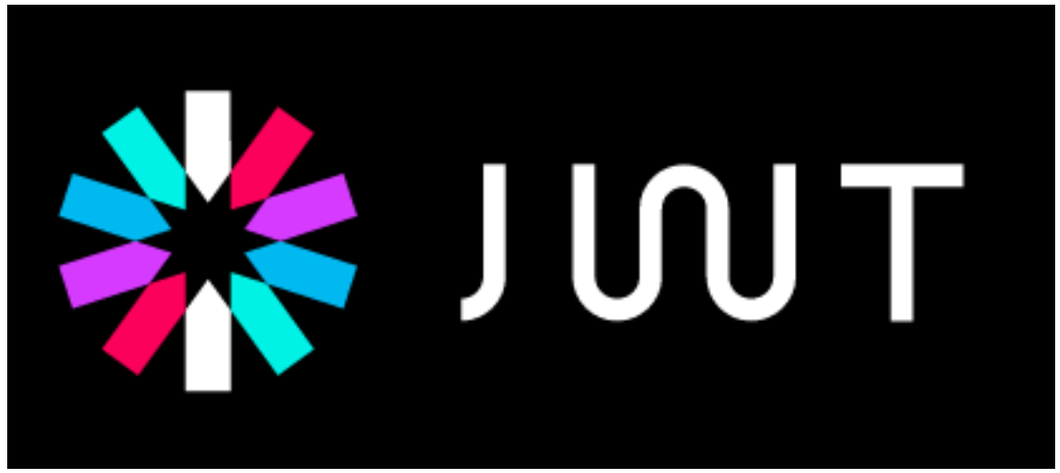
Json Web Tokens



- What is JSON Web Token?
- When should you use JSON Web Tokens?
- What is the JSON Web Token structure?
- How do JSON Web Tokens work?
- Why should we use JSON Web Tokens?

What is JSON Web Token?

- An open standard that defines a compact and self-contained way for securely transmitting information between parties as a JSON object.

  - Compact: Because of its smaller size, JWTs can be sent through an URL, POST parameter, or inside an HTTP header.

  - Self-contained: The payload contains all the required information about the user, avoiding the need to query the database more than once.

When should you use JSON Web Tokens?

- Authentication: Once the user is logged in, each subsequent request will include the JWT, allowing the user to access routes, services, and resources that are permitted with that token.
    - Because of its small overhead it can be used across different domains (single signon.
- Information Exchange: JSON Web Tokens are a good way of securely transmitting information between parties, because as they can be signed.
    - as the signature is calculated using the header and the payload, you can also verify that the content hasn't been tampered with.

What is the JSON Web Token structure?

- Three parts separated by dots (.), which are:
  - Header
  - Payload
  - Signature
- A JWT typically looks like the following.
  - xxxxx.yyyyy.zzzzz

JWT Structure : Header

- Typically consists of two parts:
  - hashing algorithm being used, such as HMAC SHA256 or RSA.
  - type of the token, which is JWT,
- This JSON is Base64Url encoded to form the first part of the JWT.

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

JWT Structure : Payload

- Payload contains the claims - statements about an entity (typically, the user) and additional metadata. There are three types of claims:

  - Reserved claims: A set of predefined claims which are not mandatory but recommended, to provide a set of useful, interoperable claims. Examples: iss (issuer), exp (expiration time), sub (subject), aud (audience)

  - Public claims: These can be defined at will by those using JWTs. But to avoid collisions they should be defined in the IANA JSON Web Token Registry or be defined as a URI that contains a collision resistant namespace.

  - Private claims: These are the custom claims created to share information between parties that agree on using them.

```
{
  "sub": "1234567890",
  "name": "John Doe",
  "admin": true
}
```

JWT Structure : Signature

- Take the encoded header, the encoded payload, a secret, the algorithm specified in the header, and sign it.

- The signature is used to verify that the sender of the JWT is who it says it is and to ensure that the message wasn't changed along the way.

- For example if you want to use the HMAC SHA256 algorithm, the signature will be created in the following way:

```
HMACSHA256(
  base64UrlEncode(header) + "." +
  base64UrlEncode(payload),
  secret)
```

The Token

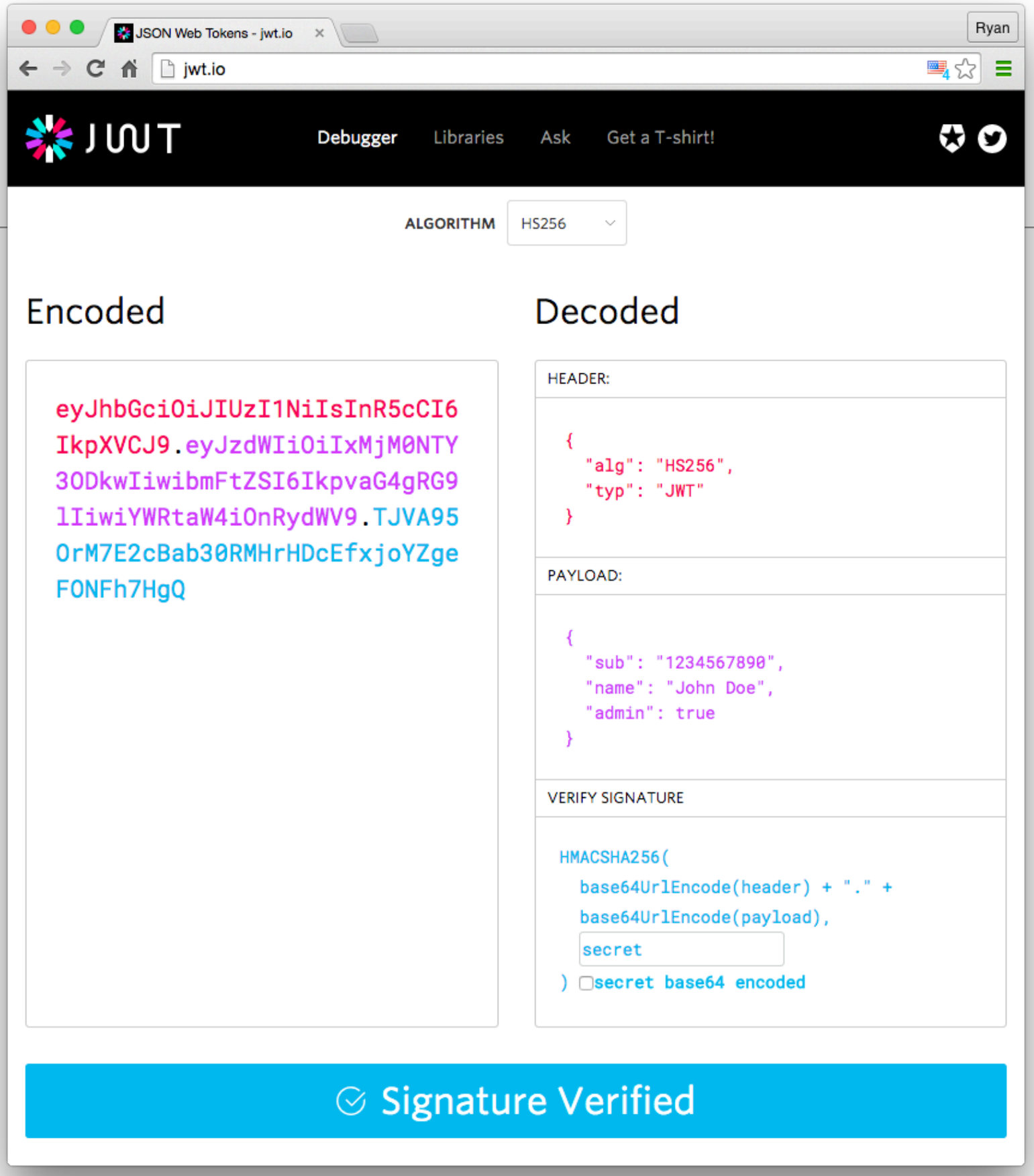
```
{
  "sub": "1234567890",
  "name": "John Doe",
  "admin": true
}
```

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

```
HMACSHA256(
  base64UrlEncode(header) + "." +
  base64UrlEncode(payload),
  secret)
```

```
eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.
eyJzdWIiOiIxMjM0NTY3ODkwIiwibmFtZSI6IkpvaG4
gRG9lIiwiaXNTb2NpYWwiOnRydWV9.
4pcPyMD09olPSyXnrXCjTwXyr4BsezdI1AVTmud2fU4
```

- The output is three Base64 strings separated by dots that can be easily passed in HTML and HTTP environments,


JSON Web Tokens - jwt.io
Ryan
jwt.io
JWT
Debugger
Libraries
Ask
Get a T-shirt!
ALGORITHM
HS256
Encoded
eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJzdWIiOiIxMjM0NTY3ODkwIiwibmFtZSI6IkpvaG4gRG9lIiwiYWRtaW4iOnRydWV9.TJVA95OrM7E2cBab30RMHrHDcEfxjoYZgeFONFh7HgQ
Decoded
HEADER:
{
"alg": "HS256",
"typ": "JWT"
}
PAYLOAD:
{
"sub": "1234567890",
"name": "John Doe",
"admin": true
}
VERIFY SIGNATURE
HMACSHA256(
base64UrlEncode(header) + "." +
base64UrlEncode(payload),
secret
) secret base64 encoded
Signature Verified

Another Example

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

Header

```
{
 "iss”:”http://trustyapp.com/”,
 "exp": 1300819380,
 “sub”: ”users/8983462”,
 “scope”: “self api/buy”
}
```

Body (‘Claims’)

```
tß´—™à%O˜v+nî…SZu¯µ€U…8H×
```

Cryptographic Signature

The Claims

```
{
 "iss”:”http://trustyapp.com/”,

 "exp": 1300819380,

 “sub”: ”users/8983462”,

 “scope”: “self api/buy”
}
```

← Who issued the token

← When it expires

← Who it represents

← What they can do

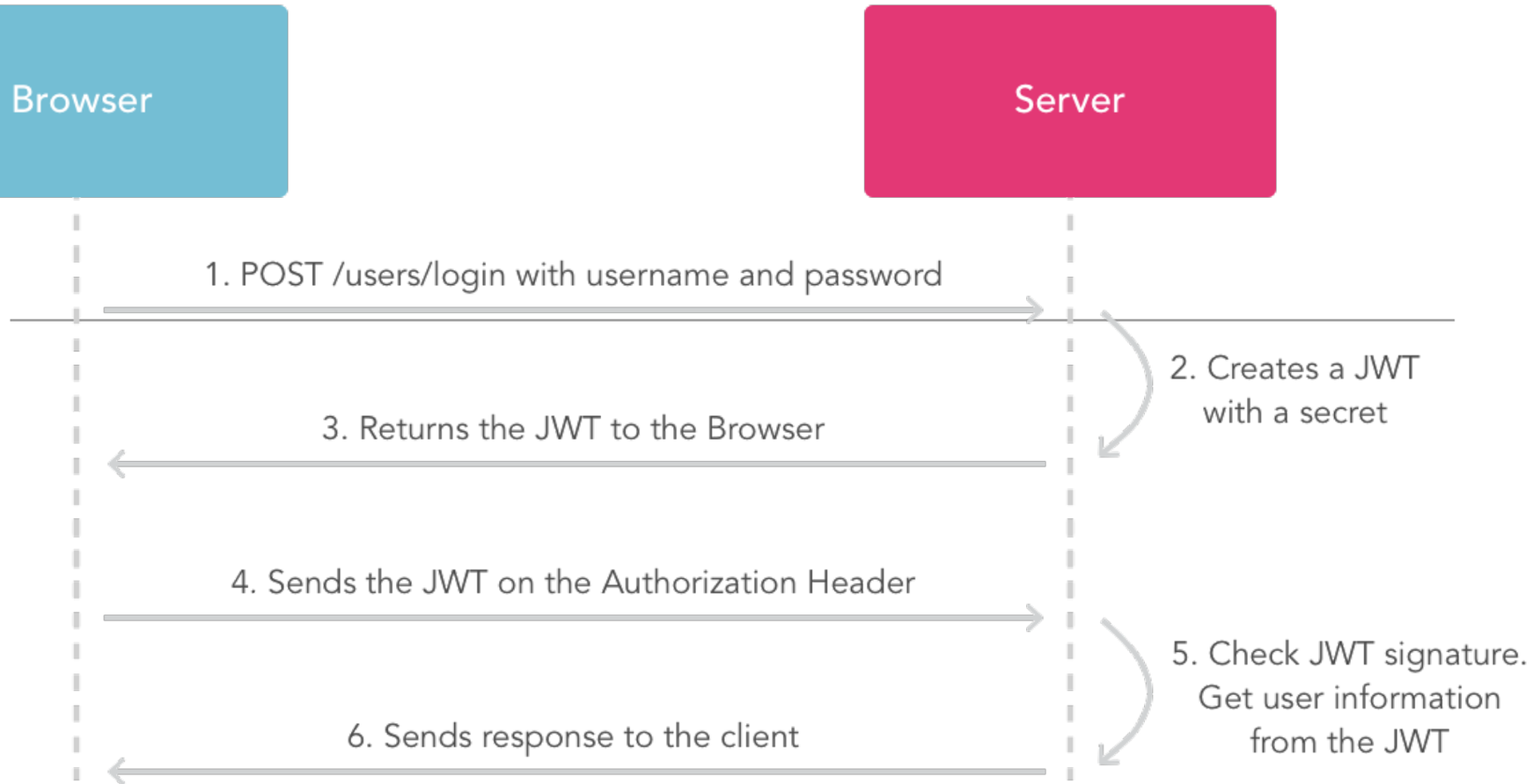
How do JSON Web Tokens work?

- When the user successfully logs in using their credentials, a JSON Web Token will be returned and must be saved locally, perhaps in local storage in a browser.

- If user wants to access a protected route or resource, the the JWT is sent, typically in the Authorization header using the Bearer schema

```
Authorization: Bearer <token>
```

- The server's protected routes will check for a valid JWT in the Authorization header, and if it's present, the user will be allowed to access protected resources.



- Token contains all the necessary information.

- Token may even make requests to downstream services

Stateless APIs

Why should we use JSON Web Tokens?

- **Compact** : Less verbose than XML, more compact than Security Assertion Markup Language Tokens (SAML).

- **Security:** JWT tokens can use a public/private key pair in the form of a X.509 certificate for signing. Signing XML can introducing obscure security holes compared to the simplicity of signing JSON.

- **Convenience:** JSON parsers are common in most programming languages because they map directly to objects. Conversely, XML doesn't have a natural document-to-object mapping