Secure Application Design

OpenID Connect: Delegated Authentication in Practice

Summer 2025

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he/his

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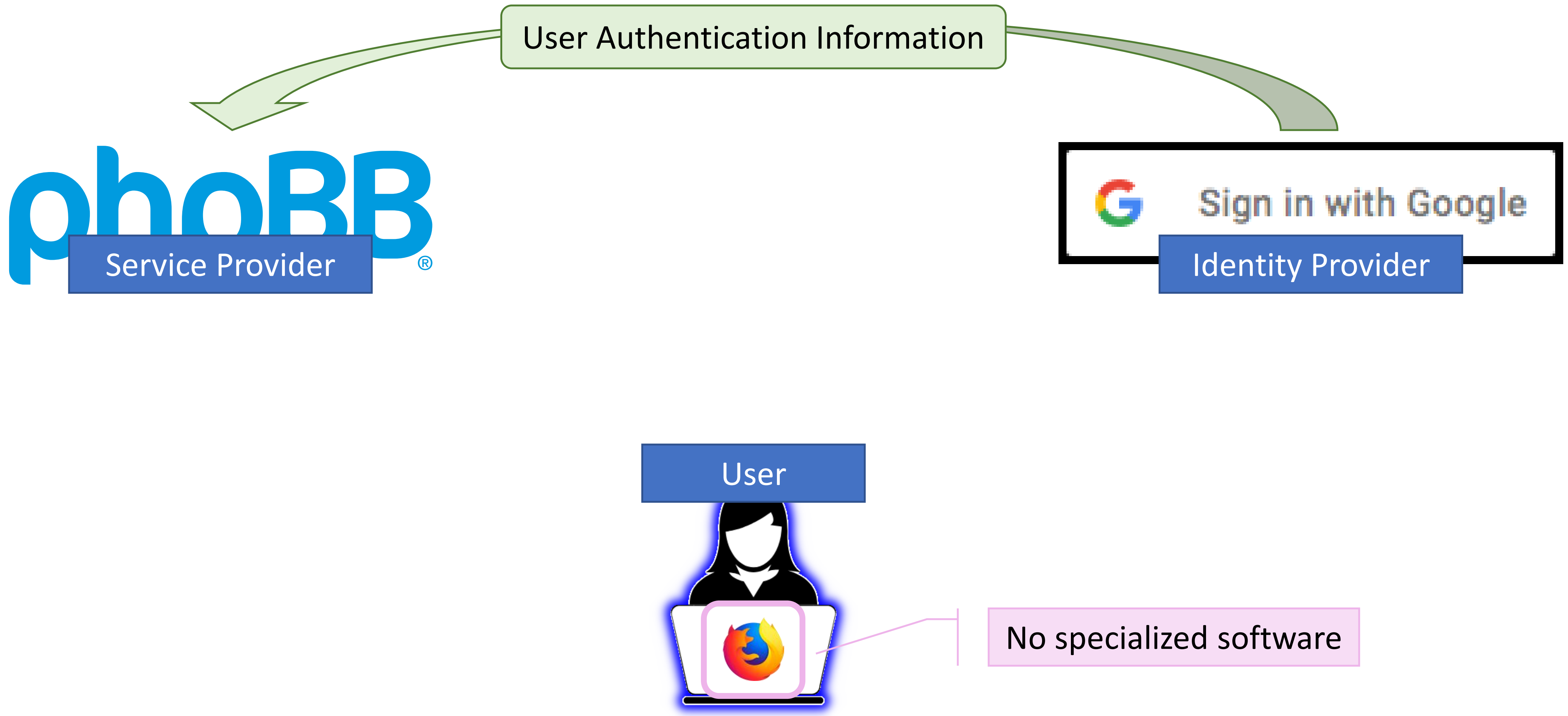
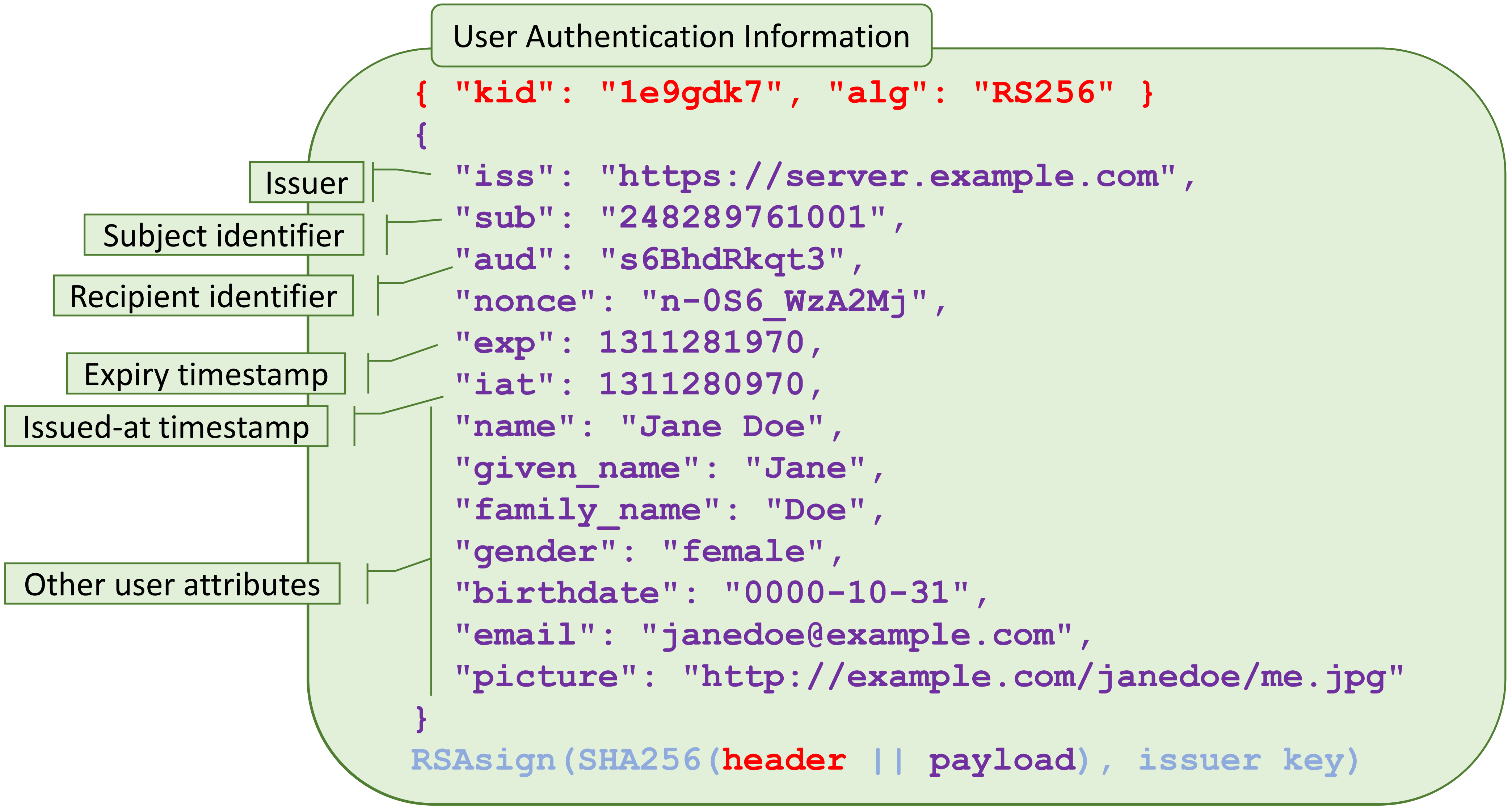
Goals

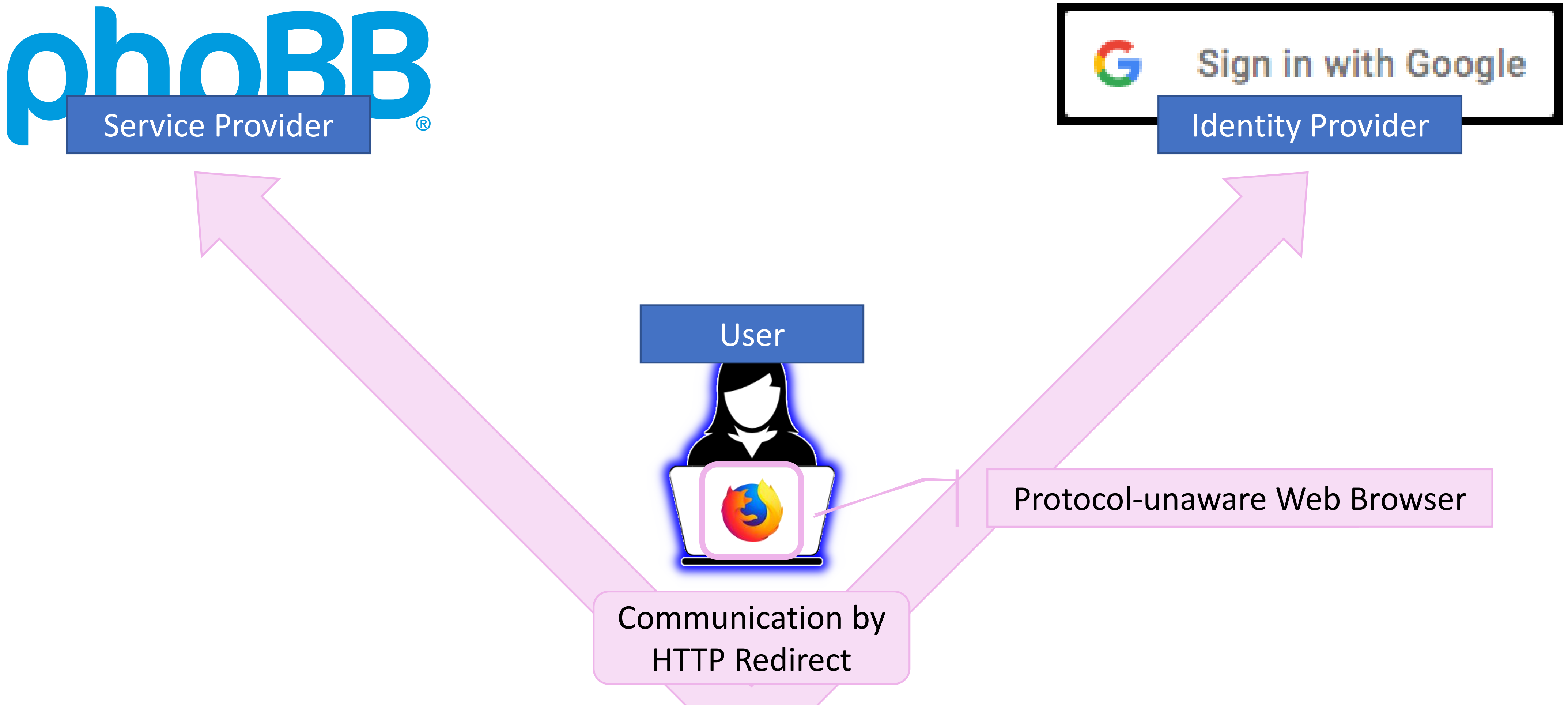

User Authentication Information
phpBB
Service Provider
Sign in with Google
Identity Provider
User
No specialized software

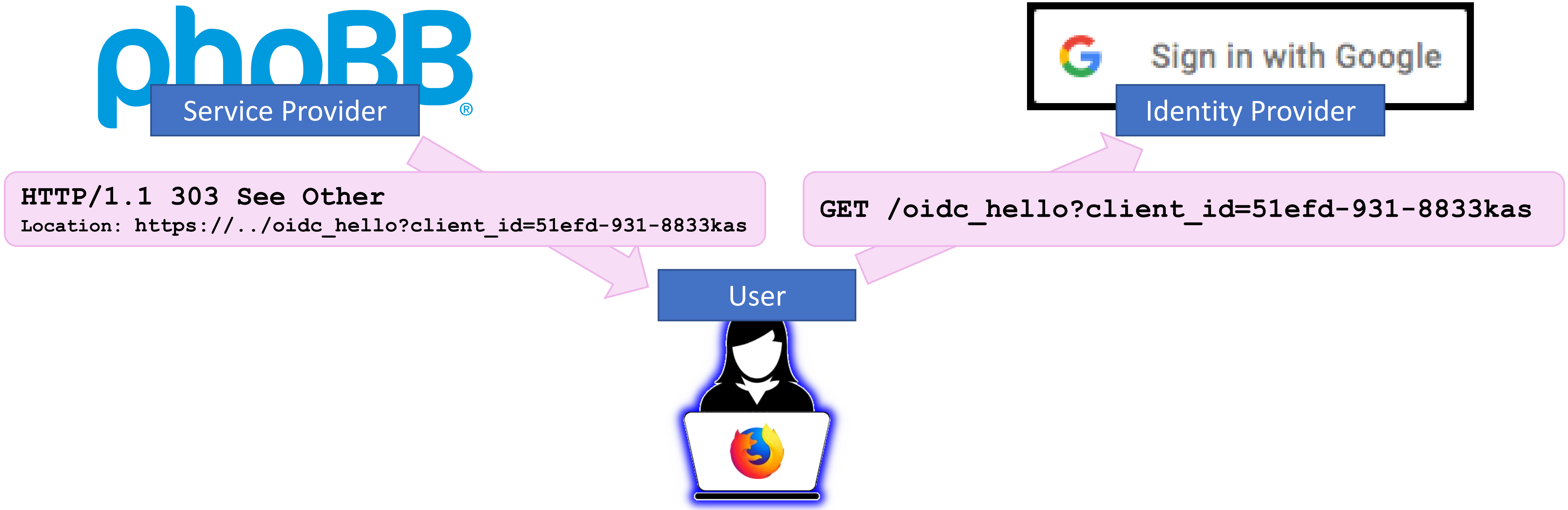
ID Token



```
{ "kid": "1e9gdk7", "alg": "RS256" }
{
  "iss": "https://server.example.com",
  "sub": "248289761001",
  "aud": "s6BhdRkqt3",
  "nonce": "n-0S6_WzA2Mj",
  "exp": 1311281970,
  "iat": 1311280970,
  "name": "Jane Doe",
  "given_name": "Jane",
  "family_name": "Doe",
  "gender": "female",
  "birthdate": "0000-10-31",
  "email": "janedoe@example.com",
  "picture": "http://example.com/janedoe/me.jpg"
}
RSAsign(SHA256(header || payload), issuer key)
```

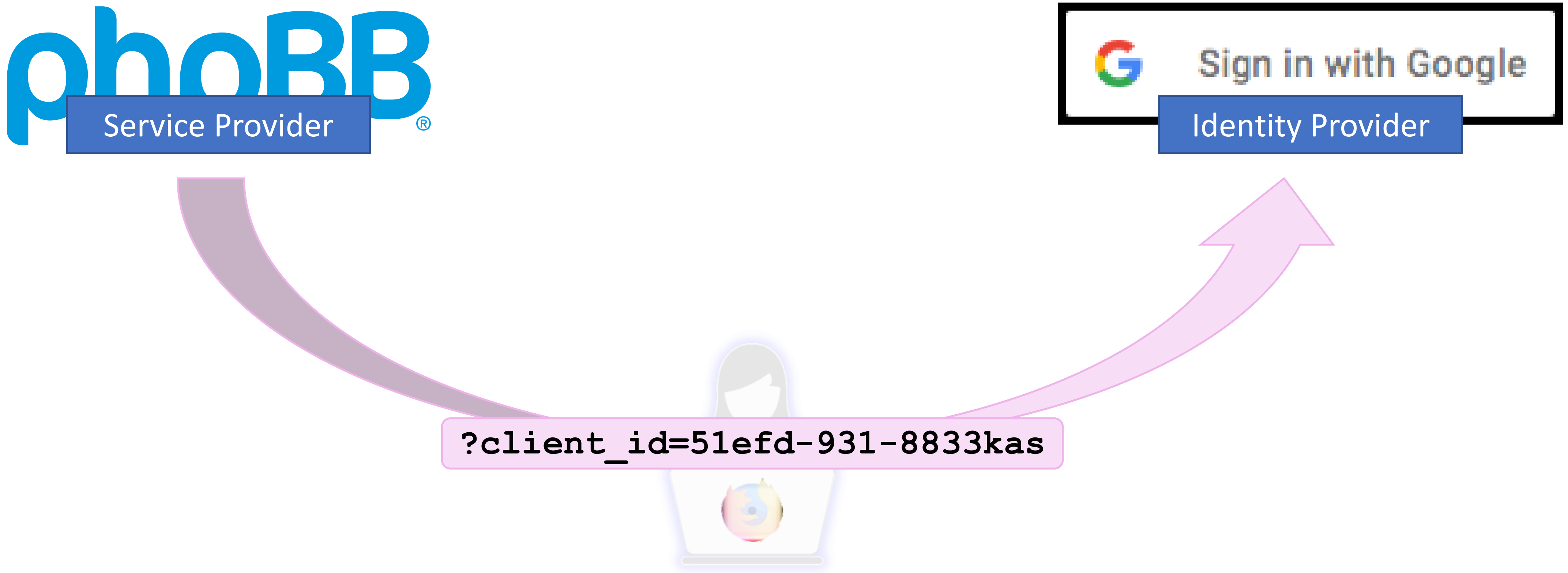
Goals

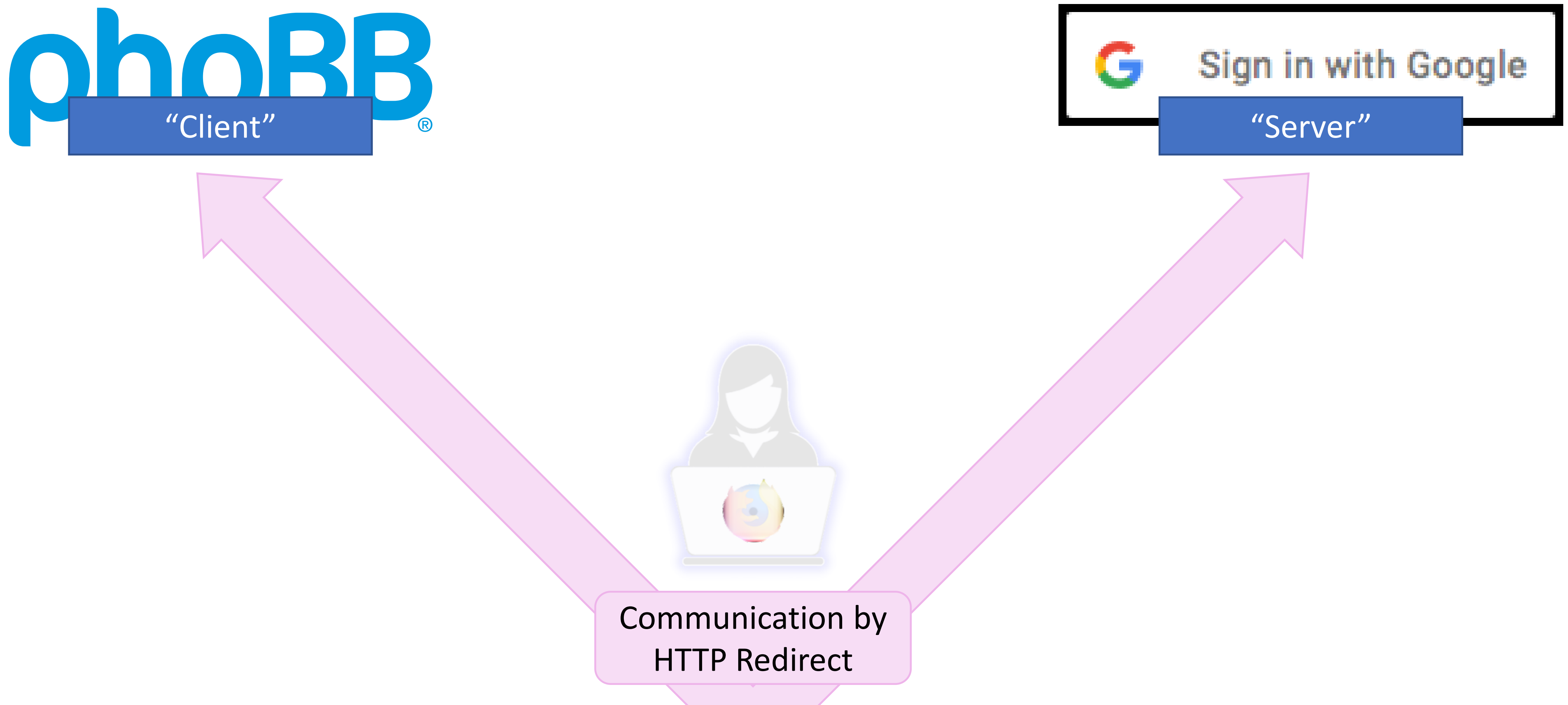

phpBB
Service Provider
Sign in with Google
Identity Provider
User
Protocol-unaware Web Browser
Communication by HTTP Redirect

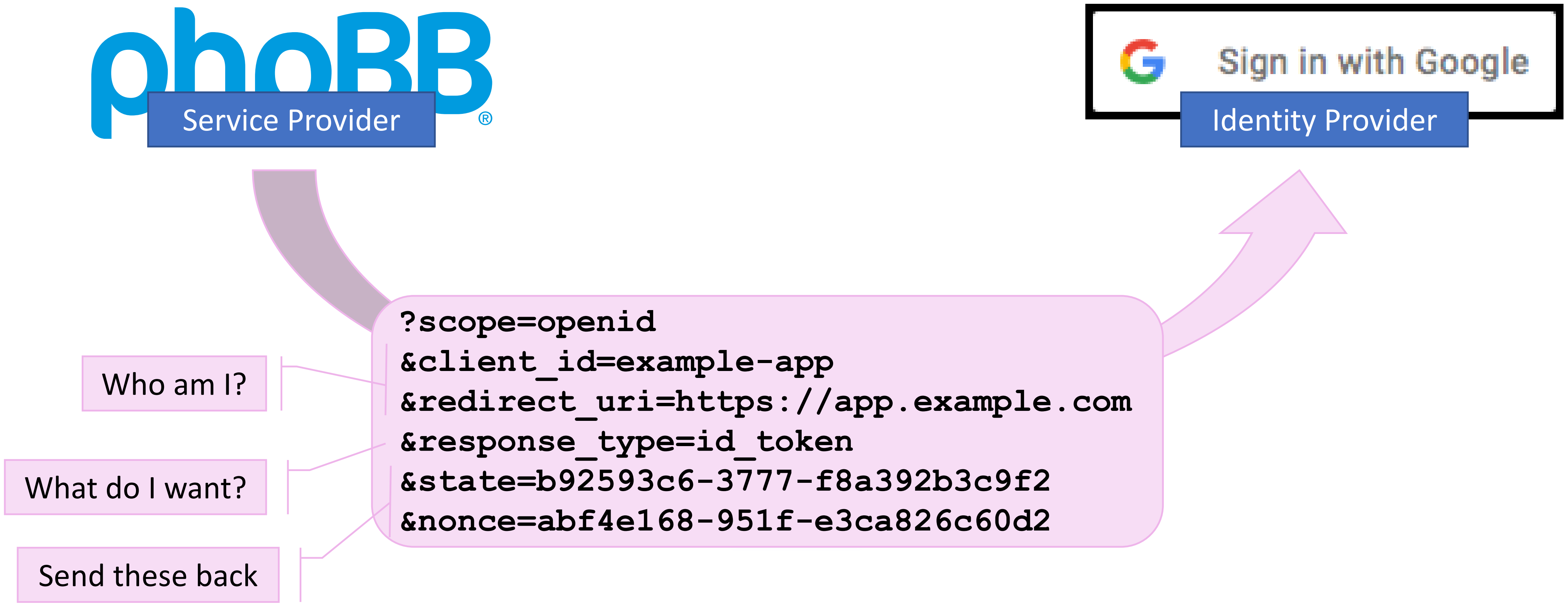


```
HTTP/1.1 303 See Other
Location: https://../oidc_hello?client_id=51efd-931-8833kas
```

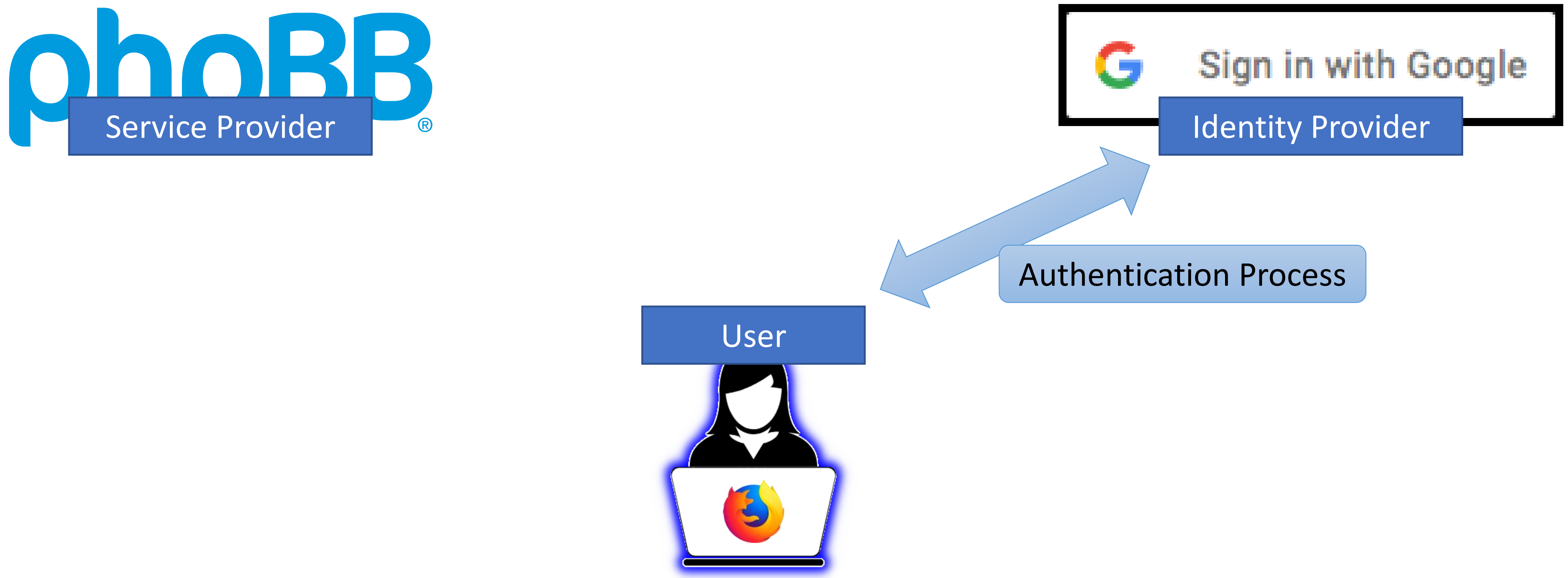
```
GET /oidc_hello?client_id=51efd-931-8833kas
```

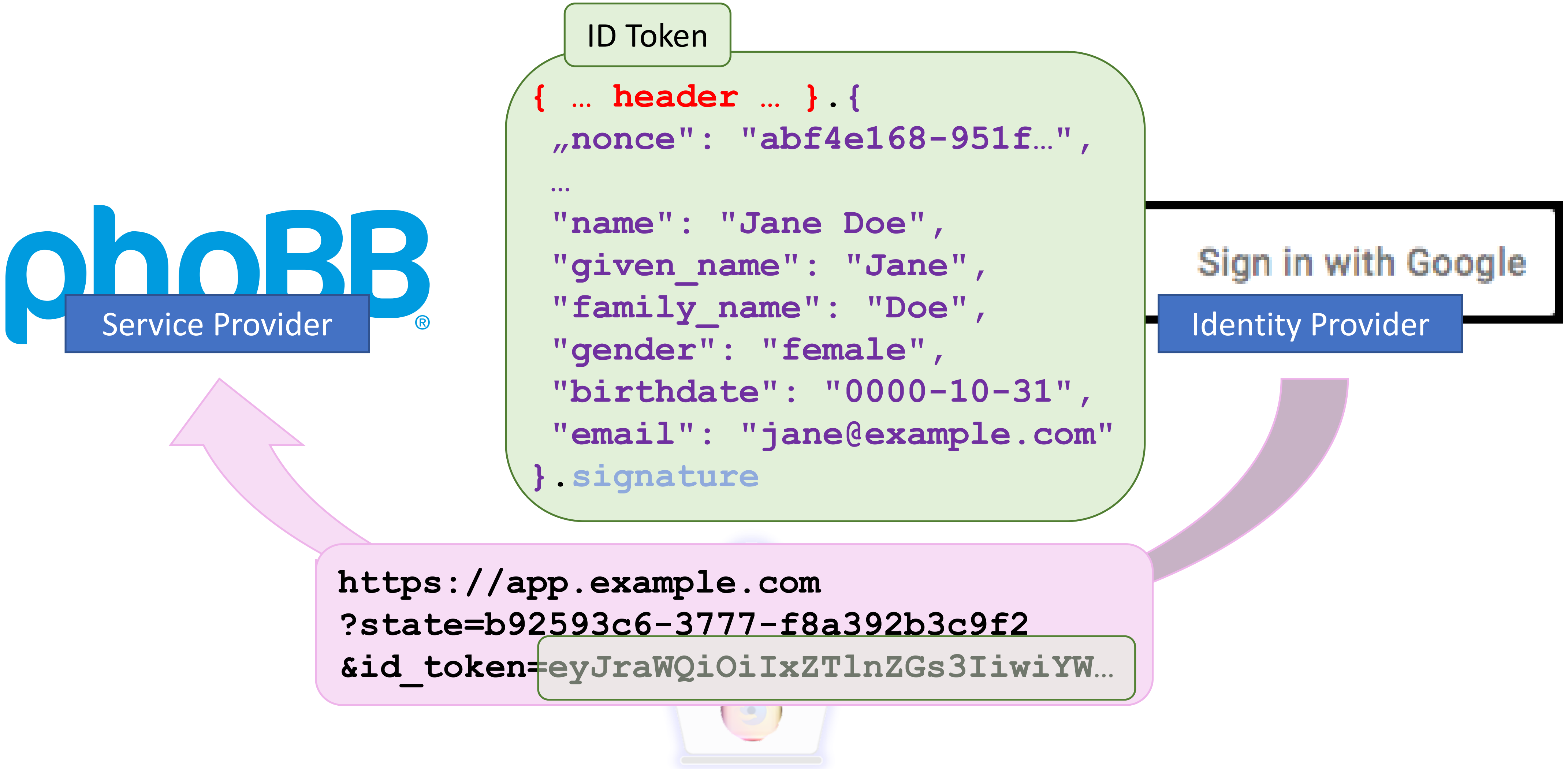

phpBB
Service Provider
Sign in with Google
Identity Provider
?client_id=51efd-931-8833kas


phpBB®
"Client"
Sign in with Google
"Server"
Communication by HTTP Redirect



```
?scope=openid
&client_id=example-app
&redirect_uri=https://app.example.com
&response_type=id_token
&state=b92593c6-3777-f8a392b3c9f2
&nonce=abf4e168-951f-e3ca826c60d2
```


phpBB
Service Provider
Sign in with Google
Identity Provider
Authentication Process
User

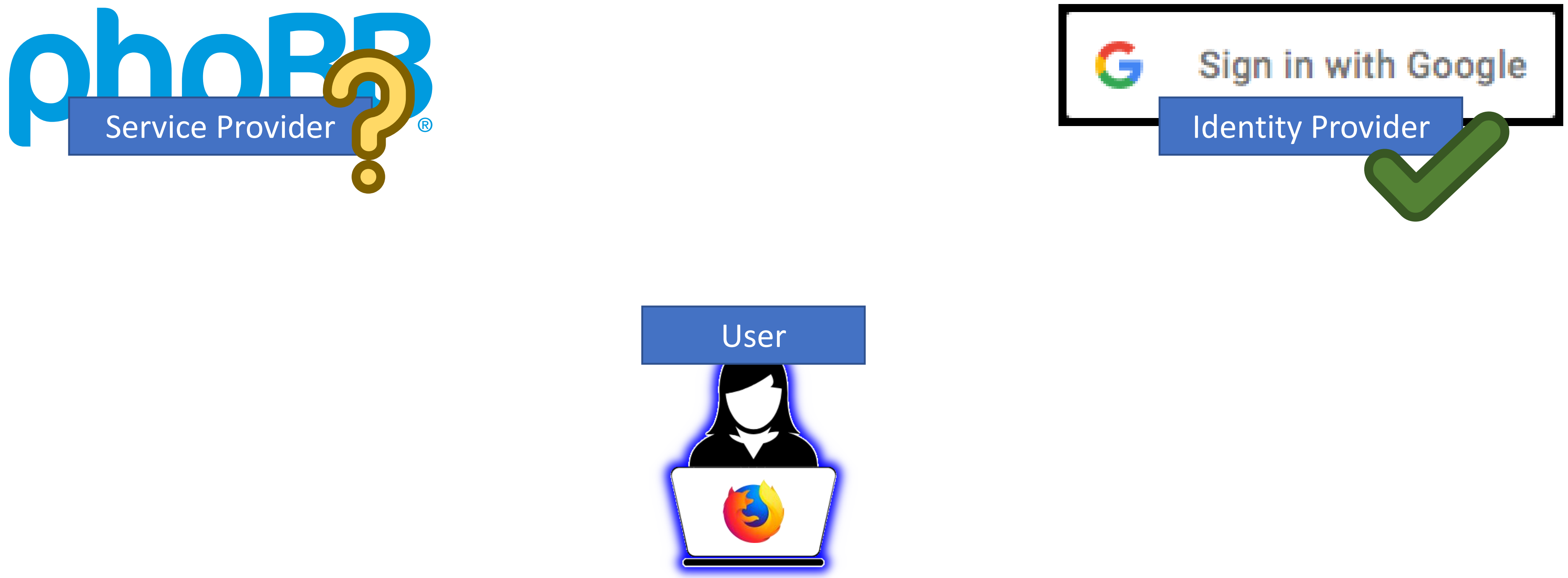


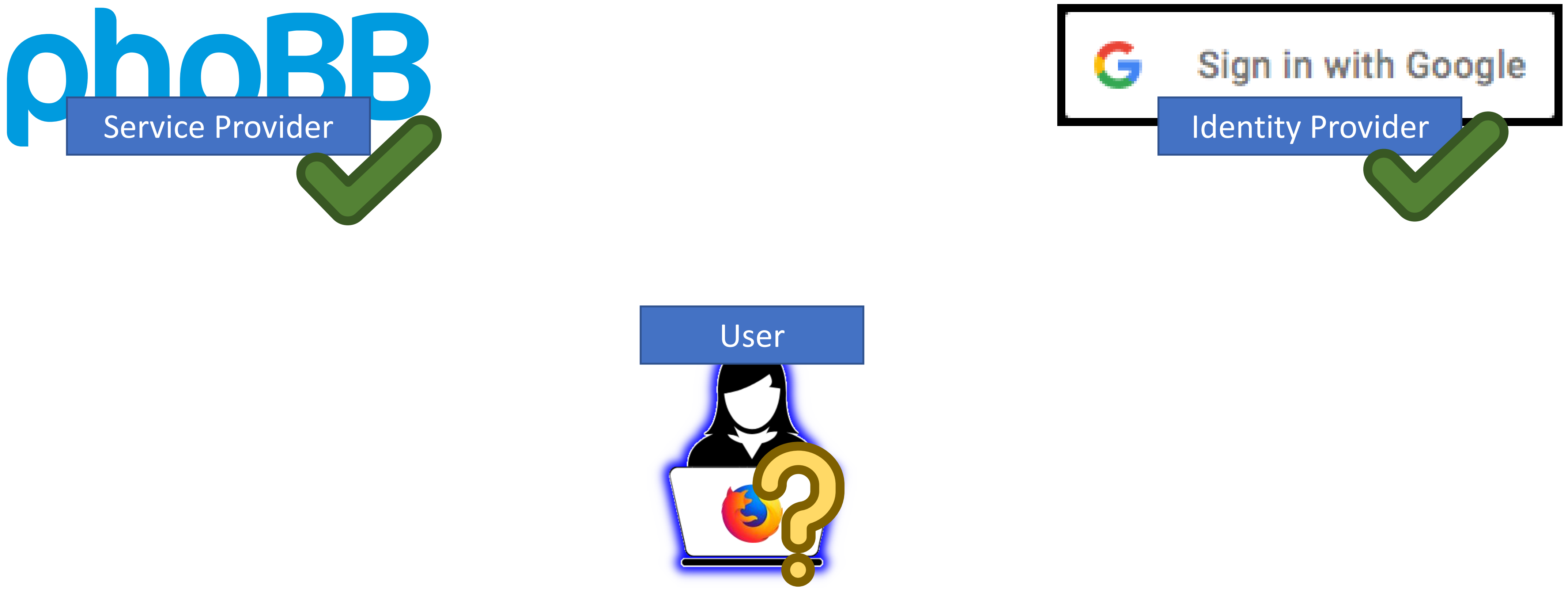
```
{ … header … }.{
 „nonce": "abf4e168-951f…",
 …
 "name": "Jane Doe",
 "given_name": "Jane",
 "family_name": "Doe",
 "gender": "female",
 "birthdate": "0000-10-31",
 "email": "jane@example.com"
}.signature
```

```
https://app.example.com
?state=b92593c6-3777-f8a392b3c9f2
&id_token=eyJraWQiOiIxZTlnZGs3IiwiYW…
```

OpenID Connect: Implicit Flow

- Service Provider redirects to *authorization endpoint* at IdP
- Identity Provider performs authentication
- Identity Provider redirects to *redirect URI* at SP with ID Token

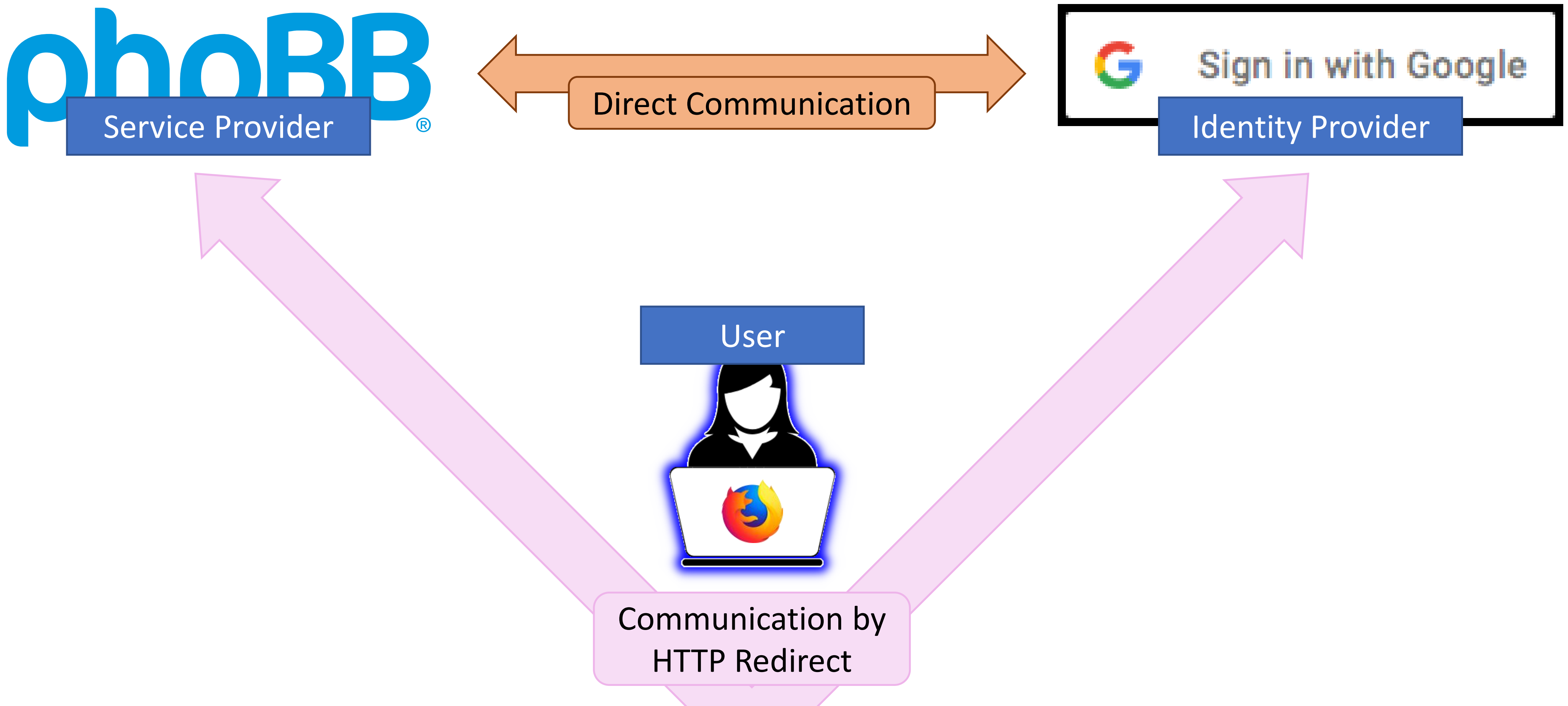

phpBB
Service Provider
Sign in with Google
Identity Provider
User

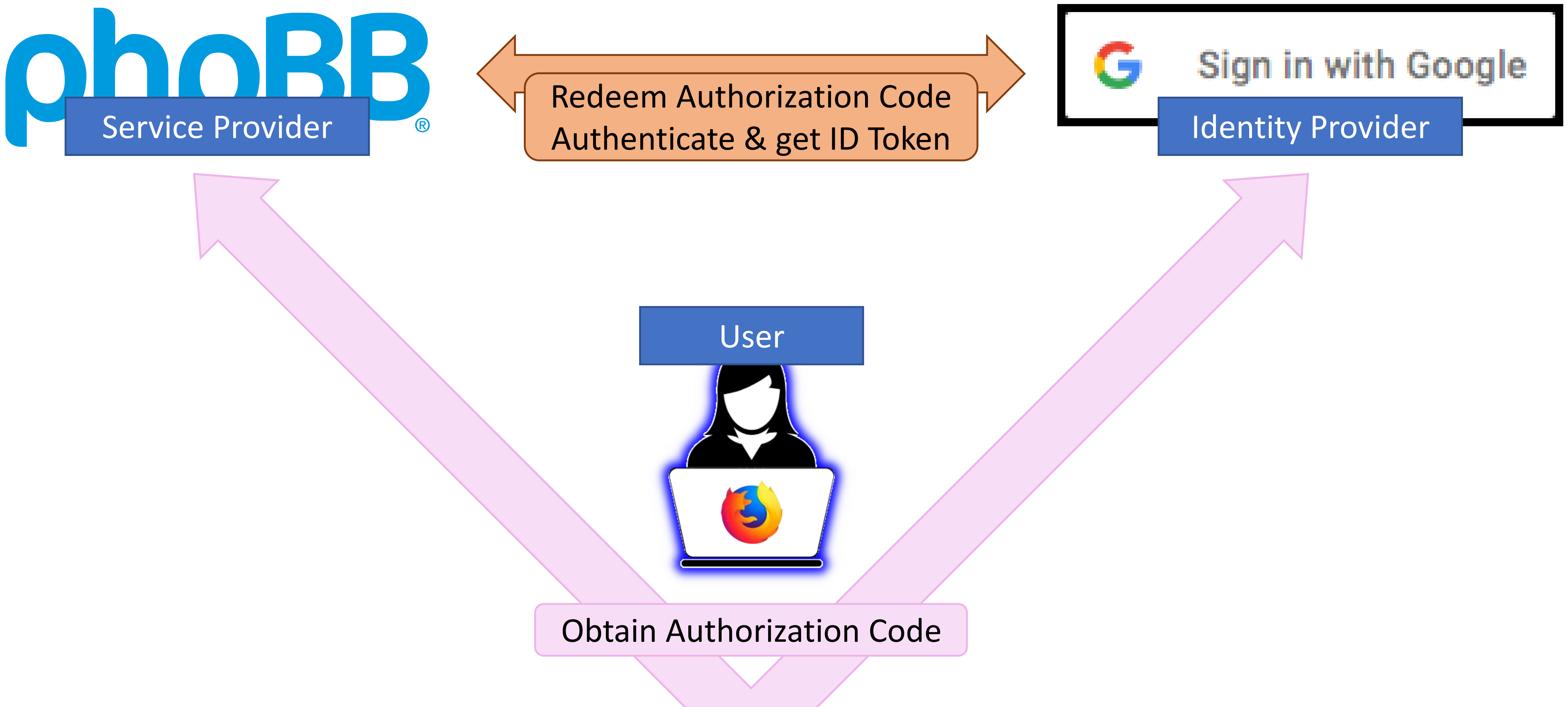

phpBB
Service Provider
Sign in with Google
Identity Provider
User

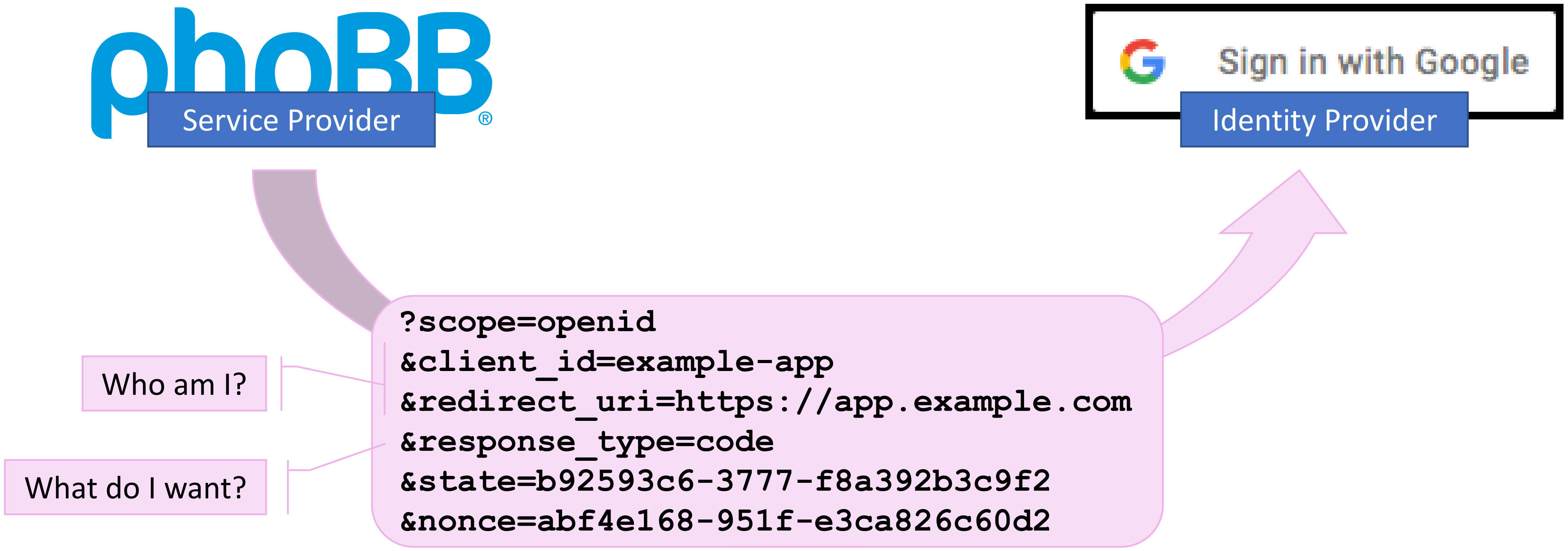
OpenID Connect: Implicit Flow

- Service Provider redirects to *authorization endpoint* at IdP
- Identity Provider performs authentication
- Identity Provider redirects to *redirect URI* at SP with ID Token

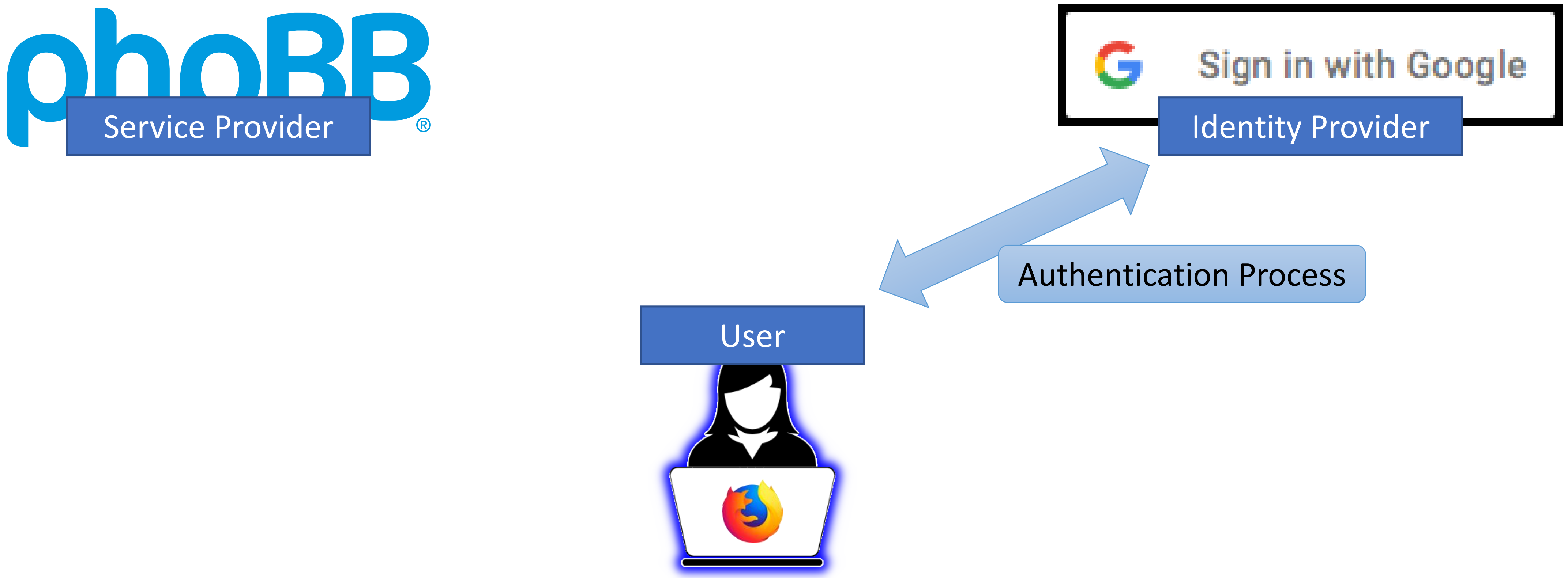
- The ID Token is exposed to the user's browser
  - Malicious extensions might capture it
  - It might be stored in browser history

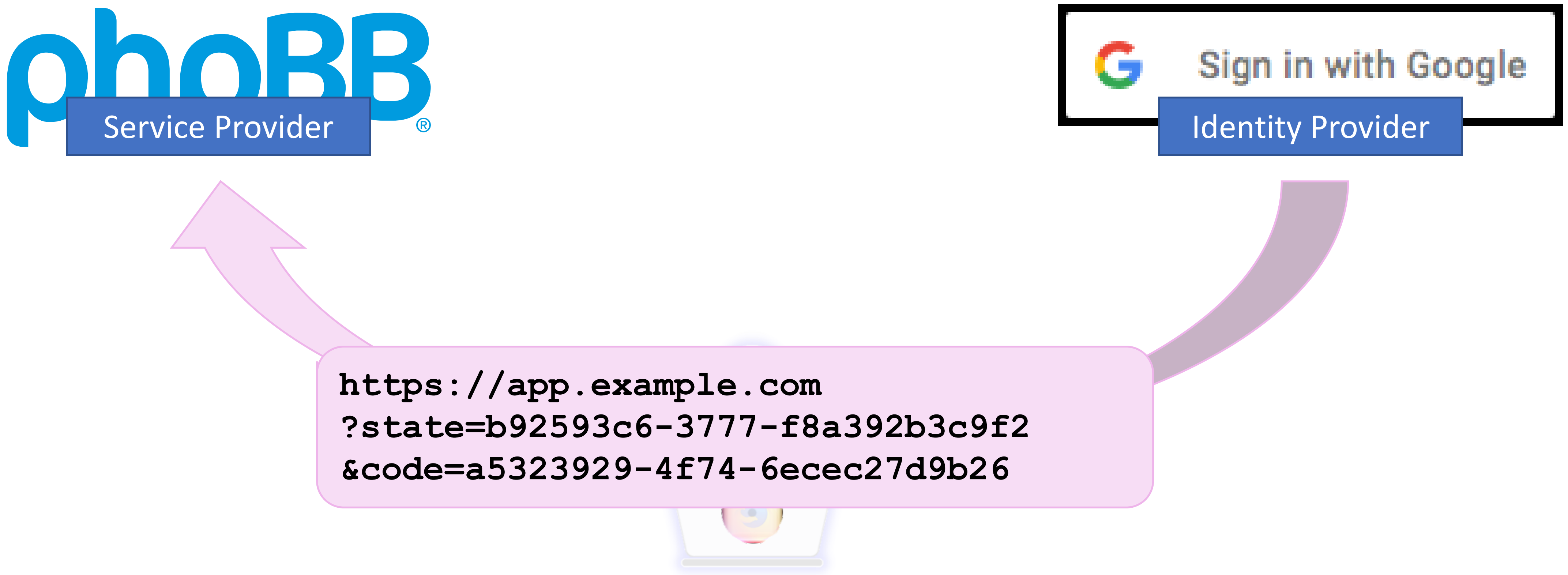

Service Provider
Direct Communication
Sign in with Google
Identity Provider
User
Communication by HTTP Redirect


Service Provider
Redeem Authorization Code
Authenticate & get ID Token
Sign in with Google
Identity Provider
User
Obtain Authorization Code

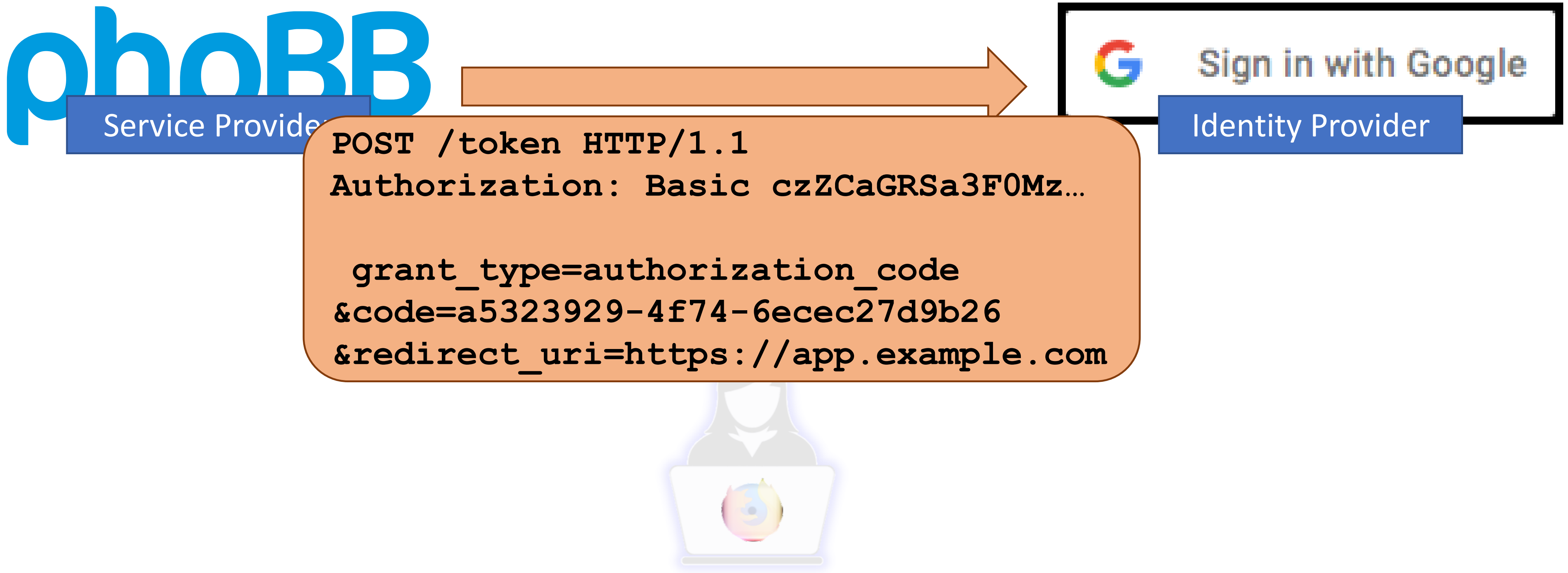


```
?scope=openid
&client_id=example-app
&redirect_uri=https://app.example.com
&response_type=code
&state=b92593c6-3777-f8a392b3c9f2
&nonce=abf4e168-951f-e3ca826c60d2
```


phpBB
Service Provider
Sign in with Google
Identity Provider
Authentication Process
User

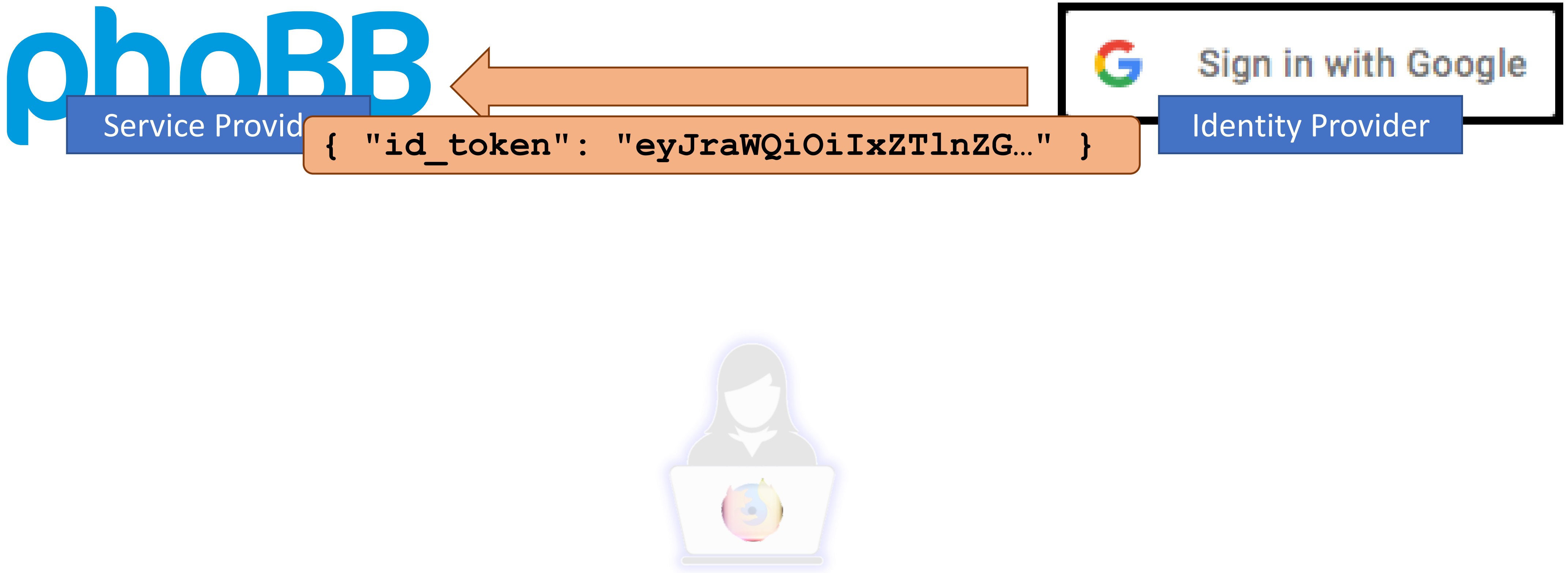


```
https://app.example.com
?state=b92593c6-3777-f8a392b3c9f2
&code=a5323929-4f74-6ecec27d9b26
```



```
POST /token HTTP/1.1
Authorization: Basic czZCaGRSa3F0Mz…

 grant_type=authorization_code
&code=a5323929-4f74-6ecec27d9b26
&redirect_uri=https://app.example.com
```



```
{ "id_token": "eyJraWQiOiIxZTlnZG…" }
```

OpenID Connect: Authorization Code Flow

- Service Provider redirects to *authorization endpoint* at IdP
- Identity Provider performs authentication
- Identity Provider redirects to SP with *authorization code*
- Service Provider redeems authorization code at IdP's *token endpoint*
    - Requires *authorization code* and *SP authentication*

Real-World Demo

Code available: https://extgit.isec.tugraz.at/A-SIT/oidc-ida-research-template

Identifiers & Pseudonyms

- *Re*-Authentication is crucial
  - How do we tell if two logins are the same person?
- Re-Authentication implies *Linkability*!
- Does every SP need the same identifier?

ID Token

```
{
 "sub": "248289761001",
 …
 "name": "Jane Doe",
 "given_name": "Jane",
 "family_name": "Doe",
 "gender": "female",
 "birthdate": "0000-10-31",
 "email": "jane@example.com"
}
```

Pairwise Pseudonyms

- Idea: different pseudonym for each service
  - Example: **`H(user secret || service provider ID)`**
  - We can still re-authenticate to the same service
  - Different services don’t know we’re the same person

- Each IdP-”user” can only have one identity at a given SP
  - Is this desirable?

Secure Application Design

FedCM: Delegated Authentication in the Future?

Summer 2025

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he/his

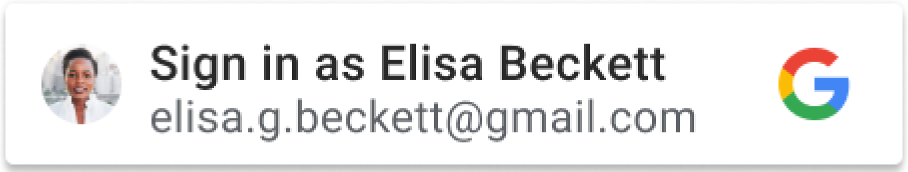
What is a third-party component?

- Component requested from a web origin that is *not* the current origin
  - Images, fonts, script files, iframes, …
- These requests trigger HTTP GET requests
  - These requests can include cookies!
- These *third-party cookies* are a powerful tracking tool
  - They allow correlating user movement across the web (e.g., “Facebook pixel”)

Why does this matter for OpenID Connect?

- For the traditional flow, it doesn't!
  - OIDC uses full-page redirects

- It matters for certain implementations…



Sign in as Elisa Beckett
elisa.g.beckett@gmail.com

  - … which are based on **`<iframe>`** s

Federated Credential Management API

- The browser is now protocol-aware!

- Here's the rough idea:
  1. The browser gets a list of logged-in accounts from the IdP
     - No reference to the requesting service provider is included
  2. The user chooses an account for log-in using browser-provided UX
     - If the user stops, the IdP never learns the requesting service provider
  3. The browser requests an ID token for the account and SP from the IdP
     - The ID token is conceptually the same as in OIDC

Demo available in Chrome: https://fedcm-rp-demo.glitch.me/

FedCM – The Future?

- Current standard only works for a specific use case
- Privacy challenges from OIDC remain unsolved
- … do we really need this?

- Browser becoming protocol-aware has great potential!
  - … if only it were used

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