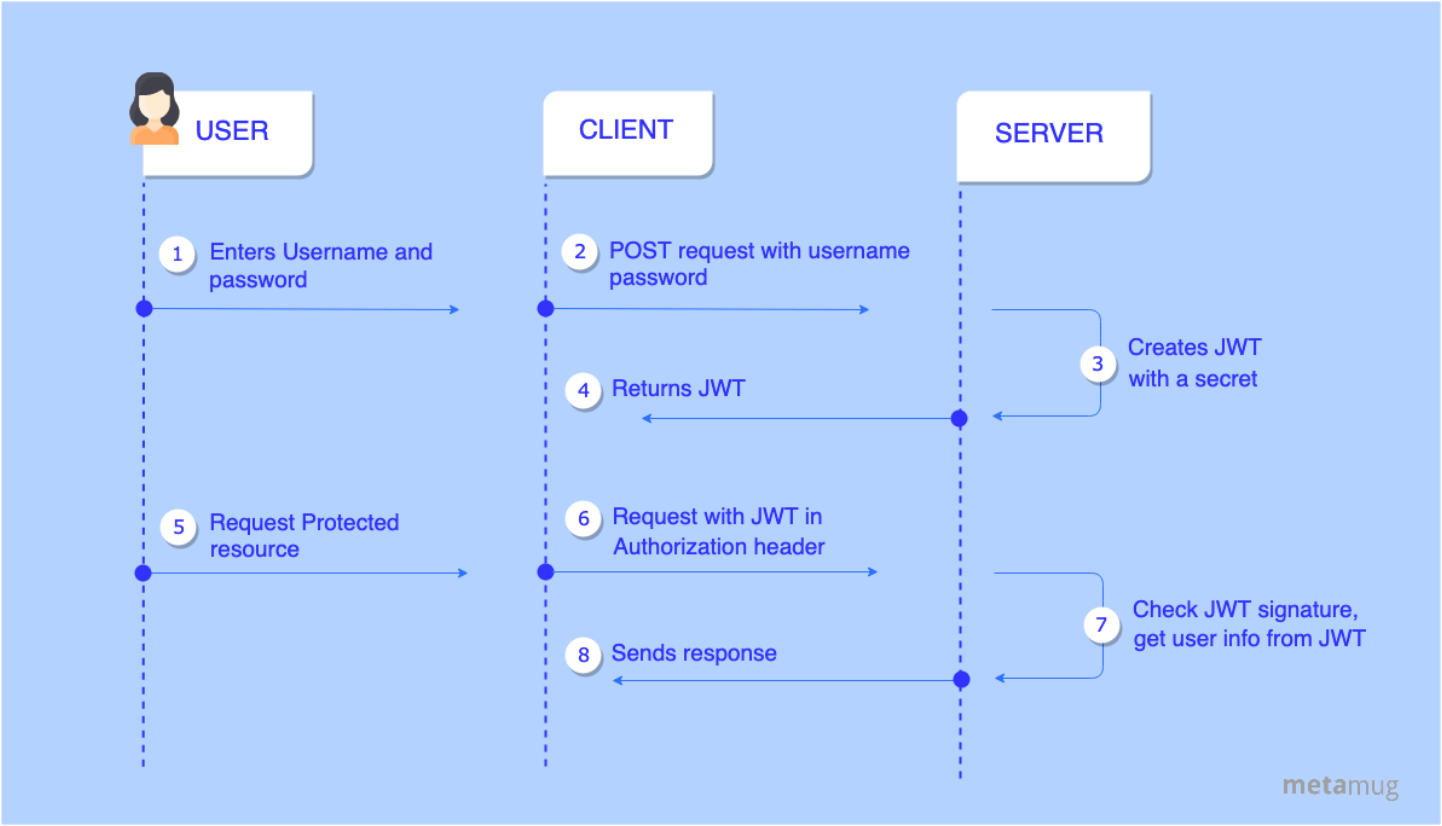
```
{
  "sub": "1234567890",
  "name": "John Doe",
  "iat": 1516239022
}
```

3 Signature

```
HMACSHA256(
BASE64URL(header)
.
BASE64URL(payload),
secret)
```

Authentication Flow





JWT Functions

Certainly! In the context of JSON Web Tokens (JWT), `jwt.sign()` and `jwt.verify()` are two crucial functions provided by the `jsonwebtoken` library in Node.js. Here's what they do

jwt.sign():

- This function is used to generate a new JWT token based on the provided payload and options.
- It takes three parameters:
  - `payload`: This is the data you want to include in the token. It can be any JSON object containing user information, metadata, or any other relevant data.
  - `secretOrPrivateKey`: This is the secret key used to sign the token. It can be a string or a buffer containing a secret cryptographic key.

- `options` (optional): These are additional options that control the behavior of the token generation process, such as expiration time (`expiresIn`), algorithm (`algorithm`), and more.

```
const jwt = require('jsonwebtoken');

// Payload containing user information
const payload = { userId: '123456', username: 'exampleuser' };

// Secret key for signing the token
const secretKey = 'your_secret_key';

// Generate a new JWT token
const token = jwt.sign(payload, secretKey, { expiresIn: '1h' });
```

jwt.verify():

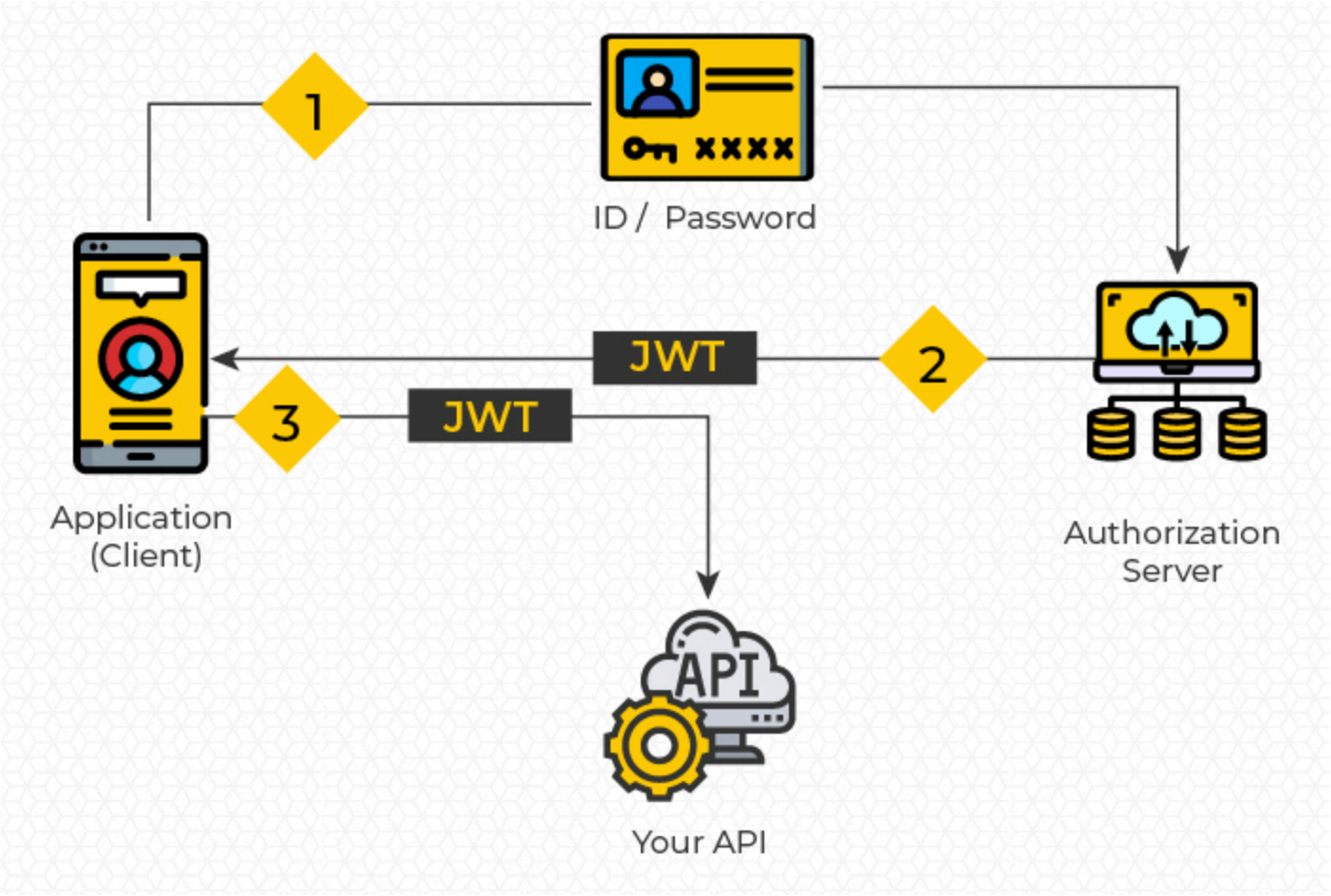
- This function is used to verify and decode a JWT token to retrieve the original payload.
- It takes three parameters:
  - `token`: The JWT token to be verified.
  - `secretOrPublicKey`: The secret key or public key used to verify the token's signature. If the token was signed using a symmetric algorithm (e.g., HMAC), you need to provide the same secret key used to sign the token. If it was signed using an asymmetric algorithm (e.g., RSA), you need to provide the public key corresponding to the private key used for signing.
  - `options` (optional): Additional options for verification, such as algorithms (`algorithms`), audience (`audience`), issuer (`issuer`), and more.

```
// Verify and decode the JWT token
jwt.verify(token, secretKey, (err, decoded) => {
    if (err) {
        // Token verification failed
        console.error('Token verification failed:', err.message);
    } else {
        // Token verification successful
        console.log('Decoded token:', decoded);
    }
});
```

Our Hotel App Flow

For the First Time, User is completely new to the site

1. **Signup Route (`/signup`):** This route will handle user registration and issue a JWT token upon successful registration.
2. **Login Route (`/login`):** This route will handle user login and issue a new JWT token upon successful authentication.
3. **Protected Routes:** These routes will be accessed only by providing a valid JWT token.



Install JWT

First, you'll need to install the necessary packages for working with JWT. In Node.js, you can use packages like `jsonwebtoken` to generate and verify JWTs.

```
npm install jsonwebtoken
```

jwtAuthMiddleware

Create a JWT Auth Middleware function, which is responsible for authentication via Tokens

```
// jwtAuthMiddleware.js
const jwt = require('jsonwebtoken');

const jwtAuthMiddleware = (req, res, next) => {
    // Extract the JWT token from the request header
    const token = req.headers.authorization.split(' ')[1];
    if (!token) return res.status(401).json({ error: 'Unauthorized' });

    try {
        // Verify the JWT token
        const decoded = jwt.verify(token, process.env.JWT_SECRET);
        // Attach user information to the request object
        req.user = decoded;
        next();
    } catch (err) {
        console.error(err);
        res.status(401).json({ error: 'Invalid token' });
    }
};

module.exports = jwtAuthMiddleware;
```

- We can certainly change the variable name from `req.user` to `req.EncodedData` or any other name you prefer. The choice of variable name (`EncodedData`, `userData`, etc.) is flexible and depends on your application's conventions or requirements.
- The key aspect is to make sure that the decoded user information is attached to the request object (`req`) so that it can be easily accessed by other middleware functions or route handlers.

Once you've attached the decoded user information to `req.EncodedData` within the `jwtAuthMiddleware`, you can access it in further routes or middleware functions in your application

```
// Example route using req.EncodedData
router.get('/profile', jwtAuthMiddleware, (req, res) => {
    // Access the decoded user information from req.EncodedData
    const userData = req.EncodedData;

    // Now you can use userData to access user properties like
username, role, etc.
    res.json({ username: userData.username, role: userData.role });
});
```

- Now, Let's create a JWT token to generate functions

```
// Function to generate JWT token
const generateToken = (userData) => {
    // Generate a new JWT token using user data
    return jwt.sign({user: userData}, process.env.JWT_SECRET, { expiresIn: '1h'
});
};

module.exports = { jwtAuthMiddleware, generateToken };
```

The `expiresIn` option of `jwt.sign()` expects the time to be specified in seconds or a string describing a time span, such as `'2 days'` or `'10h'`.

```
19
20  // Function to generate JWT token
21  const generateToken = (userData) => {
22      // Generate a new JWT token using user data
23      return jwt.sign({user: userData}, process.env.JWT_SECRET, {expiresIn: "7d"});
24  };
25
```

- If you want to make sure, expireIn parameter works properly then you have to pass the payload as a proper object.
- Your payload needs to be an object otherwise it's treated as a string.

```
16
17      const payload = {
18          username: response.username,
19          email: response.email
20      };
21
22      // Generate JWT token
23      const token = generateToken(payload);
24      console.log("response.id, :", payload);
25      console.log("Token, :", token);
26      response.token = token;
27
```

Validate JWT in Encoder

Encoded PASTE A TOKEN HERE

```
eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.ey
J1c2VybmFtZSI6Imp3dHByaW5jZSIsImVtYWlsI
joiand0cHJpbmNld3czZGRpaTl1dUBleGFtcGxl
LmNvbSIsImlhdCI6MTcwNzQwMzY1N30.HxAHkv2
j1aNPHa9amPTbmuKg9yqy4K60DXCUu_hogx8
```

Decoded EDIT THE PAYLOAD AND SECRET

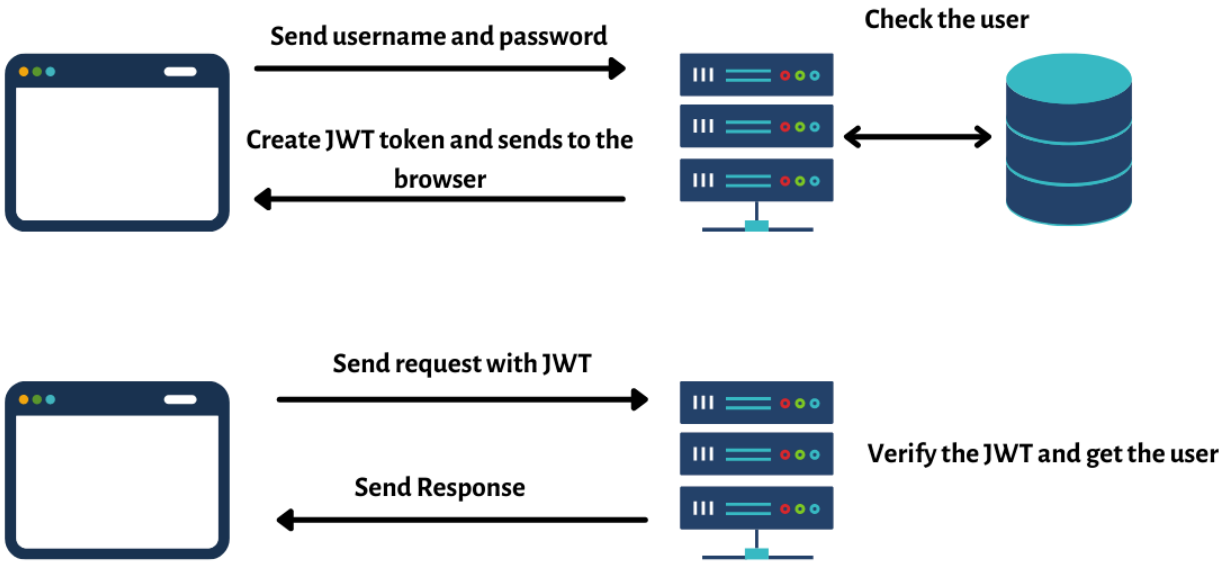
HEADER: ALGORITHM & TOKEN TYPE

```
{
  "alg": "HS256",
  "typ": "JWT"
}
```

PAYLOAD: DATA

```
{
  "username": "jwtprince",
  "email": "jwtprinceww3ddii9uu@example.com",
  "iat": 1707403657
}
```

VERIFY SIGNATURE


Send username and password
Check the user
Create JWT token and sends to the browser
Send request with JWT
Verify the JWT and get the user
Send Response

Login Route

```
// Login route
router.post('/login', async (req, res) => {
    try {
        // Extract username and password from request body
        const { username, password } = req.body;

        // Find the user by username
        const user = await Person.findOne({ username });

        // If user does not exist or password does not match, return error
        if (!user || !(await user.comparePassword(password))) {
            return res.status(401).json({ error: 'Invalid username or
password' });
        }

        const payload = { id: user.id, email: user.email }

        // Generate JWT token
        const token = generateToken(payload);

        // Send token in response
        res.json({ token });
    } catch (err) {
        console.error(err);
        res.status(500).json({ error: 'Internal Server Error' });
    }
});
```

Profile Route

```
router.get('/profile', jwtAuthMiddleware, async (req, res) => {
    try {
        // Extract user id from decoded token
        const userId = req.user.id;

        // Find the user by id
        const user = await Person.findById(userId);

        // If user does not exist, return error
        if (!user) {
            return res.status(404).json({ error: 'User not found' });
        }

        // Send user profile as JSON response
        res.json(user);
    } catch (err) {
        console.error(err);
        res.status(500).json({ error: 'Internal Server Error' });
    }
});
```

Important Points:

When the server receives this request, it parses the `Authorization` header to extract the JWT token.

```
const authorizationHeader = 'Bearer
eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJzdWIiOiIxMjM0NTY3ODkwIiwibmF
tZSI6IkpvaG4gRG9lIiwiaWF0IjoxNTE2MjM5MDIyfQ.SflKxwRJSMeKKF2QT4fwpMeJ
f36POk6yJV_adQssw5c';
const token = authorizationHeader.split(' ')[1];
console.log(token); // Output:
eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJzdWIiOiIxMjM0NTY3ODkwIiwibmF
tZSI6IkpvaG4gRG9lIiwiaWF0IjoxNTE2MjM5MDIyfQ.SflKxwRJSMeKKF2QT4fwpMeJ
f36POk6yJV_adQssw5c
```

The `split(' ')` method separates the header value into an array of substrings using the space (' ') character as the delimiter. The `[1]` index accesses the second element of this array, which is the JWT token.

We can Add one more line of check in the jwtAuthMiddleware

```
const authHeader = req.headers.authorization;
    if (!authHeader) return res.status(401).json({ error: 'Token required'
});
```

Expire Time-based Token

```
24
25  // Function to generate JWT token
26  const generateToken = (userData) => {
27      // Generate a new JWT token using user data
28      return jwt.sign({userData}, process.env.JWT_SECRET, {expiresIn: 30});
29  };
30
31  module.exports = { jwtAuthMiddleware, generateToken };
32
```

```
37
38  router.get('/profile', jwtAuthMiddleware, async (req, res) => {
39      try {
40          // Extract user id from decoded token
41          console.log(req.user)
42          const userId = req.user.userData.id;      You, 7 minutes ago •
43          console.log("userId", userId)
44
```

HEADER
Algorithm

```
{
    "alg": "RS256"
    "typ": "JWT"
}
```

PAYLOAD
Data

```
{
    "sub": "99999-xxx-xxx-8888888"
    "preferred_name": "customer"
    "iat": 1556578278
    ...
}
```

SIGNATURE
Verification

```
RS256(
    base64Encode(HEADER) + '.' +
    base64Encode(PAYLOAD))
```