

# SECURE APPS WITH OAUTH & OIDC

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CADEC 2020.01.23 & 2020.01.29 | CALLISTAENTERPRISE.SE

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# AGENDA

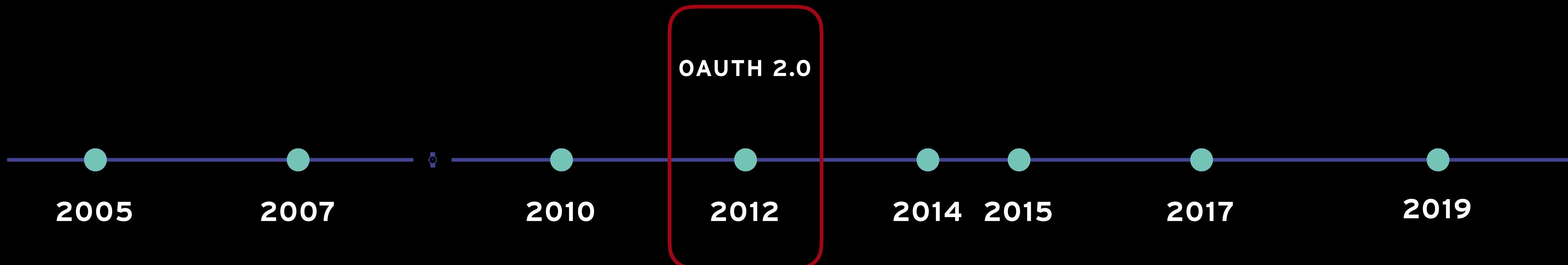
- Intro
  - Background
- OAuth/OIDC - Technology overview
  - Demo
- Best Current Practice anno 2020 for securing Apps\* with OAuth/OIDC
- Wrap Up

\* JavaScript Single Page Apps (SPA) and Mobile Apps

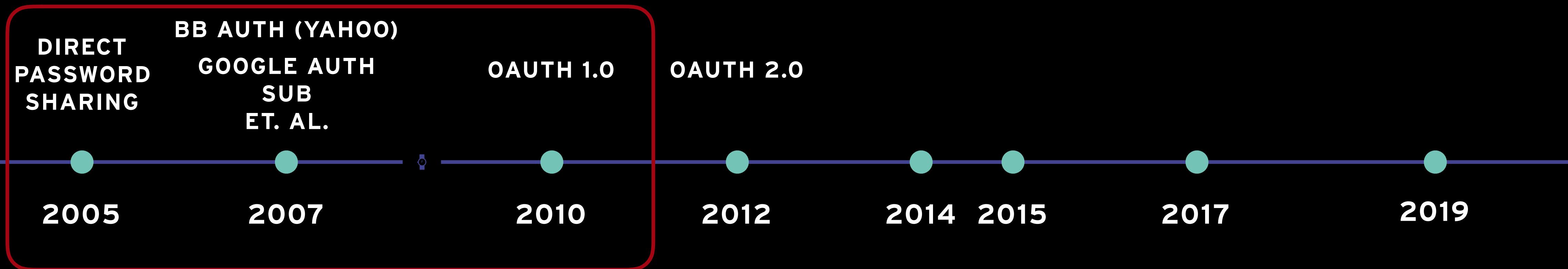
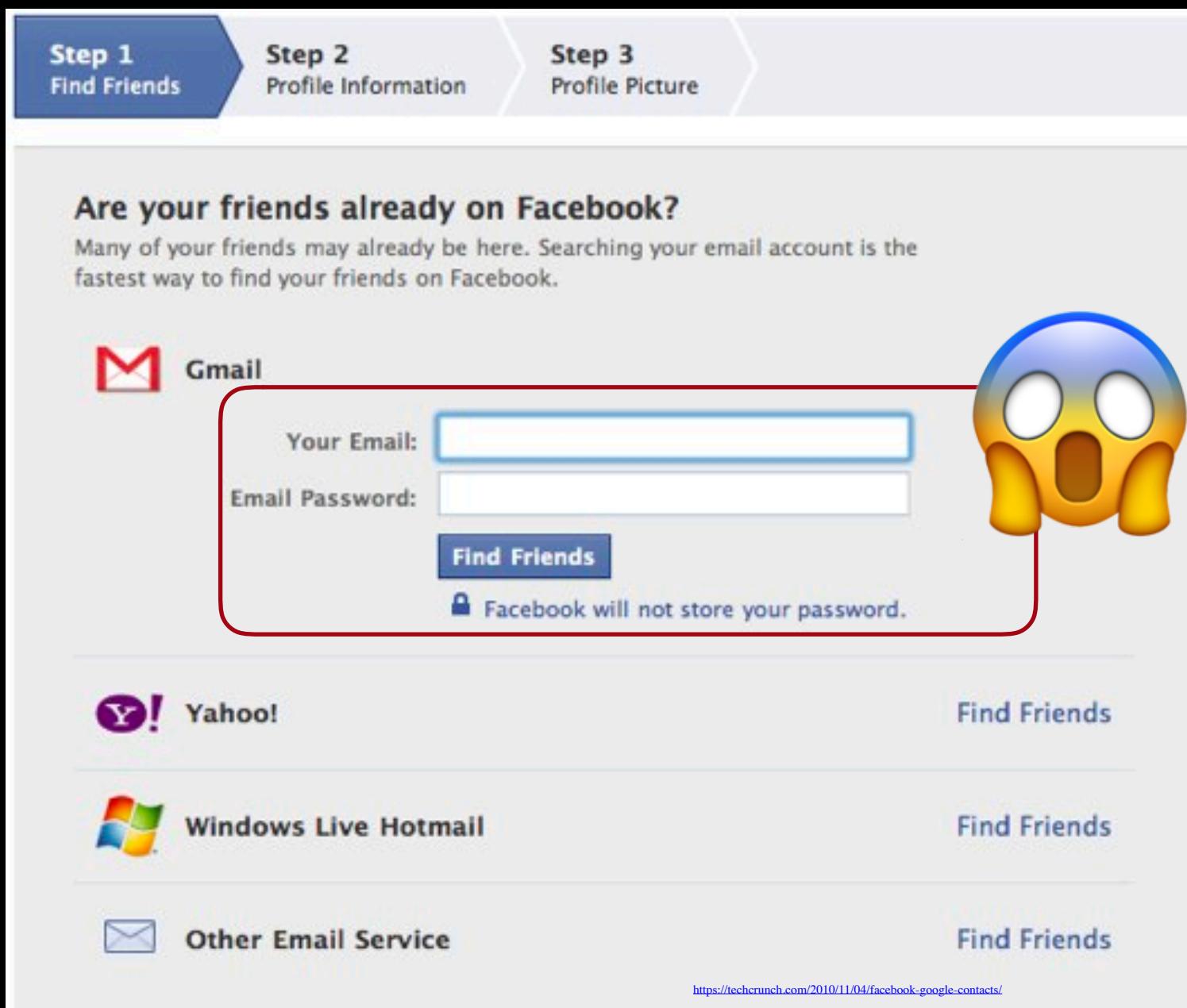


## INTRO : WHAT IS OAUTH (2.0)?

- RFC 6749 - Internet Engineering Task Force (IETF)
- An extensible framework for *Access Delegation*
  - » "the one that controls a resource grants access to a software application to do something with that resource on their behalf"
- Is **not** for authentication
- Does **not define authorization per se** (as in access control) - specifies the *delegation* of authorization information



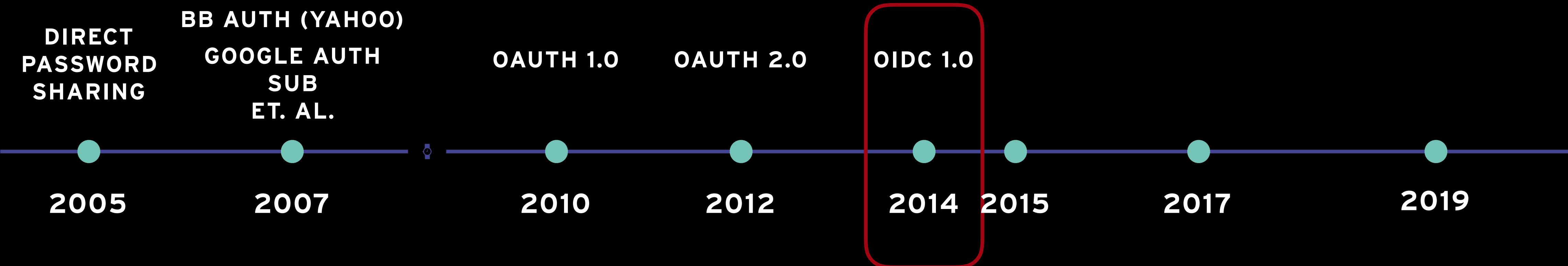
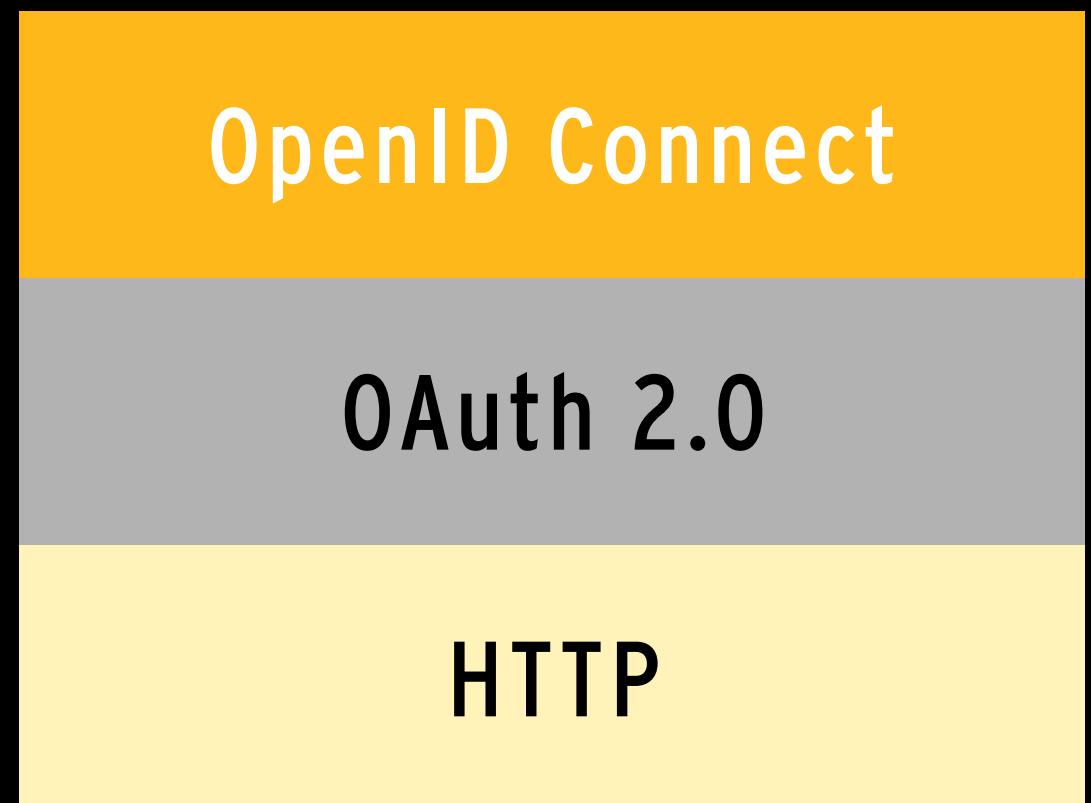
# INTRO: BACKGROUND - PRIMARY USE CASE



# INTRO

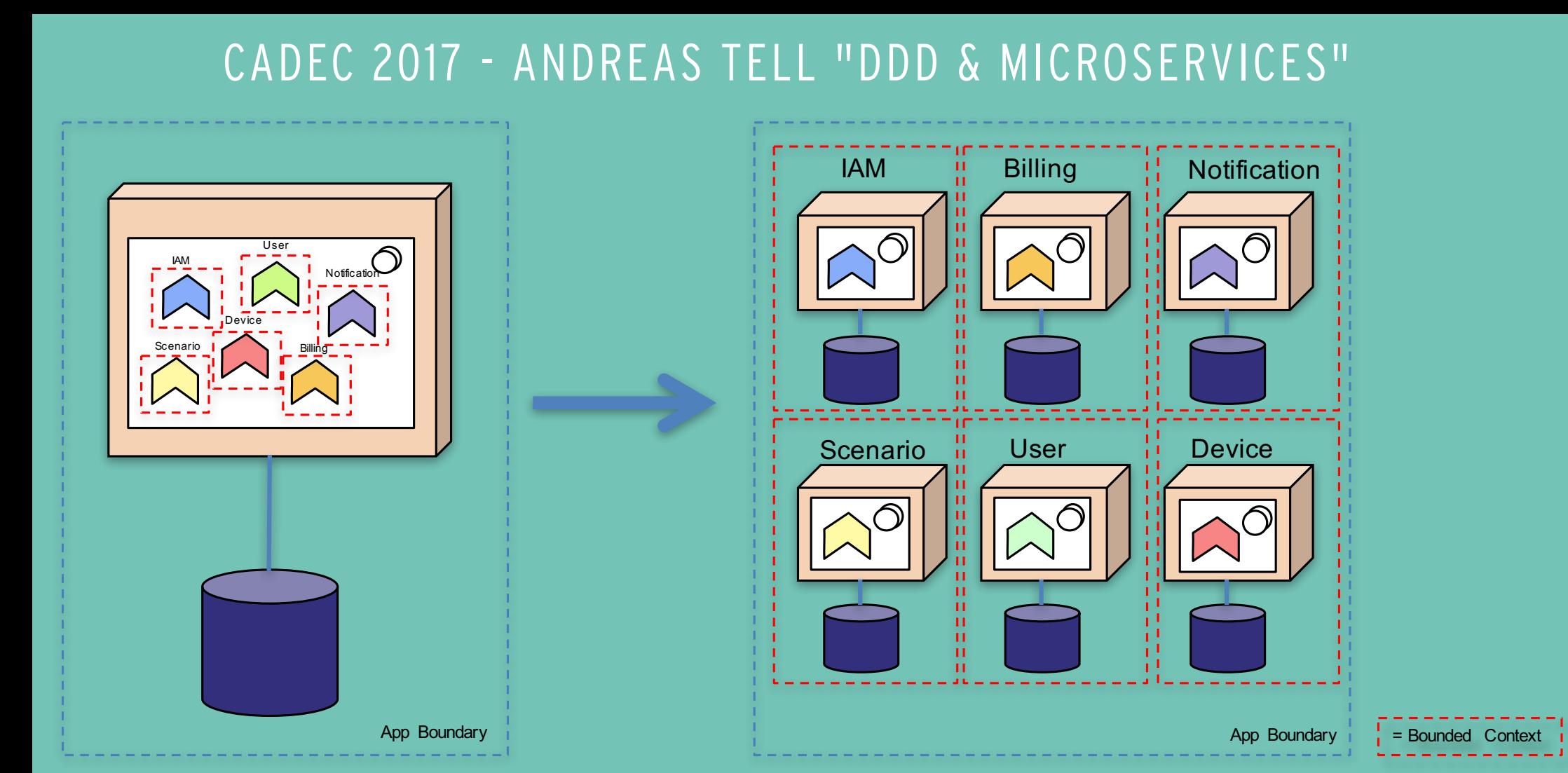


- OpenID Connect - OIDC
  - A simple identity layer on top of OAuth
  - Built on the process flows of OAuth with some extensions added for authentication
  - Adds standard vocabulary (i.e. parameters) and endpoints
  - User identity is encoded in an "ID Token"



## ■ APPLICABILITY - WHEN USE IT?

- HTTP and user-agent centric
- Developed for apps and APIs
  - Also for first-party apps
- A very good fit for distributed apps (Mini/Micro Services)
  - Centralized Identity and Access Mgmt (IAM)



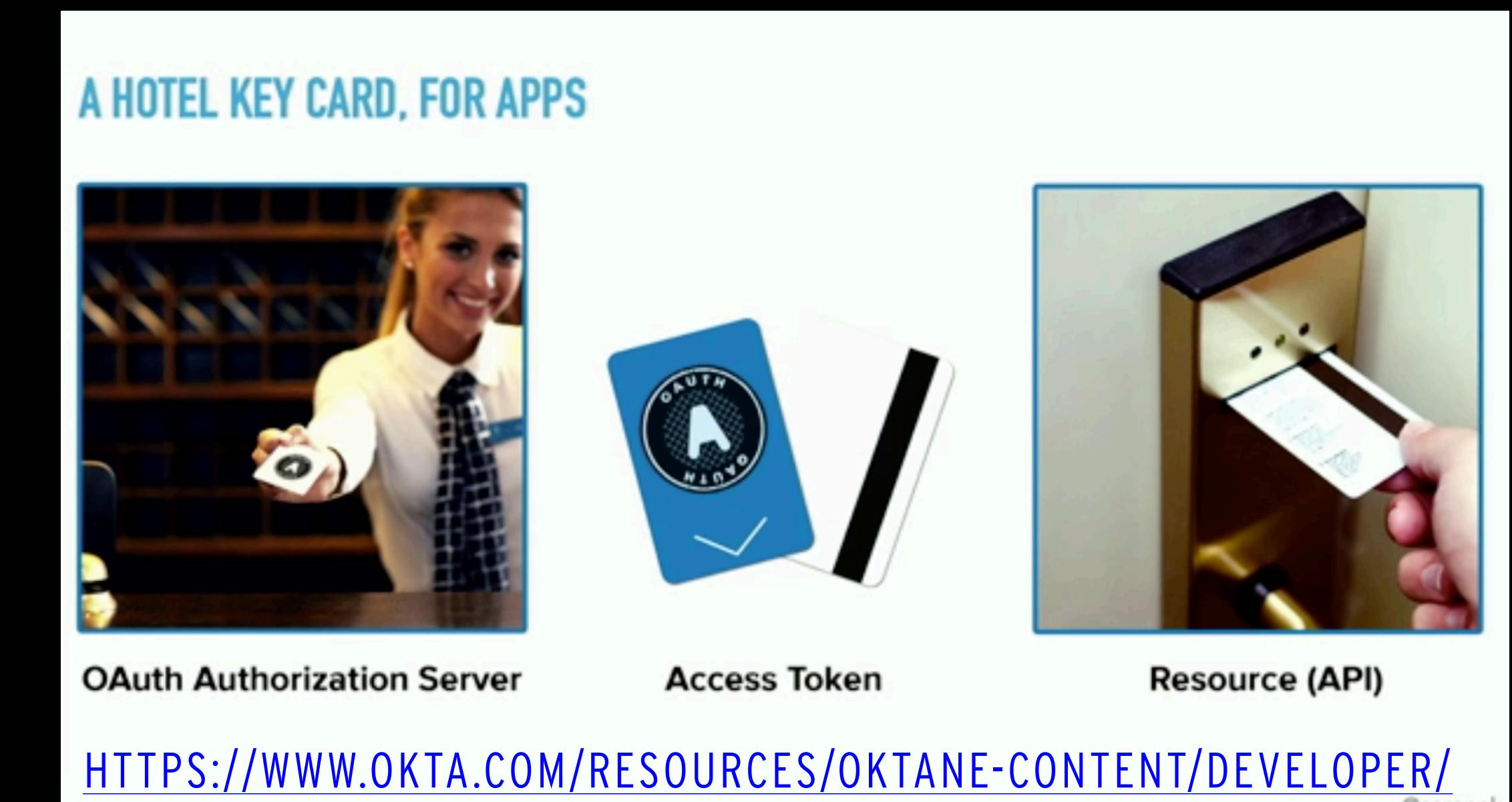
# TECHNOLOGY OVERVIEW

- OAuth
- OIDC
- Direct Password Sharing
- ID Token
- Authorization
- Authentication
- Delegated Authorization
- Access Token
- Refresh Token
- Resource Owner
- Resource Server
- Auth. Server
- OpenID Provider (OP)
- Client
- Relying Party (RP)
- Public vs Confidential Client
- Client Id
- Client Registration
- Grant Types
- Authorization Code Flow
- Authorization Code
- Implicit Flow
- Front channel
- Backchannel
- Redirect
- JWT
- Signature Validation
- Claims
- Opaque Token
- Reference Token
- First-party authorization
- Third-party authorization
- Client Impersonation
- Token Interception
- Auth Cookie
- CORS
- PKCE
- SHA256
- Code Challenge
- State parameter
- Nonce
- Social Login
- MFA
- Token Replay
- Client Credentials Flow
- Custom URI Scheme
- User Store
- User-Info Endpoint
- Subject Identifier
- Same Site Cookies
- HTTP Only Cookies
- Sender Constrained Tokens
- CSRF
- Poached easter eggs
- XSS
- Replay Attack
- TLS
- mTLS
- Token Leakage
- ALG claim
- Signature
- Well known URI endpoint
- SSO
- Device Flow
- Resource Owner Password Flow
- Refresh Token Flow

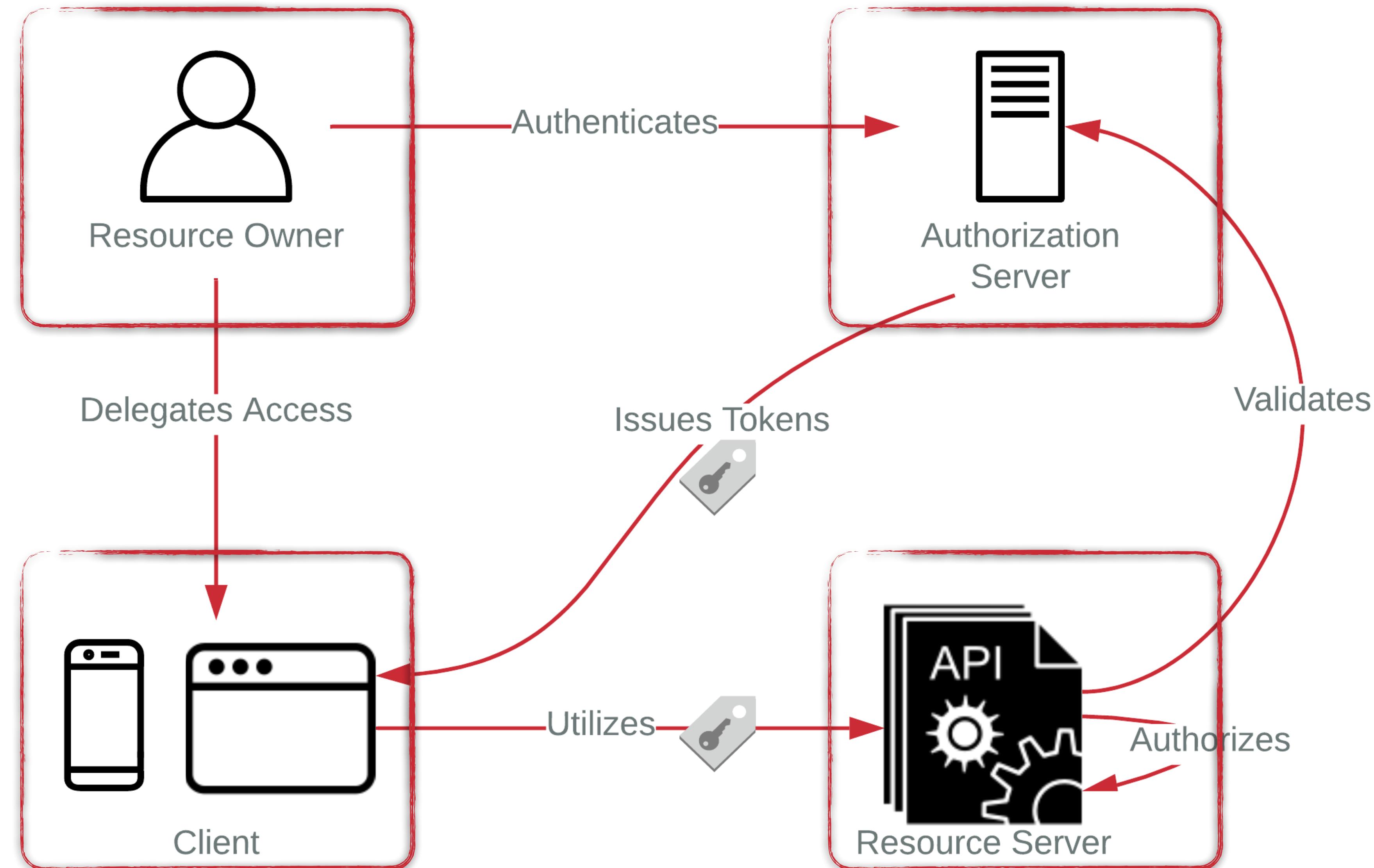
# TECHNOLOGY OVERVIEW - SCOPE, CONSENTS & TOKENS

- Scope
- Consent
- Tokens
  - Access Token
  - ID Token (OIDC)
  - Refresh Token
  - Limited lifespan
  - Opaque vs. self-contained

The left side shows the Google OAuth 2.0 Playground consent screen, where a user is prompted to grant permissions to the application, including access to their contacts. The right side shows the Auth0 Debugger tool, which decodes a JWT token. The decoded payload includes a sub (subject) of "1234567890", a name of "John Doe", and an iat (issued at) timestamp of "1516239022". The debugger also shows the verification of the token's signature using HMACSHA256.



# TECHNOLOGY OVERVIEW - OAUTH2 ROLES/ACTORS





Implicit Grant

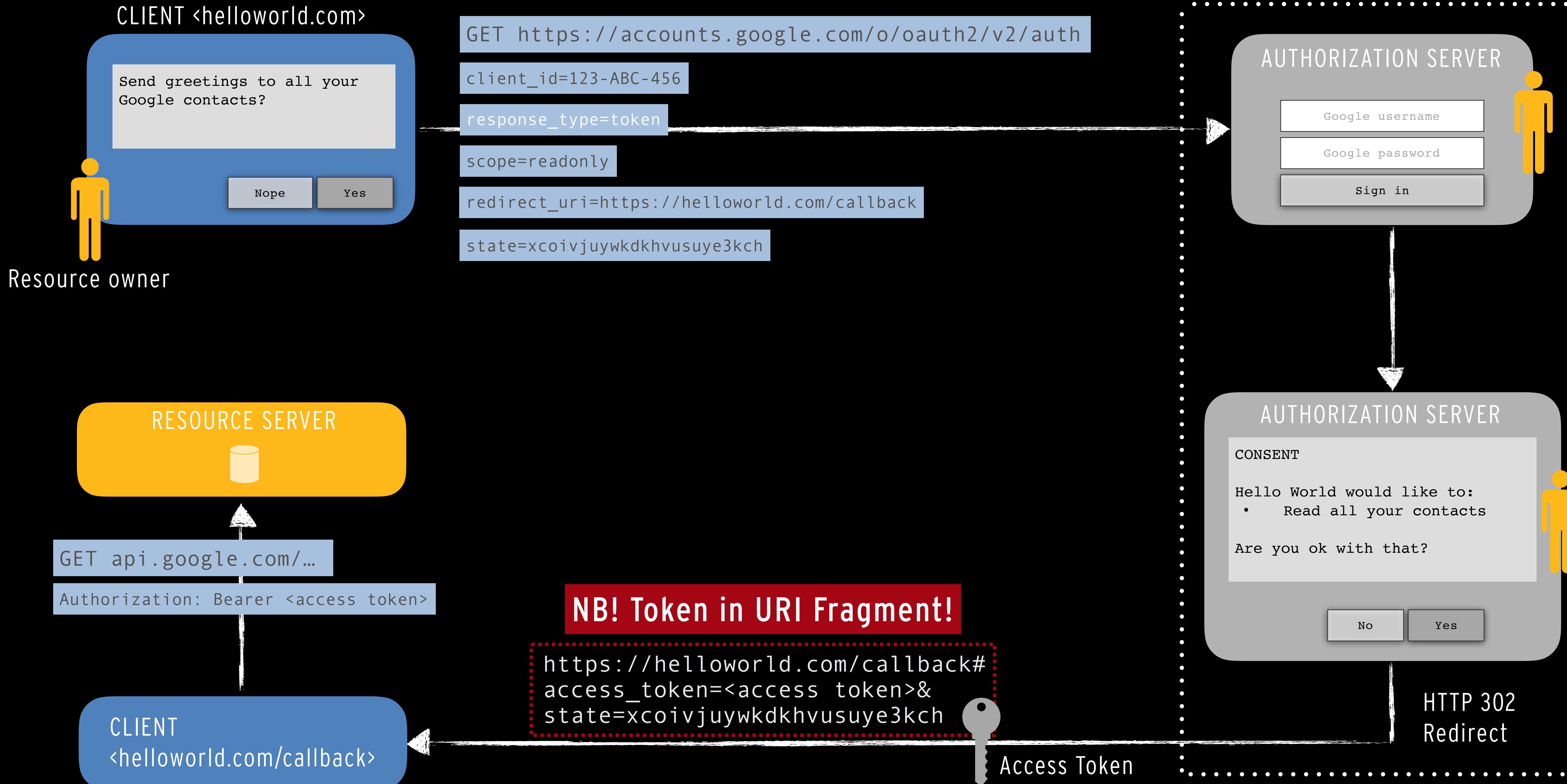
Authorization Code Grant

Client Credentials Grant

Resource Owner Password  
Credentials Grant

Others: Refresh Flow, Device  
Flow

# TECHNOLOGY OVERVIEW - IMPLICIT GRANT FLOW



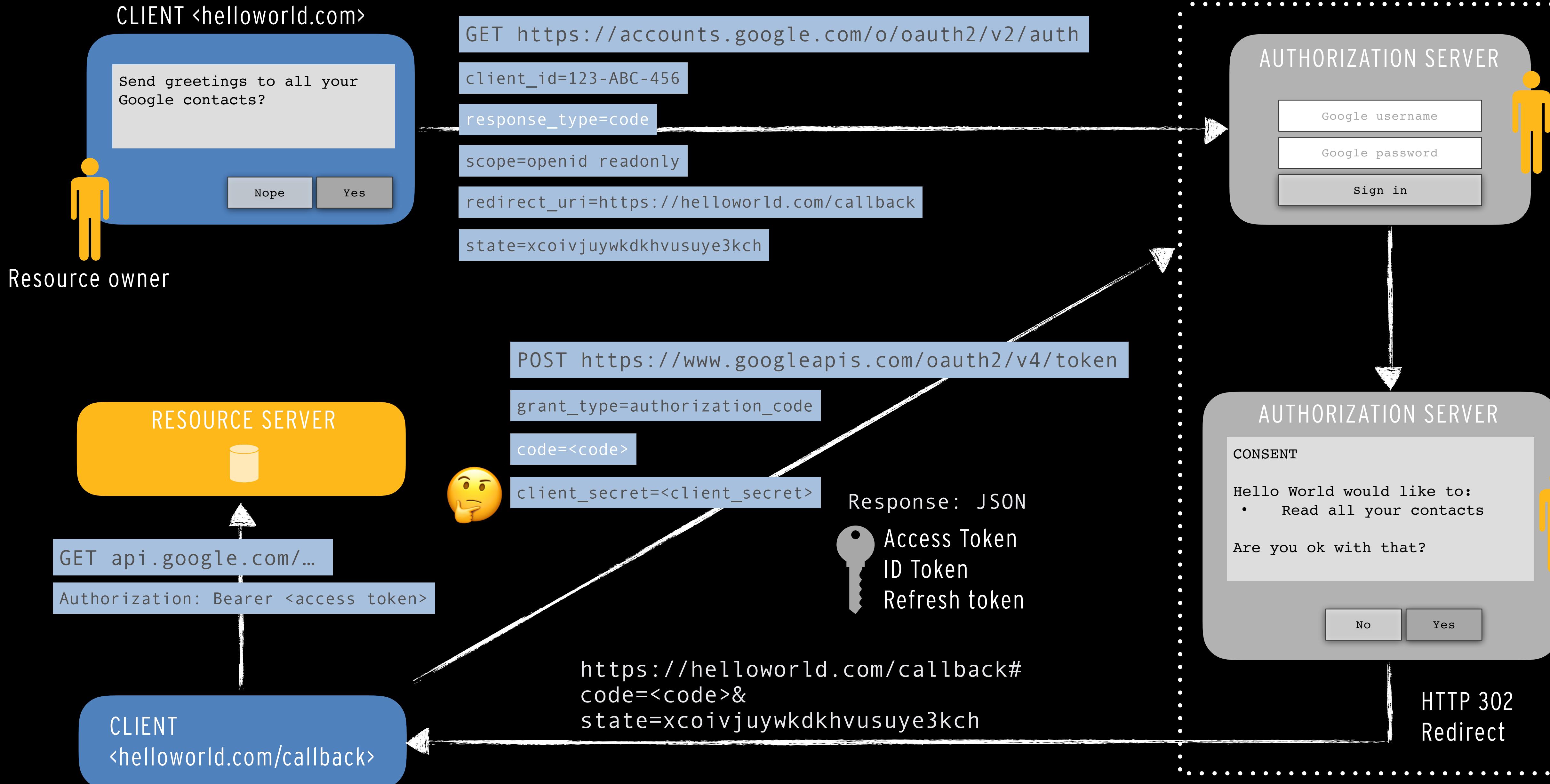
## IMPLICIT GRANT WEAKNESSES

- Token in URI prone to "Token Leakage"
  - 3rd party JavaScripts
  - Browser History
  - Referrer Header
  - Browser plugins

```
chrome.history.search({text: '', maxResults: 10}, function(data) {  
  data.forEach(function(page) {  
    console.log(page.url);  
  });  
});
```

<https://developer.chrome.com/extensions/history>

# TECHNOLOGY OVERVIEW - AUTHORIZATION CODE GRANT FLOW



# CONFIDENTIAL VS PUBLIC CLIENTS

- Core spec (2012) - <https://tools.ietf.org/html/rfc6749#section-2.1>

The screenshot shows a GitHub Gist page titled "2.1. Client Types". The page discusses OAuth client types, specifically confidential and public clients. A yellow callout highlights the definition of a public client.

**2.1. Client Types**

OAuth defines two client types, based on their ability to authenticate securely with the authorization server (i.e., ability to maintain the confidentiality of their client credentials):

**confidential**

Clients capable of maintaining the confidentiality of their credentials (e.g., client implemented on a secure server with restricted access to the client credentials), or capable of secure client authentication using other means.

**public**

Clients incapable of maintaining the confidentiality of their credentials (e.g., clients executing on the device used by the resource owner, such as an installed native application or a web browser-based application), and incapable of secure client authentication via any other means.

Twitter for Android Sign-Up

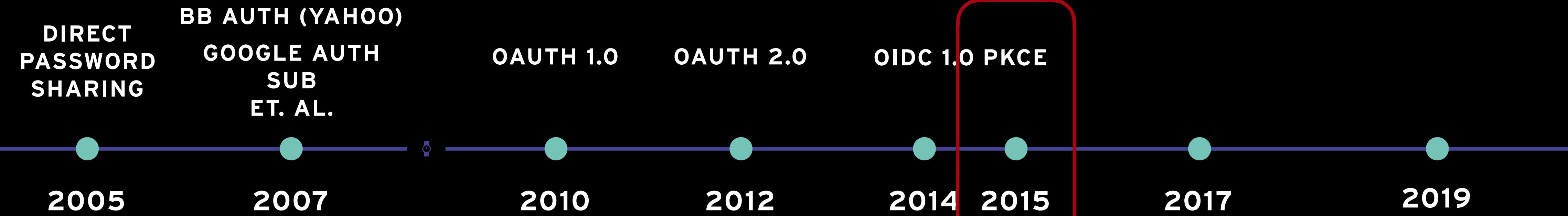
Consumer key: RwYLhxGZpMqsWZENFVw  
Consumer secret: Jk80YVGqc7Iz1IDEjCI6x3ExMSBnGjzBAH6qHcWJlo

@aaronpk

# PKCE

RFC 7636 - Proof of key code exchange

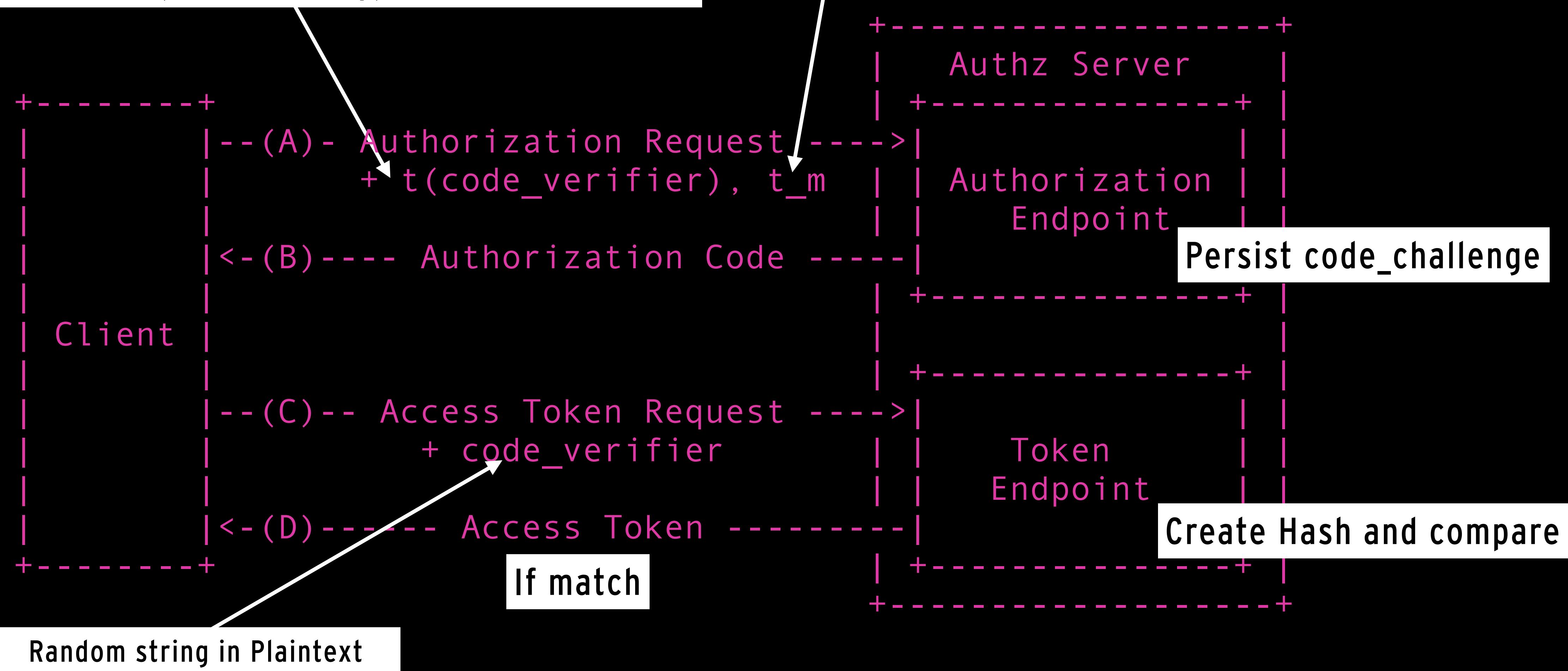
"Pixie"



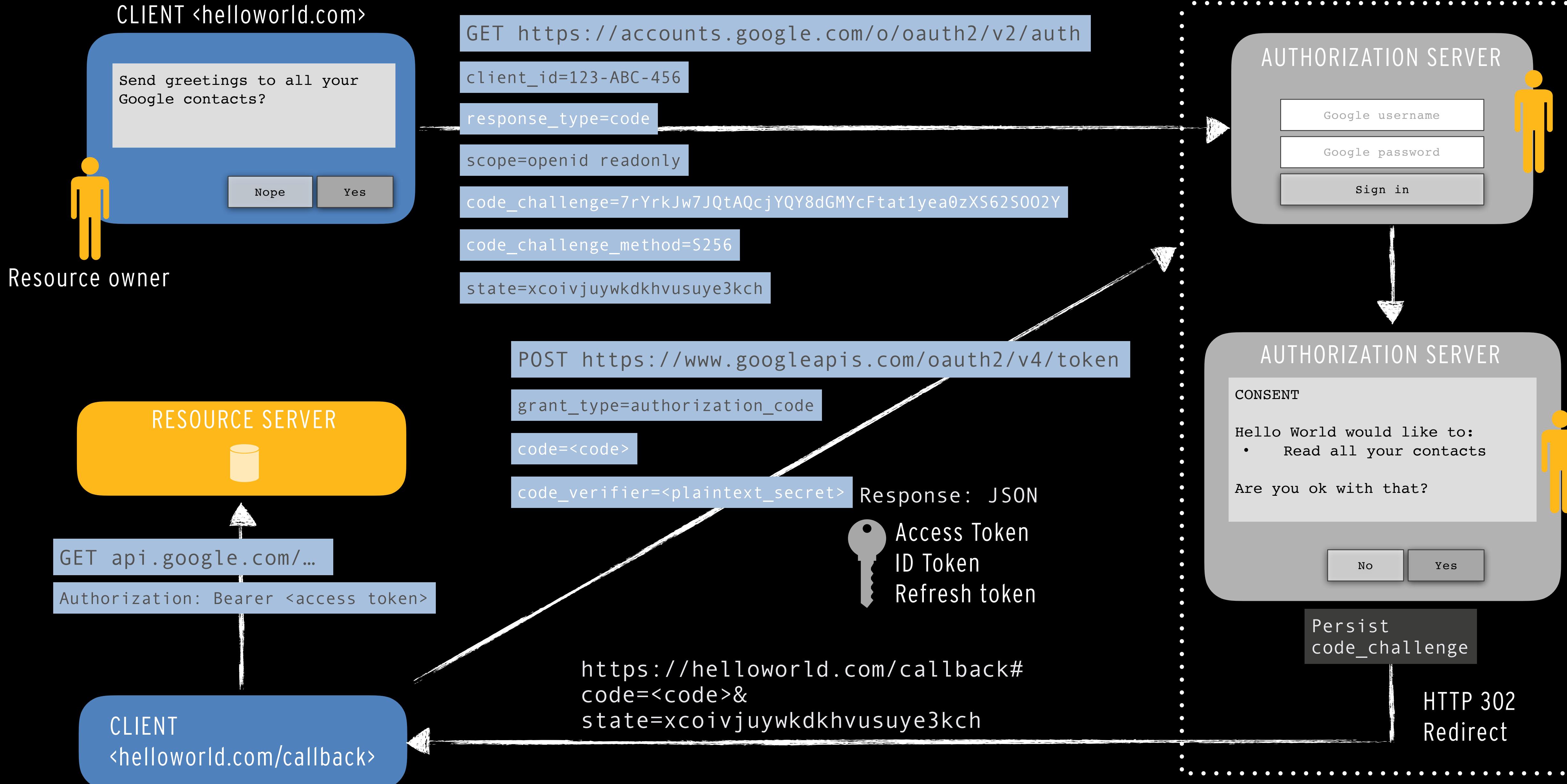
# PKCE

code\_challenge  
= cryptographic hash of random string (43-128 chars)  
(requires WebCrypto)

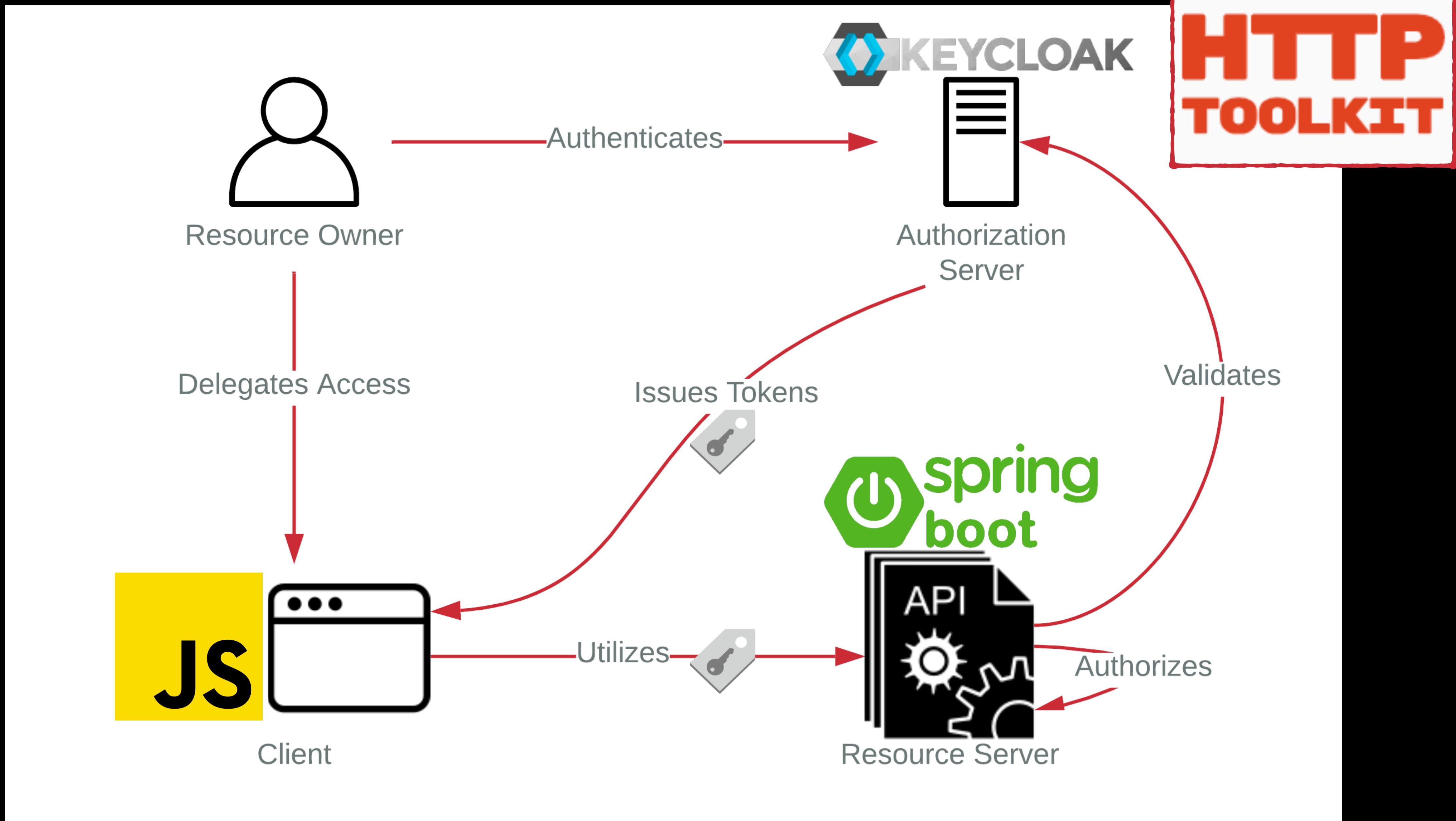
Hash method  
=S256



# TECHNOLOGY OVERVIEW - AUTHORIZATION CODE GRANT FLOW + PKCE

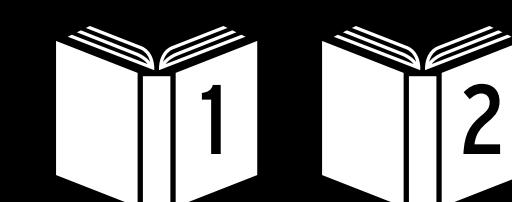
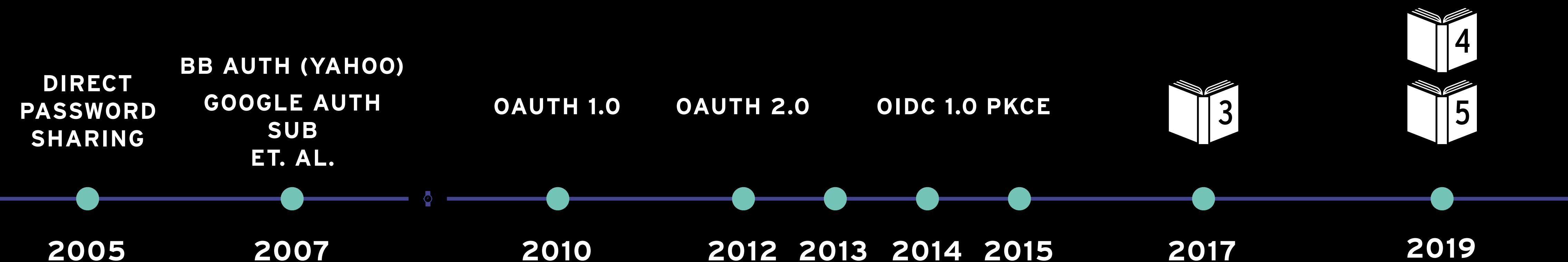


## DEMO: AUTH CODE GRANT + PKCE



## BEST CURRENT PRACTICE - SECURITY CONSIDERATIONS

1. OAuth 2 main spec: <https://tools.ietf.org/html/rfc6749#section-10>
2. OAuth 2.0 Threat Model and Security Considerations: <https://tools.ietf.org/html/rfc6819>
3. OAuth 2.0 for Native Apps: <https://tools.ietf.org/html/rfc8252#section-8>
4. OAuth 2.0 Security Best Current Practice: <https://tools.ietf.org/html/draft-ietf-oauth-security-topics-13>
5. OAuth 2.0 for Browser-Based Apps BCP: <https://tools.ietf.org/html/draft-ietf-oauth-browser-based-apps-04#section-9>



## | BEST CURRENT PRACTICE (BCP) - GENERAL

- TLS - end 2 end
- Don't DIY
- Enforce strict URL-redirection rules in Auth Server
- Always use CSRF mitigation techniques
- Verify JWTs
- Manage your tokens!
  - POLP (Principle of Least Privilege)
  - Lifespan/expiration time
  - Rotate Refresh Tokens



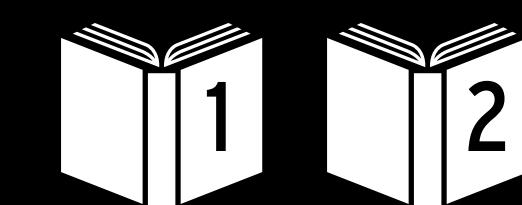
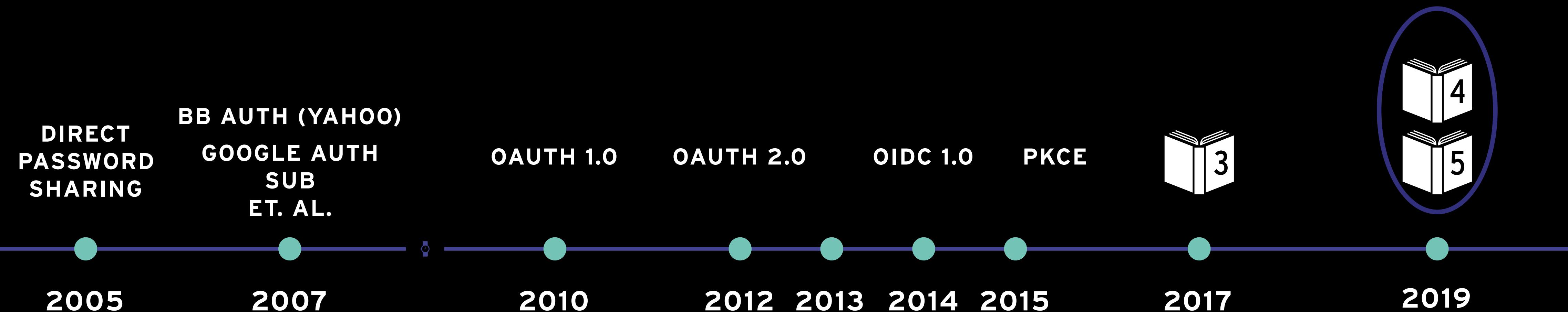
<HTTPS://SKOLBANKEN.UNIKUM.NET/SKOLBANKEN/PLANERING/3678643542>

# BEST CURRENT PRACTICE - SPA

JS

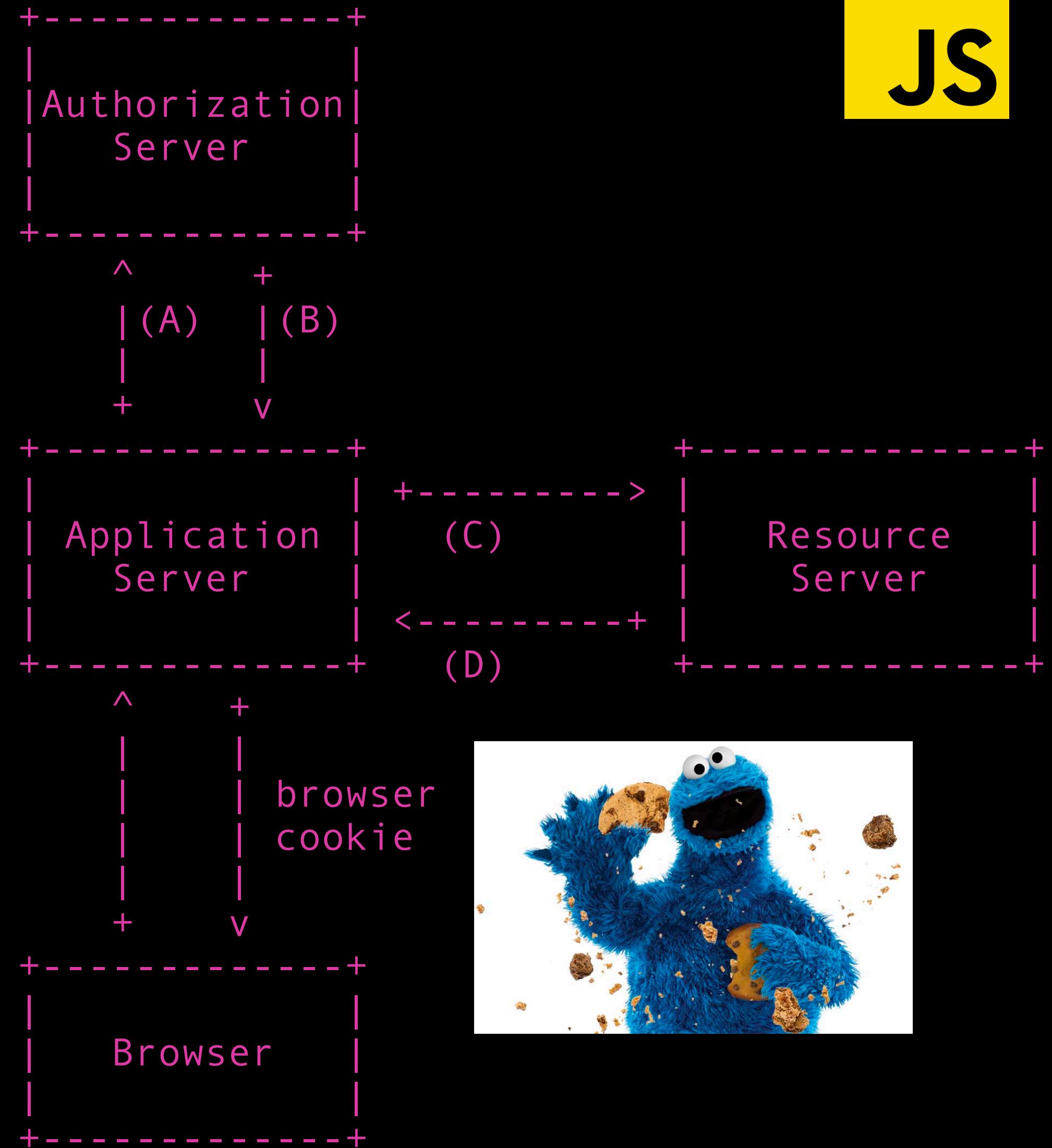
- Use PKCE
- Only use trusted 3rd party JavaScripts
  - Control JavaScript execution via Content Security Policy
- No secure storage in browsers, keep tokens in transient memory

4. OAuth 2.0 Security Best Current Practice  
5. OAuth 2.0 for Browser-Based Apps BCP



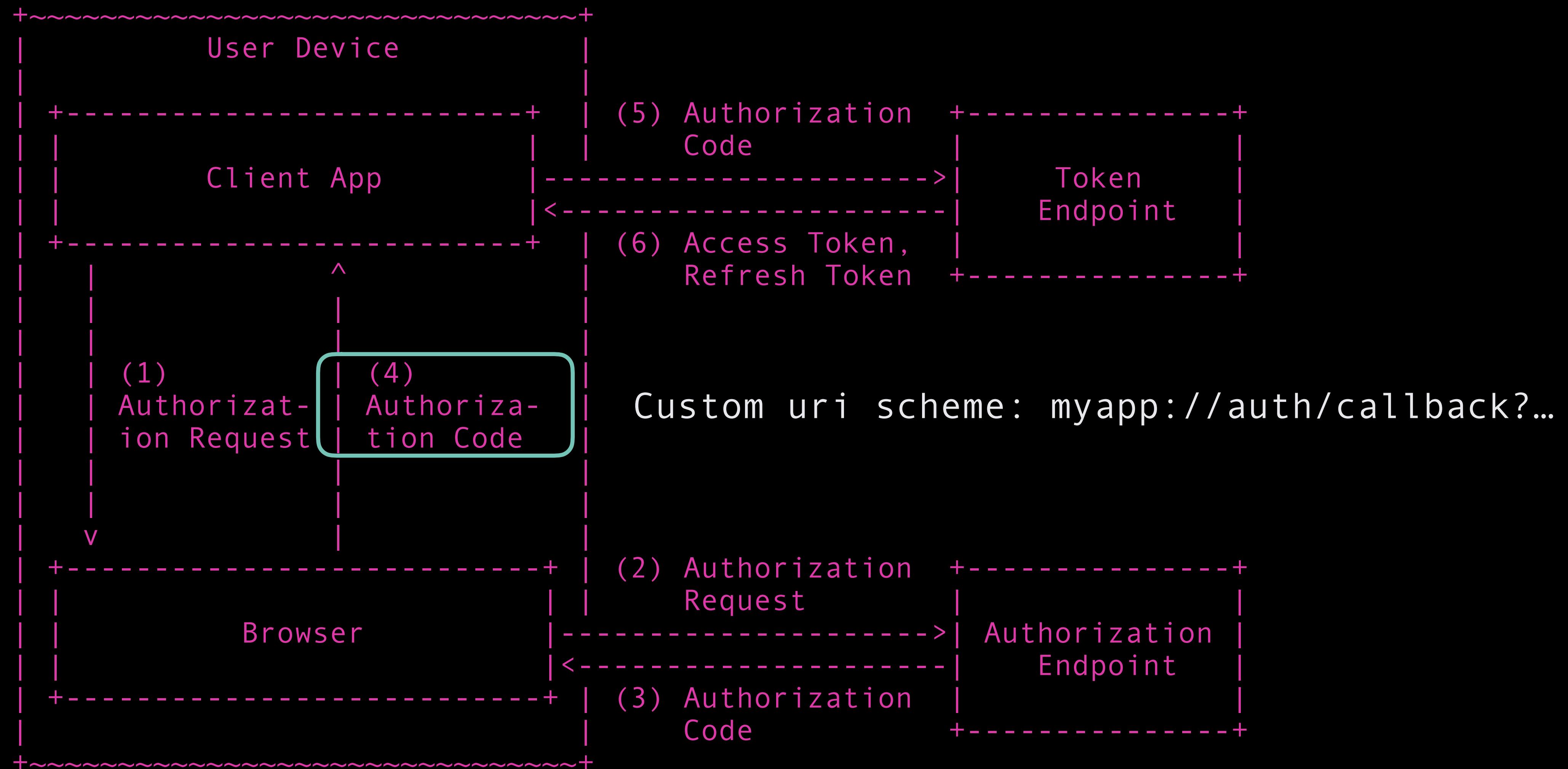
# SAME DOMAIN ARCHITECTURE FOR SPA

- Use good old cookie(s) to authenticate
  - » HTTP Only
  - » Secure
- If the SPA has a dedicated backend served from the same origin (domain) as the SPA itself
- Downsides
  - Backend has to proxy calls
  - If the actual tokens should be associated with the cookie session state is introduced



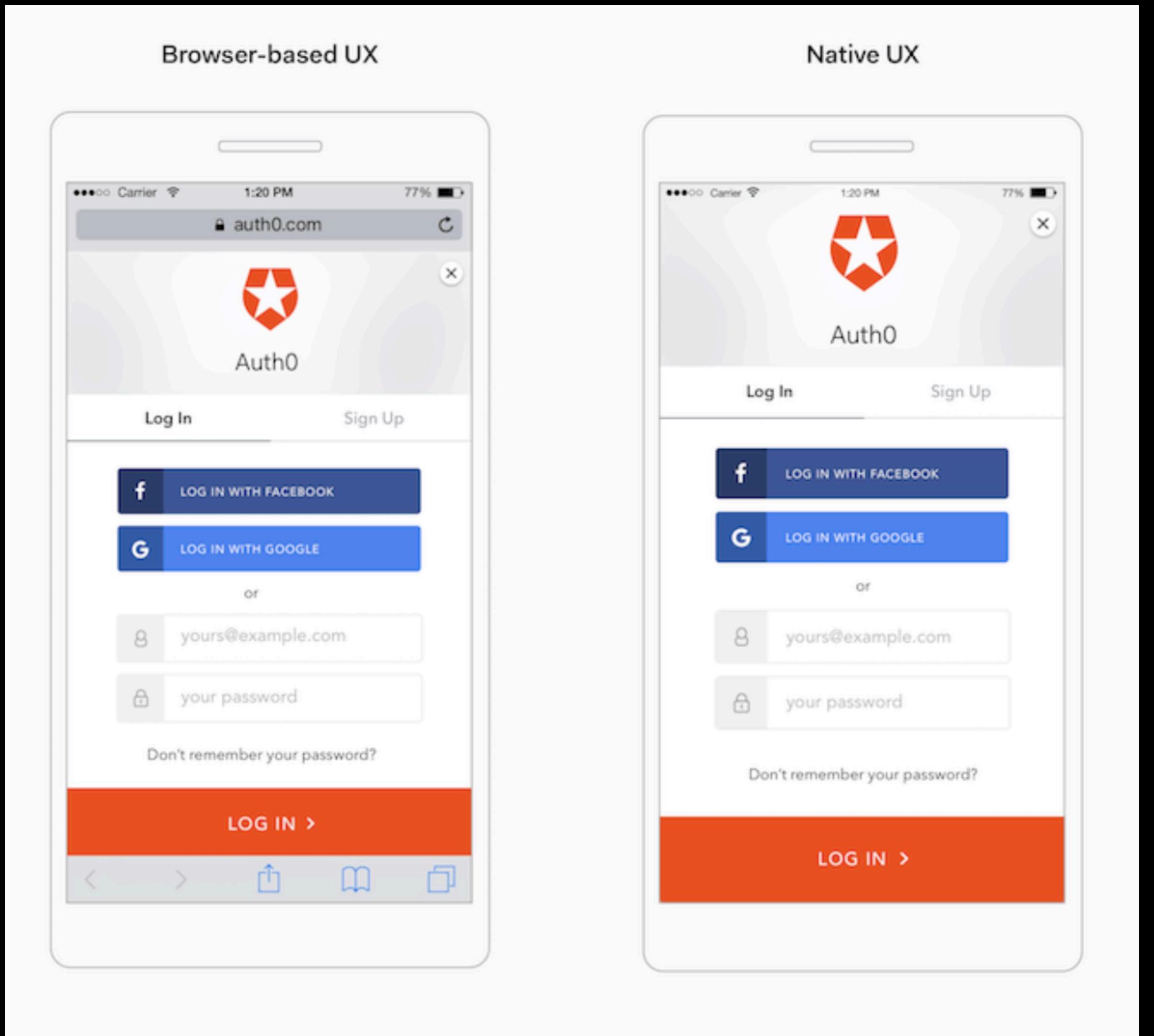
[HTTPS://TOOLS.IETF.ORG/HTML/DRAFT-IETF-OAUTH-BROWSER-BASED-APPS-04#SECTION-6.2](https://tools.ietf.org/html/draft-ietf-oauth-browser-based-apps-04#SECTION-6.2)

# NATIVE/MOBILE APPS



# BEST CURRENT PRACTICE - MOBILE/NATIVE CLIENTS

- Use PKCE
- Use "app claimed" verified https schemes for redirect if possible
  - iOS Universal Links
  - Android App Links
- Use the real external browser of the OS over "native widget"
  - Easier for user to determine if the request is legit (URL, TLS)
  - Don't share credentials with the app
  - Can partake in web SSO



[HTTPS://AUTH0.COM/DOCS/DESIGN/BROWSER-BASED-VS-NATIVE-EXPERIENCE-ON-MOBILE](https://auth0.com/docs/design/browser-based-vs-native-experience-on-mobile)

Best current practice for Public Clients  
- SPAs and Mobile -  
is  
Authorization Code Flow with PKCE.

For SPAs with same domain scenarios and dedicated backend;  
consider using cookies  
to eliminate the need to store tokens in the Browser

Implicit Flow is viable in situations when only obtaining ID Tokens  
(i.e `response_type=id_token`)

## WRAP UP: ON THE HORIZON

- "Sender constrained" Tokens:
  - "Level up" Bearer Tokens into "Holder of Key" tokens using cryptography
    - » OAuth 2.0 Token binding
    - » OAuth 2.0 Mutual-TLS Client Authentication and Certificate-Bound Access Tokens
  - No wide support, still just a drafts...
- OAuth 2.1 (proposed)
- OAuth 3.0 (new WG TBD)

## WRAP UP: BALANCED SECURITY MEASURES



<https://defence-blog.com/army/oman-to-acquire-k2-black-panther-tanks-from-south-korea.html>

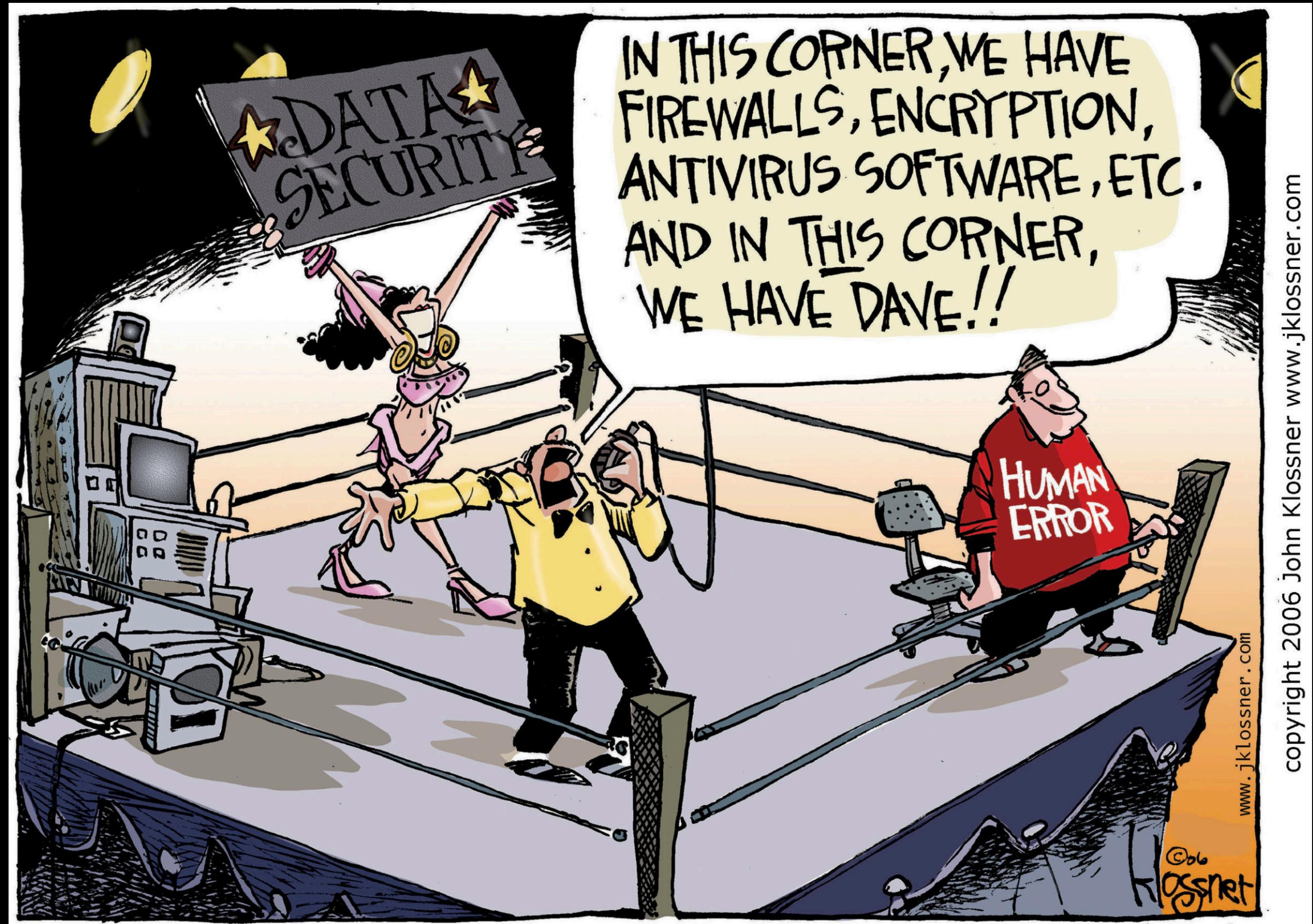


[https://www.autoevolution.com/news/knight-xv-world-s-most-secure-suv-costs-310000-3286.html#agal\\_3](https://www.autoevolution.com/news/knight-xv-world-s-most-secure-suv-costs-310000-3286.html#agal_3)



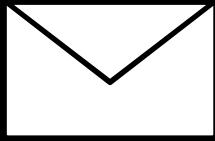
<https://europe.autonews.com/blogs/renault-twizy-gets-new-life-korea-motorcycle-replacement>

# Context Is King



# THANK YOU!

# QUESTIONs?



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## REFERENCES

- OAuth 2 main spec: <https://tools.ietf.org/html/rfc6749>
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- OAuth 2.0 for Browser-Based Apps: <https://tools.ietf.org/html/draft-ietf-oauth-browser-based-apps-04>
- "OAuth2 in Action" – Manning (ISBN 9781617293276)
- OAuth 2.0 and OpenID Connect in plain English: <https://www.youtube.com/watch?v=9960iexHze0&feature=youtu.be>