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EXPERT SOLUTIONS FOR .NET DEVELOPERS

Authentication & API access for native/mobile applications

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Code Again for the First Time!

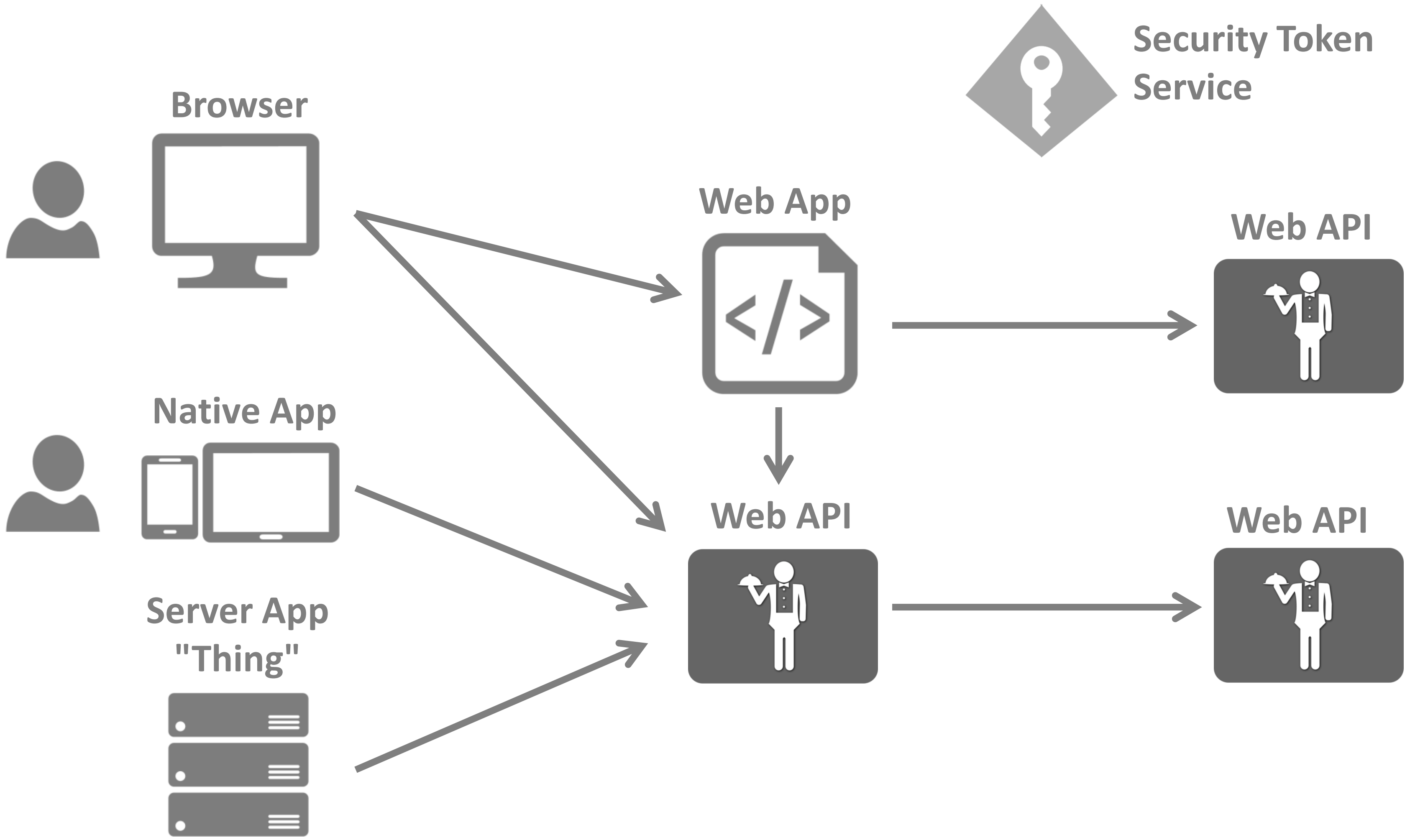
Visual Studio LIVE! 25 YEARS OF CODING INNOVATION

Native/Mobile Applications

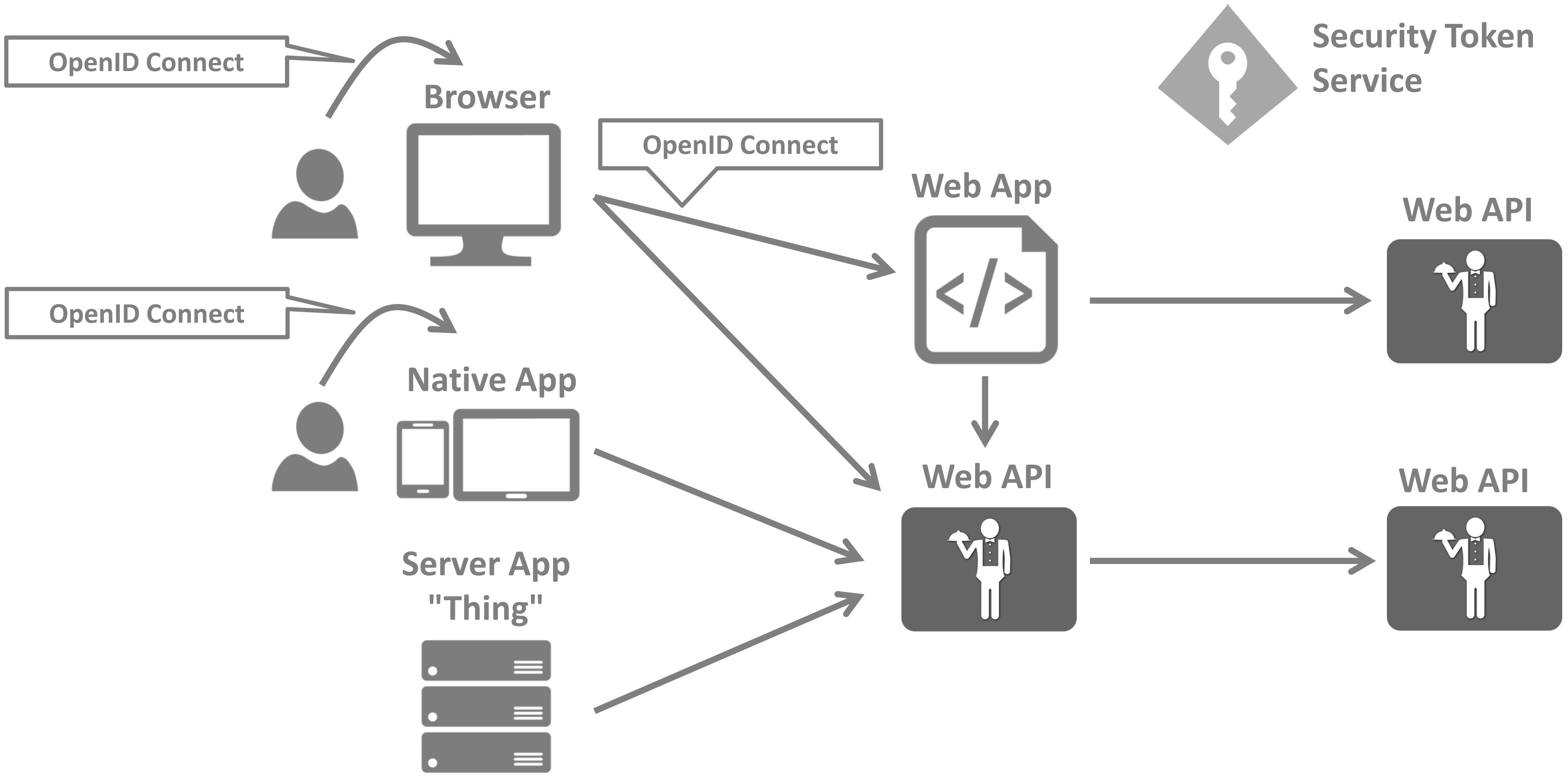
- **Applications that have access to native platform APIs**
  - desktop or mobile
  - C, C++, Objective-C, Java, C#, JavaScript, etc.

- **"OAuth 2.0 for native Applications"**
  - https://tools.ietf.org/html/rfc8252

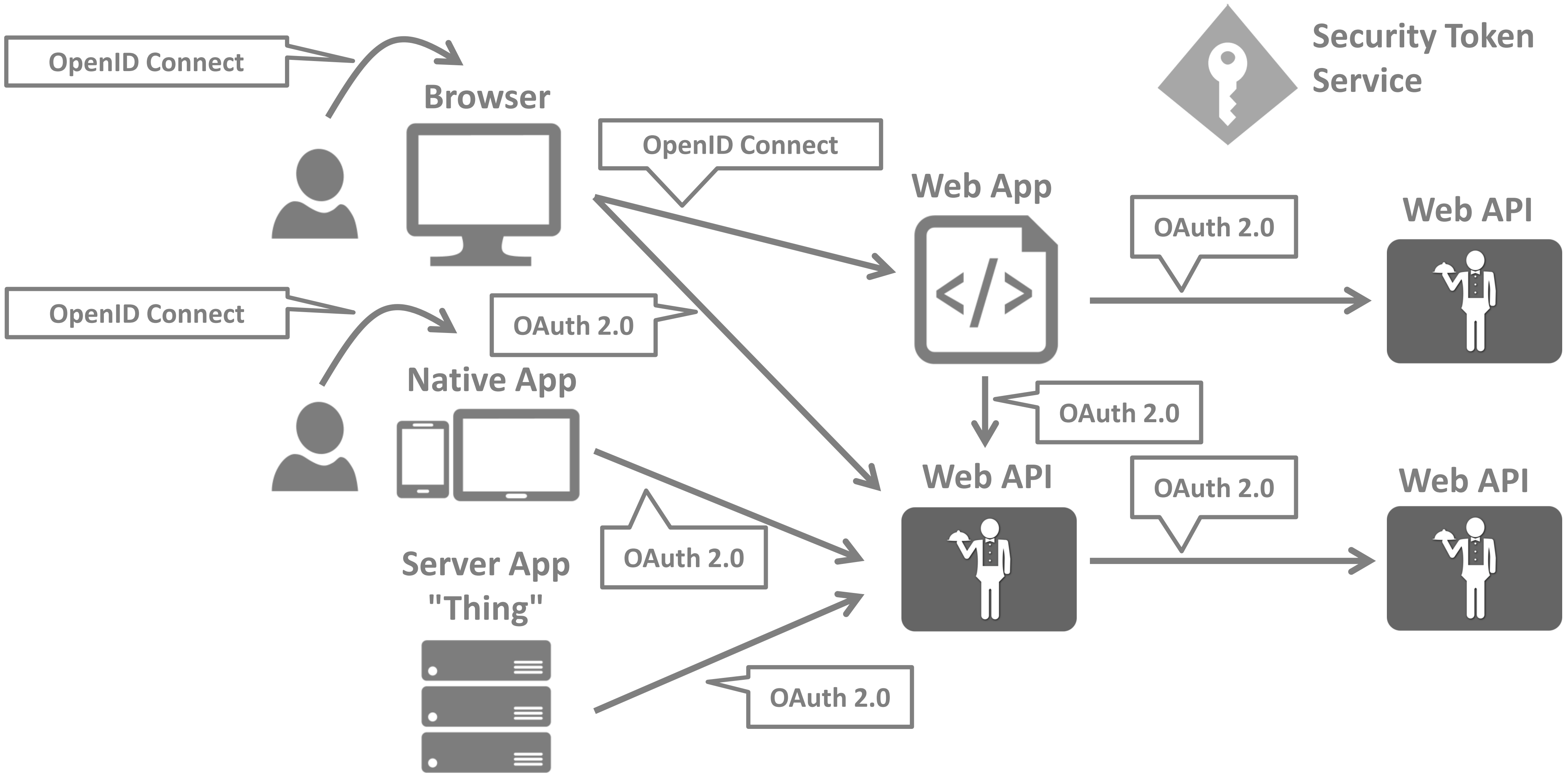
The big picture



Security protocols (I)



Security protocols (II)

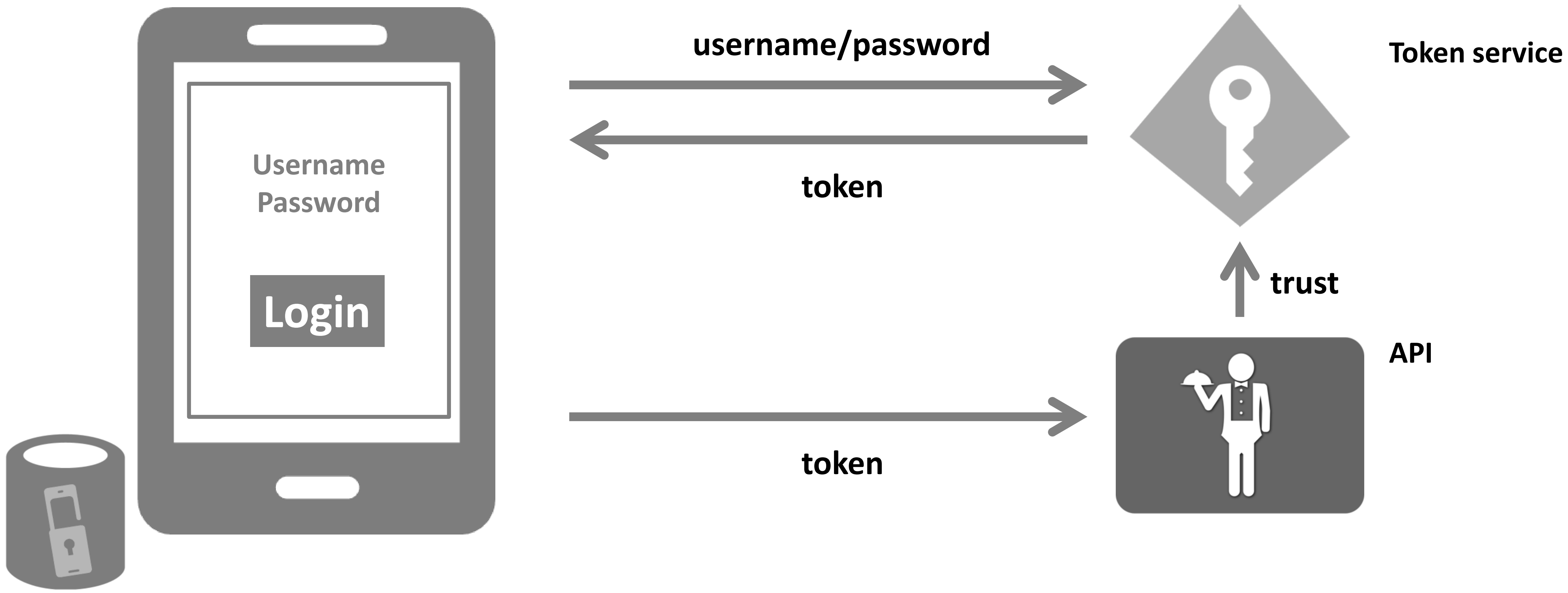


So many options…

- **Low hanging fruit**
  – OAuth 2.0 resource owner password credential flow
- **Better, but is missing out on some advanced features**
  – OAuth 2.0 implicit flow

- **Recommended**
  – OAuth 2.0 authorization code flow (with PKCE)
- **…and my favourite**
  – OpenID Connect Hybrid Flow (with PKCE)

Native login dialogs

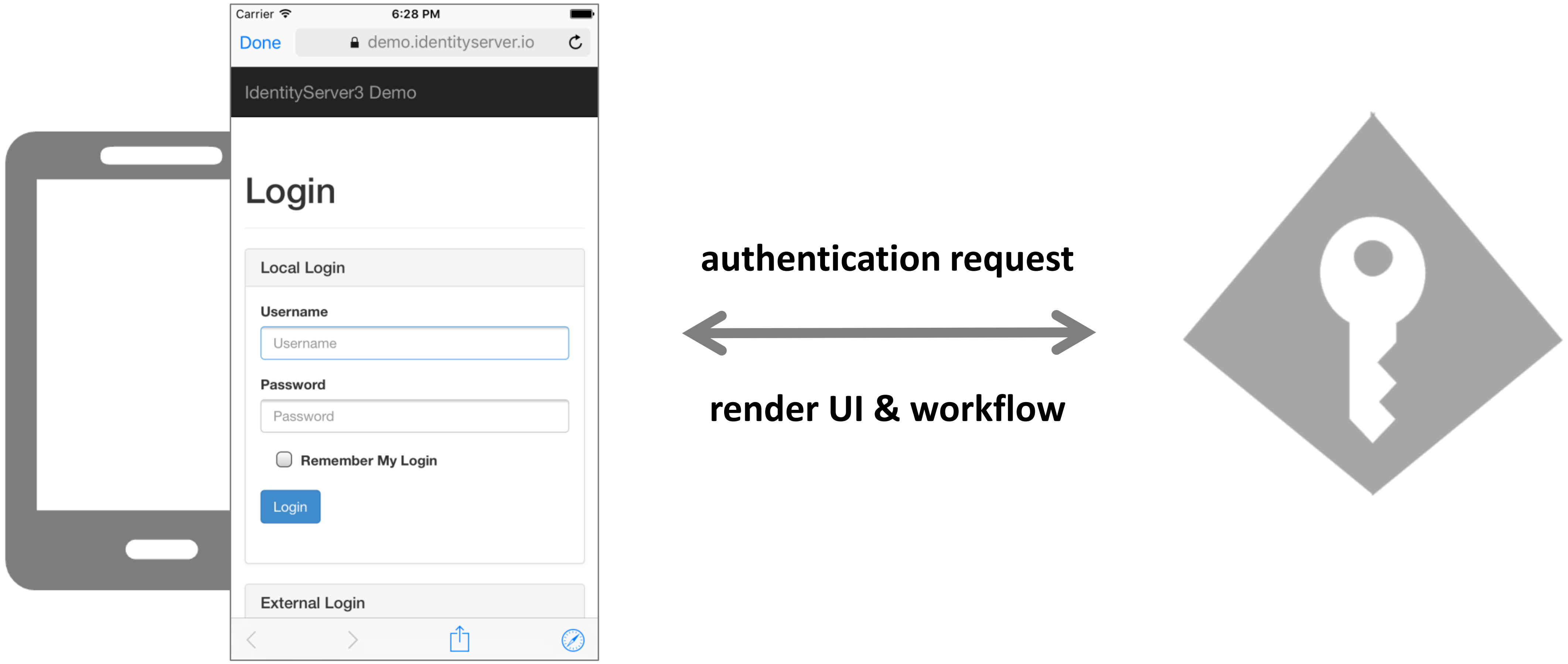


OAuth 2.0 Resource Owner Password Flow

- **Pros**
  - client app has full control over login UI
  - support for long lived API access without having to store a password

- **Cons**
  - user is encouraged to type in his master secret into "external" applications
    - especially problematic once applications also come from 3rd parties
  - no cross application single sign-on or shared logon sessions
  - no federation with external identity providers/business partners
  - every change in logon workflow requires versioning the application

Using a browser for driving the authentication workflow



Using a browser for driving the authentication workflow

- **Centralize authentication logic**
  - consistent look and feel
  - implement once, all applications get it for free
  - allows changing the workflow without having to update the applications
    - e.g. consent, updated EULA, 2FA
- **Enable external identity providers and federation**
  - federation protocols are browser based only
- **Depending on browser, authentication sessions can be shared between apps and OS**

Different Approaches

- **Choice of browser**
  - embedded web view
    - private browser & private cookie container
  - system browser
    - e.g. SFAuthenticatedSession, Chrome Custom Tabs or desktop browser
    - full featured including address bar & add-ins
    - shared cookie container

- **Handling the callback**
  - event handling
  - custom URI schemes
  - "claimed" HTTPS URIs*
  - local HTTP listener

* https://developer.apple.com/library/content/documentation/General/Conceptual/AppSearch/UniversalLinks.html

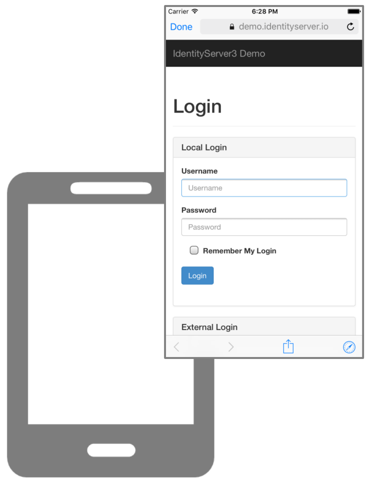
Which protocol flow?

- **Implicit flow**
  - really designed for browser-based JS apps (not native)
  - access tokens transmitted over browser (and potentially cross process)
  - no refresh tokens

- **Authorization code-based flows**
  - access tokens only over back-channel communication
  - slightly more secure due to client secret
  - allows long lived API access via refresh tokens
  - authorization code itself needs to be protected though
    - cut'n paste attack
    - man in the middle

Starting the authentication request

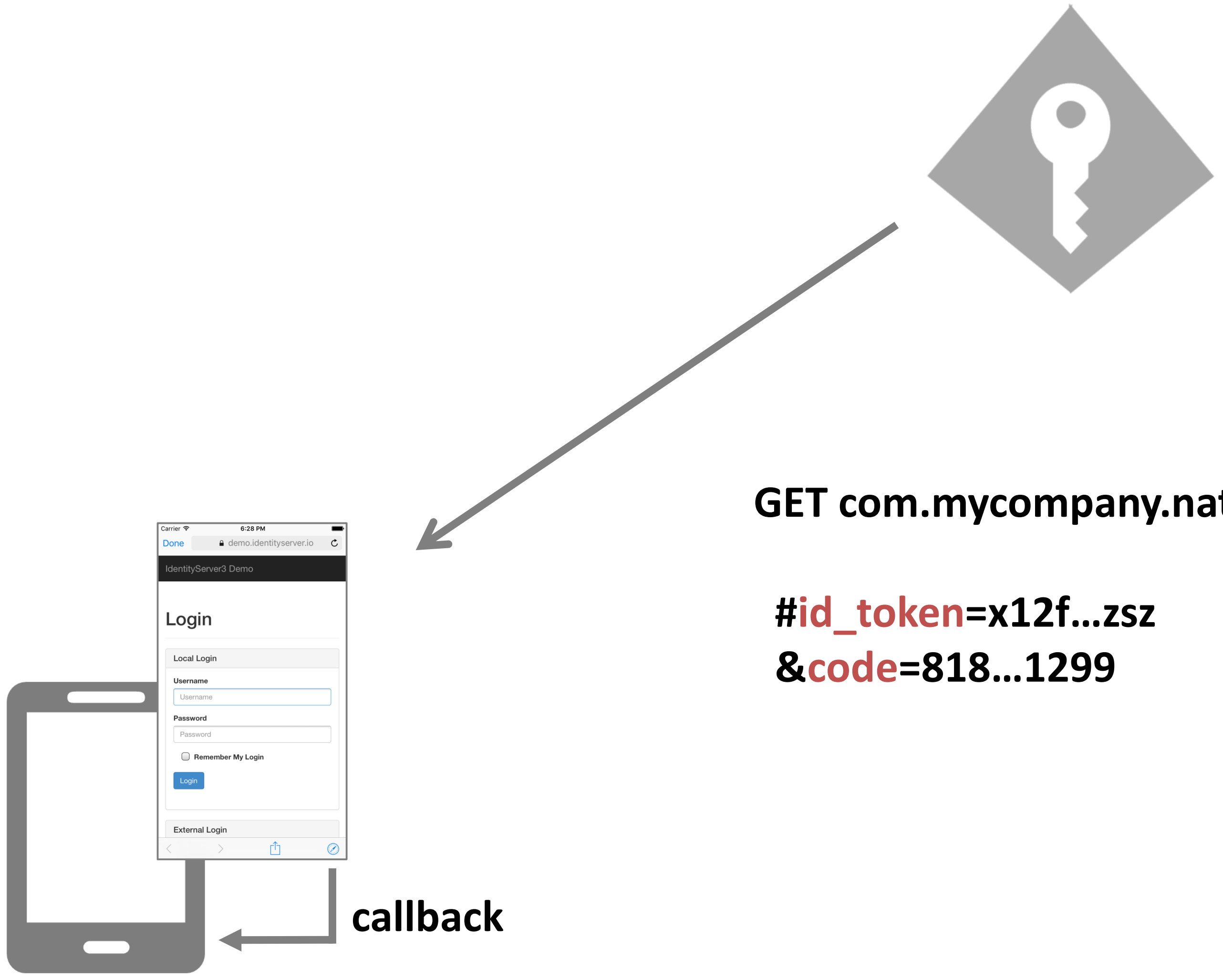
nonce = random_number
code_verifier = random_number
code_challenge = hash(code_verifier)



GET /authorize

?client_id=nativeapp
&scope=openid profile api1 api2 ***offline_access***
&redirect_uri=com.mycompany.nativeapp://cb
&response_type=*code id_token*
&nonce=j1y…a23
&code_challenge=x929..1921

Receiving the response



GET com.mycompany.nativeapp://cb

#id_token=x12f…zsz
&code=818…1299

Identity token

Header

```
{
  "typ": "JWT",
  "alg": "RS256",
  "kid": "mj399j…"
}
```

Payload

```
{
  "iss": "https://idsrv",
  "exp": 1340819380,
  "aud": "nativeapp",
  "nonce": "j1y…a23",
  "amr": [ "password", "sms" ],
  "auth_time": 12340819300

  "sub": "182jmm199"
}
```

base64url $\longrightarrow$ $\underbrace{\texttt{eyJhbGciOiJub25lIn0}}_{\textbf{Header}}\texttt{.}\underbrace{\texttt{eyJpc3MiOiJqb2UiLA0KICJleHAiOjEzMD}}_{\textbf{Payload}}\texttt{.}\underbrace{\texttt{4MTkzODAsDQogImh0dHA6Ly9leGFt}}_{\textbf{Signature}}$

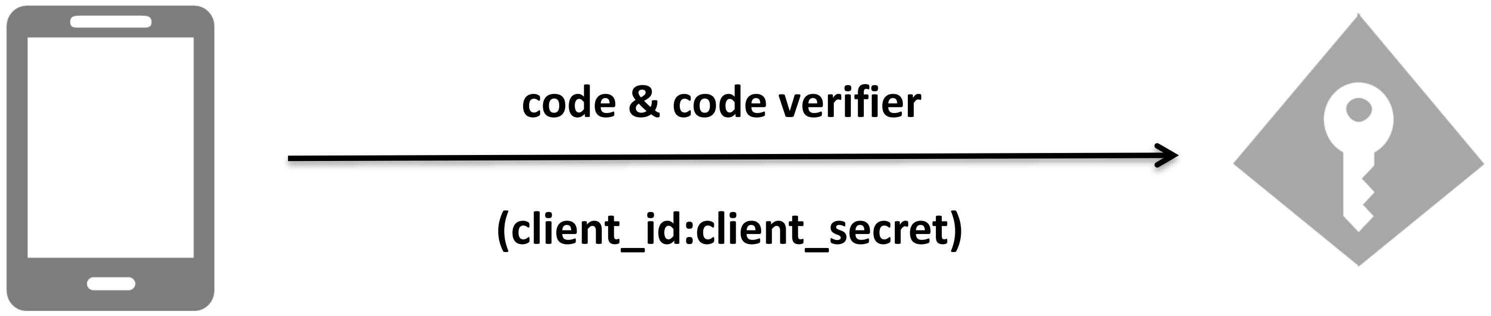
Validating the response

- **Identity token validation (section 3.1.3.7)**
  - validate signature
    - key material available via discovery endpoint
  - validate **`iss`** claim
  - validate **`exp`** (and **`nbf`**)
  - validate **`aud`** claim
- **Authorization code validation (section 3.3.2.10)**
  - hash authorization code and compare with **`c_hash`** claim

https://openid.net/specs/openid-connect-core-1_0.html

Requesting the access token

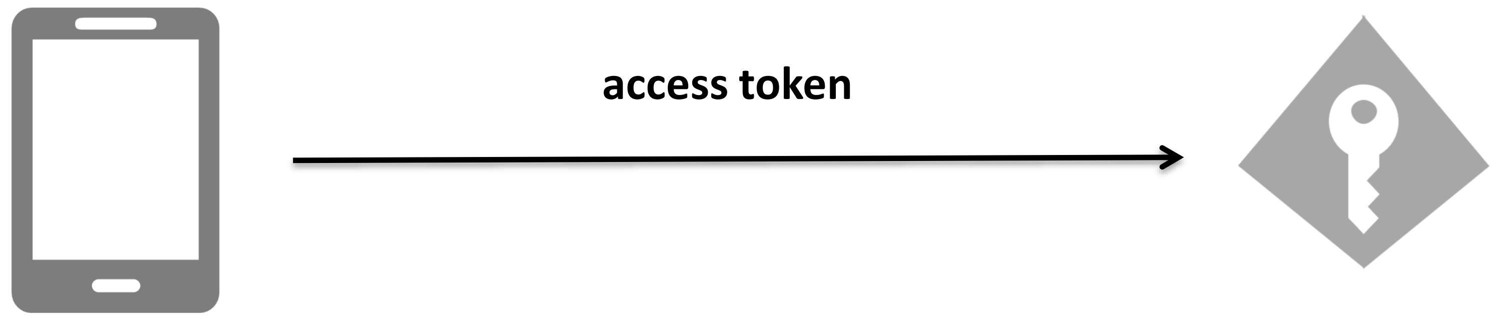
- **Exchange code for access token**
  - using client id and secret



```
{
  access_token: "xyz…123",
  refresh_token: "dxy…103"
  expires_in: 3600,
  token_type: "Bearer"
}
```

Optional: download more claims

- **OpenID Connect *UserInfo* endpoint provides claims as JSON object**



```
{
  "given_name": "Kendall",
  "preferred_username": "FluffyBunnySlippers"
  "profile_picture": "      "
}
```

Next steps

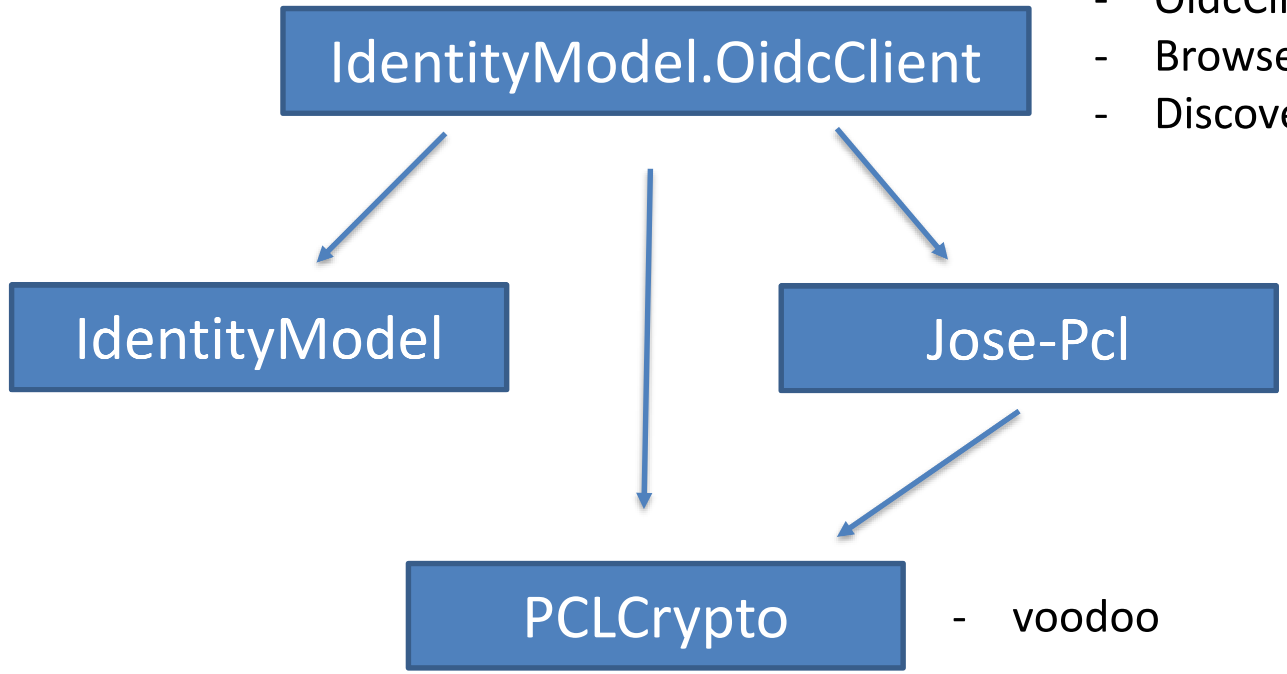
- **Persist the data in protected storage**
  - claims
  - access token
  - refresh token

- **Use access token to communicate with APIs**
- **Use refresh token to get new access tokens when necessary**

That's a lot of work!

- **Native libraries**
  - https://github.com/openid/AppAuth-iOS
  - https://github.com/openid/AppAuth-Android
- **C# portable class library (desktop .NET, UWP, mobile, iOS, Android)**
  - https://github.com/IdentityModel/IdentityModel.OidcClient
  - https://github.com/IdentityModel/IdentityModel.OidcClient.Samples

OSS FTW!



- OidcClient
- Browser coordination
- Discovery document support

- OpenID Connect & OAuth 2.0 protocol
- Refresh token handling

- JWT validation
- JWK handling

- voodoo

Setup

```
var options = new OidcClientOptions(
    authority:    authority,
    clientId:     "native",
    clientSecret: "secret",
    scope:        "openid profile api offline_access",
    redirectUri:  "com.mycompany.myapp://callback",
    webView:      webView);

var client = new OidcClient(options);
```

Authentication & requesting tokens

```
var result = await client.LoginAsync();

var claims = result.Claims;
var accessToken = result.AccessToken;
var refreshToken = result.RefreshToken;
```

Calling APIs and keeping tokens fresh

```
var apiClient = new HttpClient(result.Handler);
apiClient.BaseAddress = new Uri("https://www.mycompany.com/api/");
```

or…

```
var tokenClient = new TokenClient(
    address:      "https://demo.identityserver.io/connect/token",
    clientId:     "client",
    clientSecret: "secret");

var handler = new RefreshTokenHandler(tokenClient, refreshToken);
```

Summary

- **Open ID Connect and OAuth 2 support native/mobile apps**
- **Resource owner password flow acceptable in certain scenarios**
- **Hybrid flow with PKCE using system browser is ideal workflow**
- **IdentityModel.OidcClient helper library useful for .NET clients**