ABSICHERUNG VON MICROSERVICES MIT OPENID CONNECT UND SPRING SECURITY 5

JAX, Mainz 7.5.2019

Slides: https://andifalk.github.io/jax-2019-openid-connect-spring-security
Demos: https://github.com/andifalk/jax-2019-openid-connect-spring-security

ANDREAS FALK

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NOVATEC

AGENDA

Intro to OAuth 2.0 & OpenID Connect 1.0

Current Discussions & Best Practices in OAuth 2.0/OIDC

OAuth 2 & OIDC with Spring Security 5 (Live Demo)

OAUTH 2.0

101

RFC 6749: The OAuth 2.0 Authorization Framework

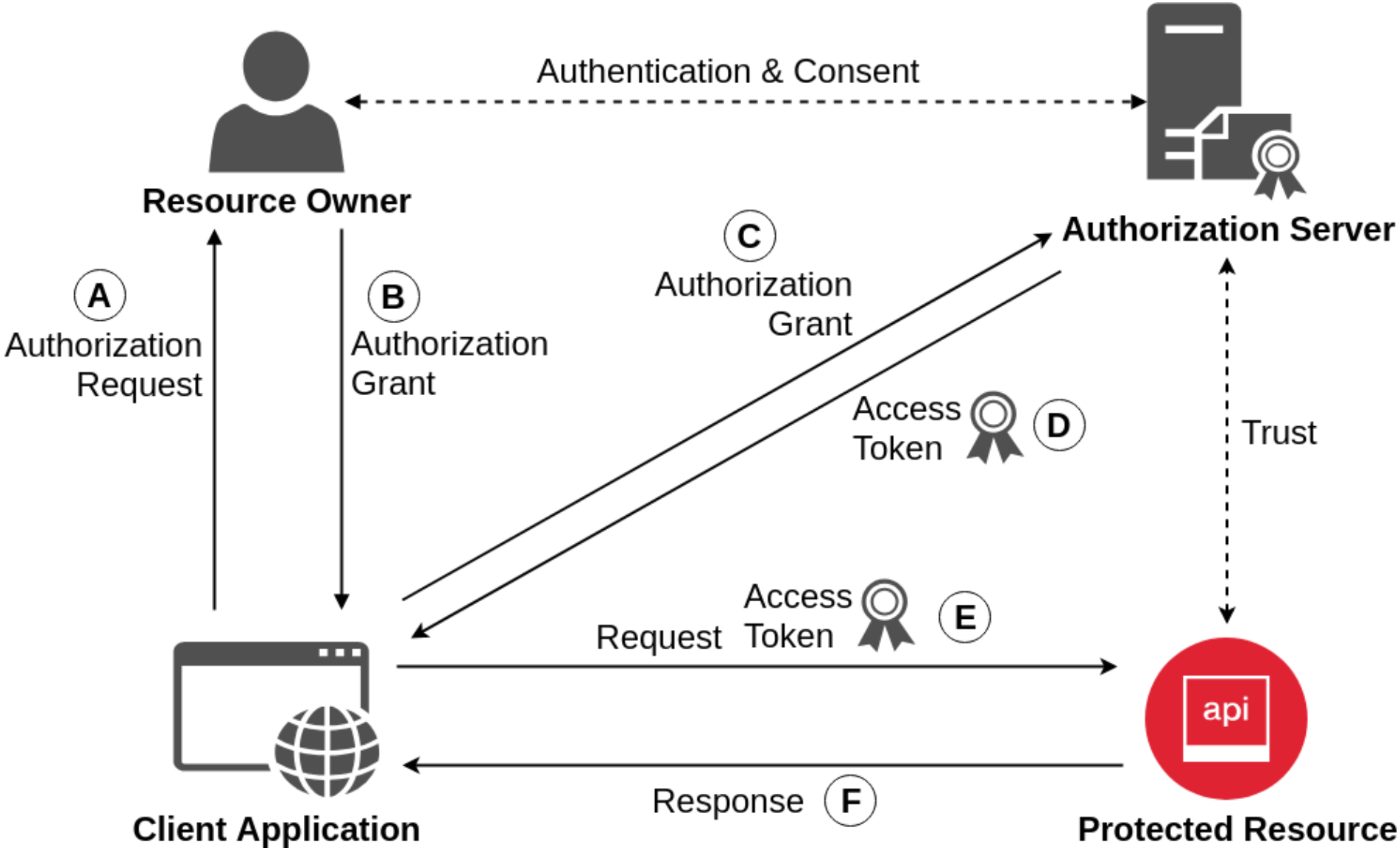
RFC 6750: OAuth 2.0 Bearer Token Usage

RFC 6819: OAuth 2.0 Threat Model and Security Considerations

WHAT IS OAUTH 2.0?

OAuth 2.0 is an authorization delegation framework

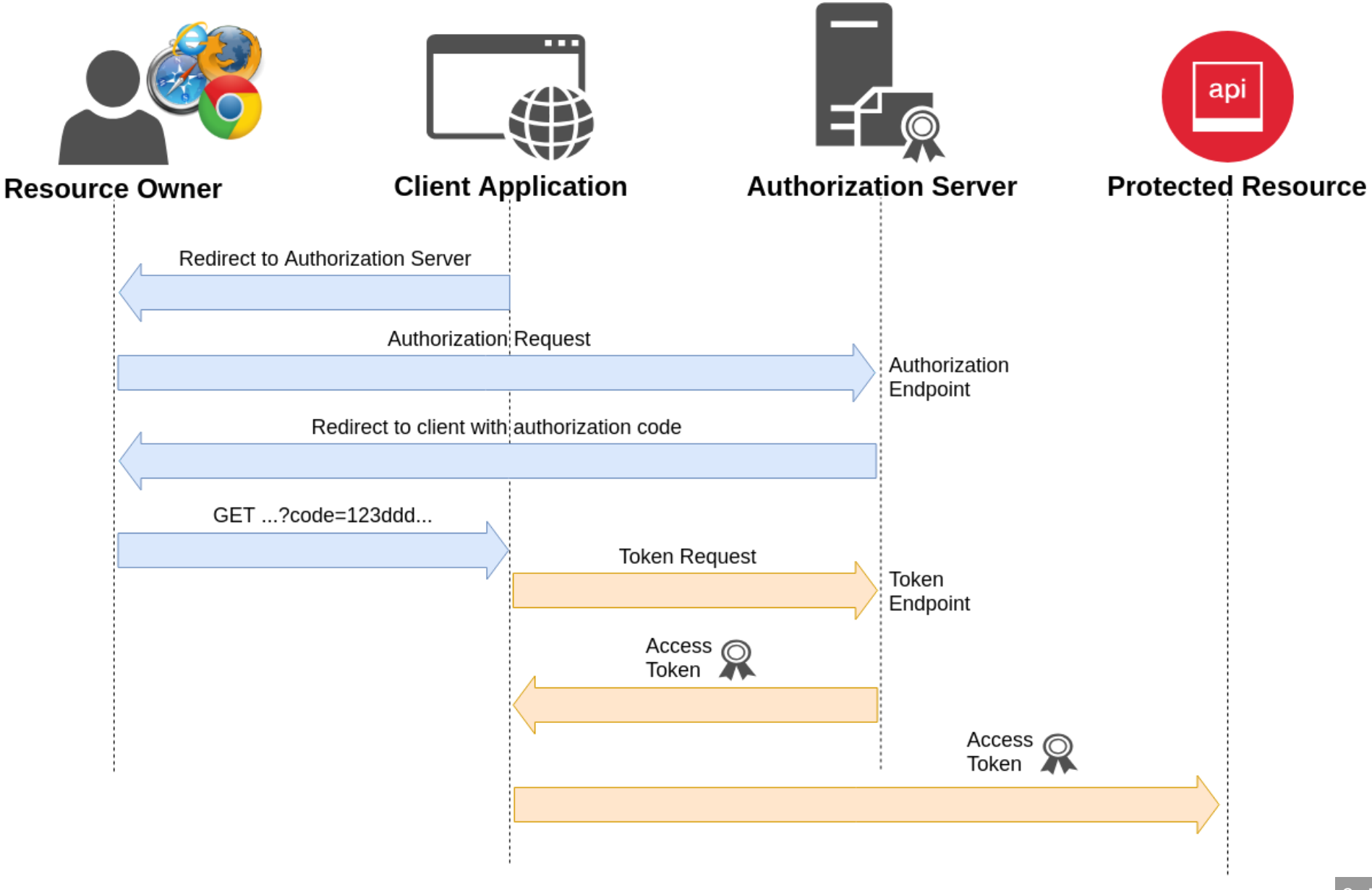
OAUTH 2.0 MODEL



OAUTH 2.0 GRANT FLOWS

Client Type	Flow	Refresh Tokens
Confidential	Authorization Code	X
Public (Native)	Authorization Code (PKCE)	X
Public (SPA)	Implicit	--
Trusted	RO Password Creds	X
No Resource Owner	Client Credentials	--

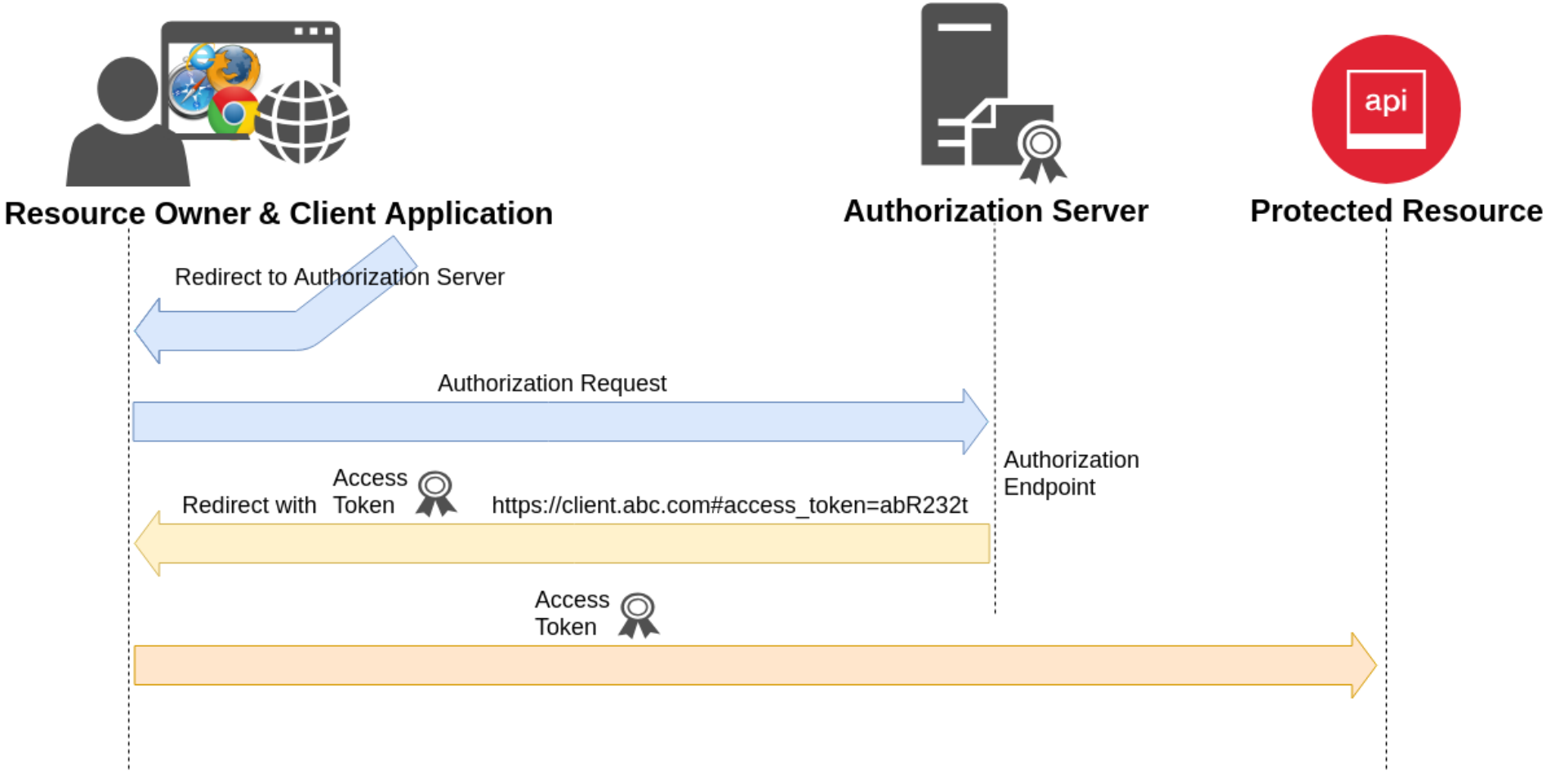
AUTHORIZATION CODE GRANT FLOW



DEMO TIME

AUTHORIZATION CODE GRANT FLOW IN ACTION

IMPLICIT GRANT FLOW



AUTHORIZATION REQUEST

GET https://authserver.example.com/authorize

?response_type=token

&client_id=abcdefg

&redirect_uri=https://client.abc.com/callback

&scope=api.read api.write

&state=xyz

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&redirect_uri=https://client.abc.com/callback

&scope=api.read api.write

&state=xyz

AUTHORIZATION RESPONSE

HTTP/1.1 302 Found

Location: https://client.abc.com/callback

#access_token=2YotnFZFEjr1zCsicMWpAA

&token_type=bearer

&expires_in=3600

&scope=api.read api.write

&state=xyz

AUTHORIZATION RESPONSE

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Location: https://client.abc.com/callback

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OPENID CONNECT 1.0

(OIDC)

101

OpenID Connect Core 1.0
OpenID Connect Dynamic Client Registration 1.0
OpenID Connect Discovery 1.0

OPENID CONNECT 1.0 IS FOR AUTHENTICATION

Jim Manico
@manicode

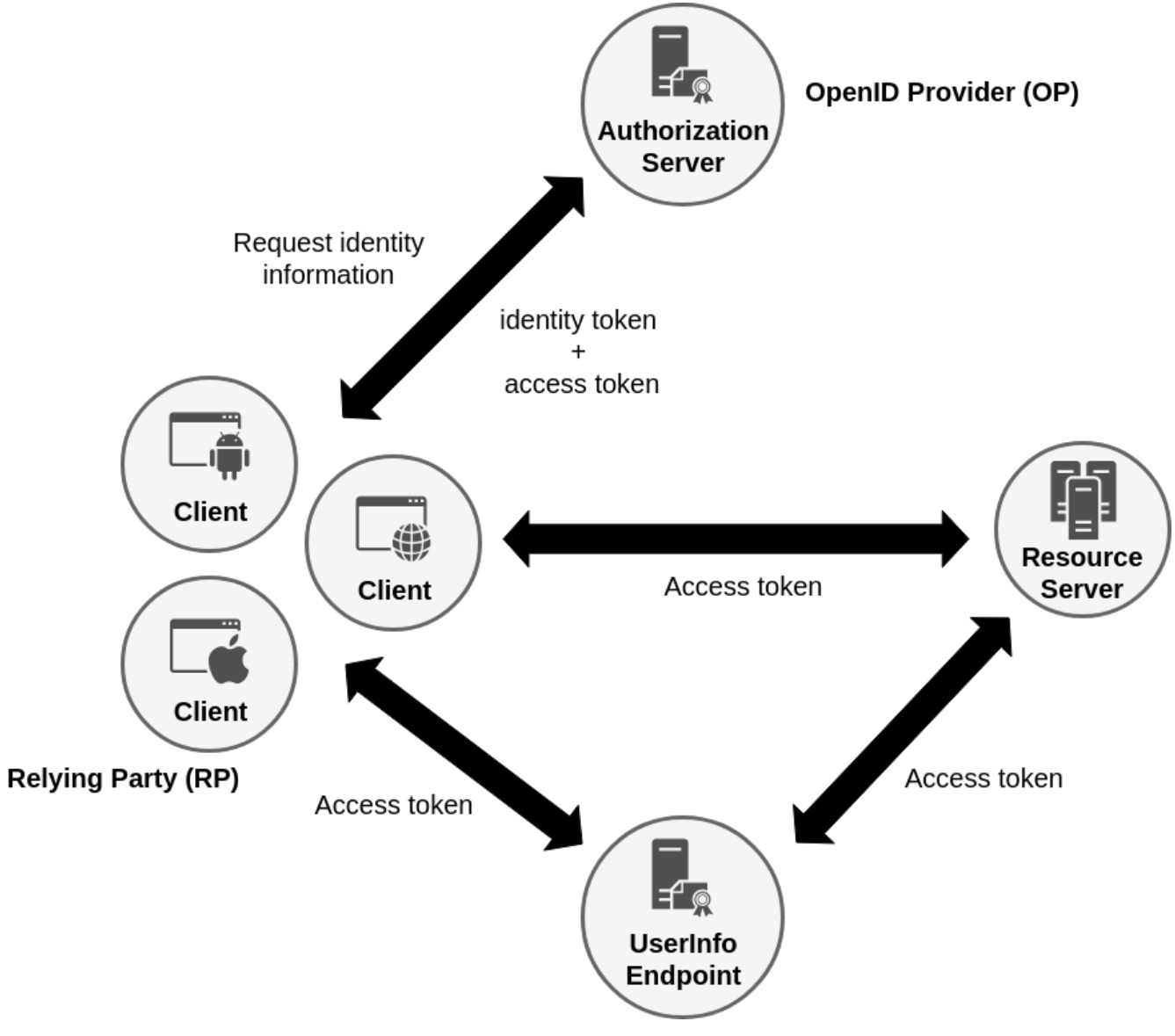
Follow

Repeat after me: OAuth 2.0 is NOT AN AUTHENTICATION PROTOCOL.
oauth.net/articles/authe …

12:22 PM - 2 Feb 2017 from Kapaa, HI

OAuth 2.0 is not an authentication protocol

OIDC MODEL


Authorization Server
OpenID Provider (OP)
Request identity information
identity token + access token
Client
Client
Client
Relying Party (RP)
Resource Server
Access token
Access token
Access token
UserInfo Endpoint

ADDITIONS TO OAUTH 2.0

Id Token (JWT format)

User Info Endpoint

Standard Scopes

Hybrid Grant Flow

OpenID Provider Configuration Information

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OpenID Provider Configuration Information

ID TOKEN

JSON WEB TOKEN (JWT)

Base 64 Encoded JSON Formatted Value of...

```
GET / HTTP/1.1
Host: localhost:8080
Authorization: Bearer eyJ0eXAiOiJKV1QiLCJhbGciOiJSUzI1N...
```

- RFC 7519: JSON Web Token (JWT)
- JSON Web Token Best Current Practices
- Proof-of-Possession Key Semantics for JSON Web Tokens (JWTs)

ID TOKEN

JSON WEB TOKEN (JWT)

Base 64 Encoded JSON Formatted Value of...

...Header

```
GET / HTTP/1.1
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Authorization: Bearer eyJ0eXAiOiJKV1QiLCJhbGciOiJSUzI1N...
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JSON WEB TOKEN (JWT)

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ID TOKEN

JSON WEB TOKEN (JWT)

Base 64 Encoded JSON Formatted Value of...

...Header

...Payload

...Signature

```
GET / HTTP/1.1
Host: localhost:8080
Authorization: Bearer eyJ0eXAiOiJKV1QiLCJhbGciOiJSUzI1N...
```

- RFC 7519: JSON Web Token (JWT)
- JSON Web Token Best Current Practices
- Proof-of-Possession Key Semantics for JSON Web Tokens (JWTs)

JSON WEB TOKEN (JWT)

Header

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

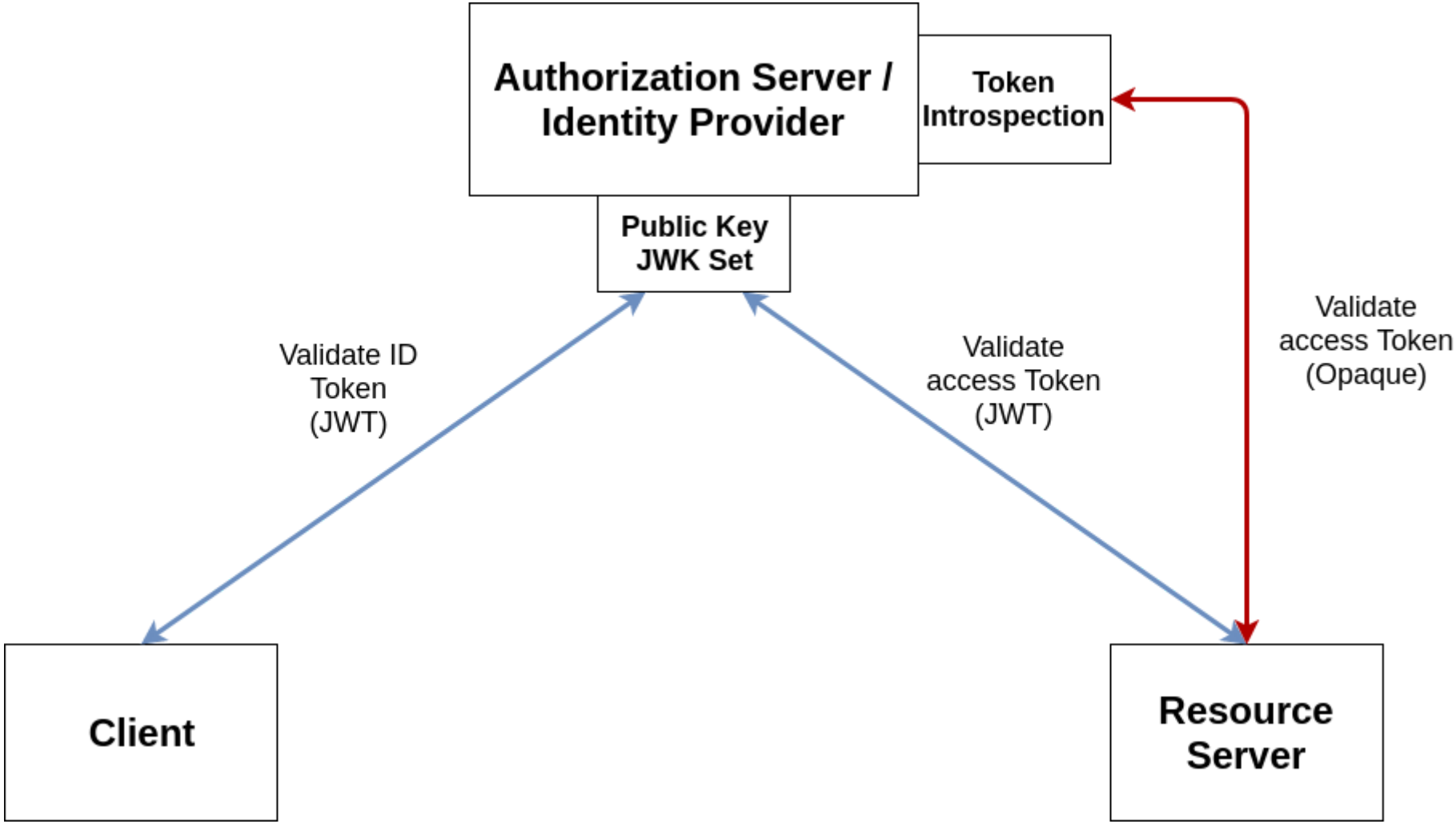
Payload

```
{
  iss: "https://identity.example.com",
  aud: "my-client-id",
  exp: 1495782385,
  nonce: "N0.468248572432335114957391247 49",
  iat: 1495739185,
  at_hash: "hC1NDSB8WZ9SnjXTid175A",
  sub: "mysubject",
  auth_time: 1495739185,
  email: "test@gmail.com"
}
```

ID TOKEN CLAIMS

Scope	Required	Description
iss	X	Issuer Identifier
sub	X	Subject Identifier
aud	X	Audience(s) of this ID Token
exp	X	Expiration time
iat	X	Time at which the JWT was issued
auth_time	(X)	Time of End-User authentication
nonce	--	Associate a client with an ID Token

TOKEN VALIDATION



USER INFO ENDPOINT

```
GET /userinfo HTTP/1.1
Host: identityserver.example.com
Authorization: Bearer SlAV32hkKG
```

```
HTTP/1.1 200 OK
Content-Type: application/json

{
 "sub": "248289761001",
 "name": "Jane Doe",
 "given_name": "Jane",
 "family_name": "Doe",
 "preferred_username": "j.doe",
 "email": "janedoe@example.com",
 "picture": "http://example.com/janedoe/me.jpg"
}
```

OPENID CONNECT 1.0 CONFIGURATION

https://example.com/.well-known/openid-configuration

```
{
  "authorization_endpoint": "https://idp.example.com/auth",
  "grant_types_supported": [
      "authorization_code",
      "implicit",
      "refresh_token"
  ],
  "issuer": "https://idp.example.com",
  "jwks_uri": "https://idp.example.com/keys",
  "token_endpoint": "https://idp.example.com/token",
  "userinfo_endpoint": "https://idp.example.com/userinfo",
  ...
}
```

OpenID Connect Discovery 1.0

DISCUSSIONS & BEST PRACTICES IN OAUTH 2.0 AND OPENID CONNECT

4TH OAUTH SECURITY WORKSHOP 2019

Stuttgart

https://sec.uni-stuttgart.de/events/osw2019

Why you should stop using the OAuth implicit grant!

Torsten Lodderstedt Follow

Nov 9, 2018 · 3 min read

No one should any longer use the implicit grant! That's what IETF's OAuth working group, the authority for official OAuth specifications, recommends in the upcoming OAuth 2.0 Security Best Current Practice RFC. The decision was met during the IETF meeting this week in Bangkok.

https://medium.com/oauth-2/why-you-should-stop-using-the-oauth-implicit-grant-2436ced1c926

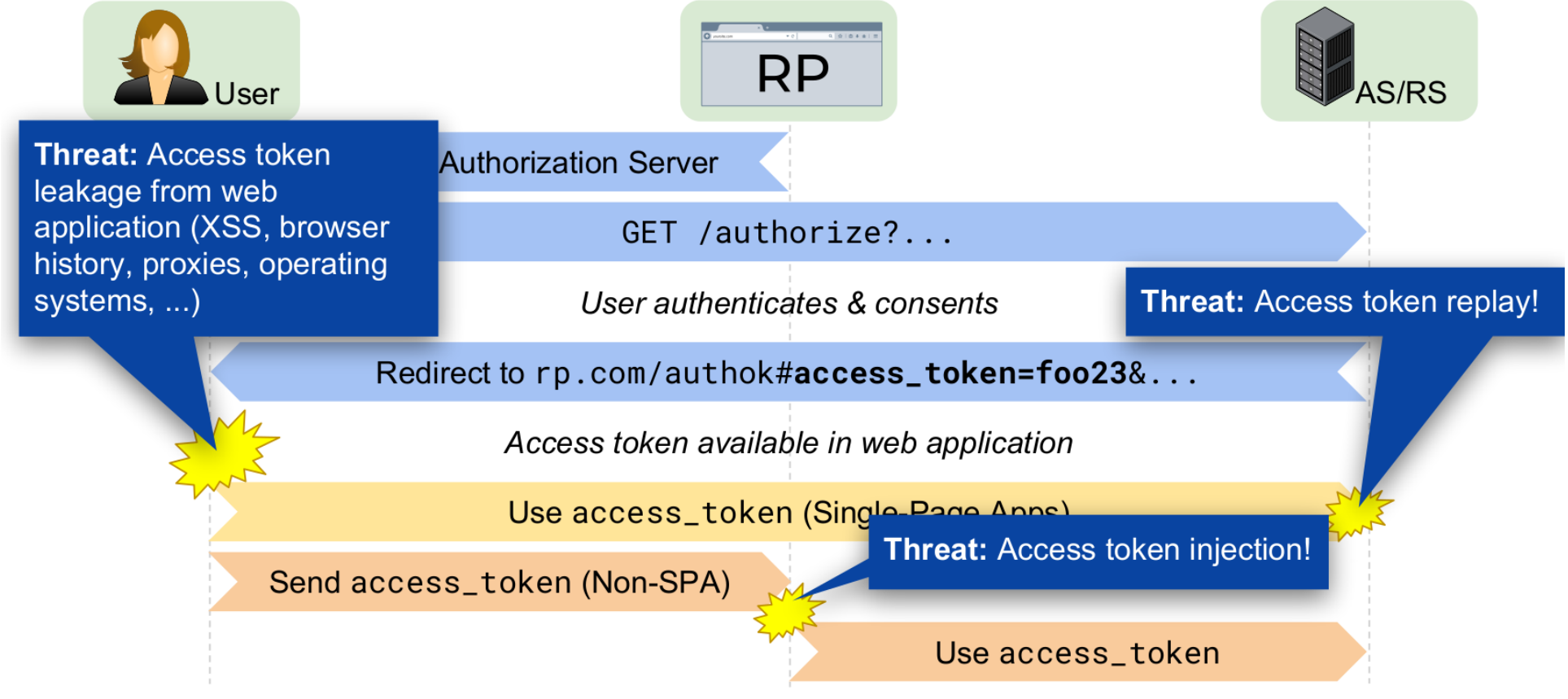
OAUTH 2.0 SECURITY BEST CURRENT PRACTICE

Torsten Lodderstedt and Daniel Fett

OAuth 2.0 Security Best Current Practice

IMPLICIT FLOW ATTACKS

Don’t use the OAuth Implicit Grant any longer!



Source: Torsten Lodderstedt and Daniel Fett

OAUTH 2.0 FOR BROWSER-BASED APPS

David Waite (PingFederate)

OAuth 2.0 for Browser-Based Apps

OAUTH 2.0 FOR BROWSER-BASED APPS

Content-Security Policy

Use a unique redirect URI

Do NOT use refresh tokens

OAuth 2.0 for Browser-Based Apps

OTHER KNOWN OAUTH 2.0 ATTACKS

- Lack of CSRF protection
- Authorization code leakage and replay
- Authorization code injection
- Open Re-directors
- State leakage and replay
- Insufficient Redirect URI matching
- Too powerful access tokens
- Mix-Up Attacks

OPEN REDIRECT !!

RELEASES

CVE-2019-3778: Spring Security OAuth 2.3.5, 2.2.4, 2.1.4, 2.0.17 Released

RELEASES  JOE GRANDJA FEBRUARY 21, 2019 0 COMMENTS

We have released Spring Security OAuth 2.3.5, 2.2.4, 2.1.4 and 2.0.17 to address CVE-2019-3778: Open Redirector in spring-security-oauth2. Please review the information in the CVE report and upgrade immediately.

“OAUTH 2.1” GRANT FLOWS

Client Type	Flow	Refresh Tokens
Confidential	**Authorization Code (PKCE)**	X
Public (Native)	Authorization Code (PKCE)	X
Public (SPA)	**Authorization Code (PKCE)**	--
~~Trusted~~	~~RO Password Creds~~	~~X~~
No Resource Owner	Client Credentials	--

PROOF KEY FOR CODE EXCHANGE BY OAUTH PUBLIC CLIENTS (PKCE)

("Pixy")

Mitigates authorization code attacks

Mitigates token leakage in SPAs

Proof Key for Code Exchange by OAuth Public Clients

PKCE - AUTHORIZATION REQUEST

GET https://authserver.example.com/authorize

?response_type=code

&client_id=abcdefg

&redirect_uri=https://client.abc.com/callback

&scope=api.read api.write

&state=xyz

&code_challenge=xyz...&code_challenge_method=

PKCE - TOKEN REQUEST

Client-Id=123, Client-Secret=456

POST https://authserver.example.com/token

Content-Type:
application/x-www-form-urlencoded

grant_type=authorization_code&code=ab23bhW56X

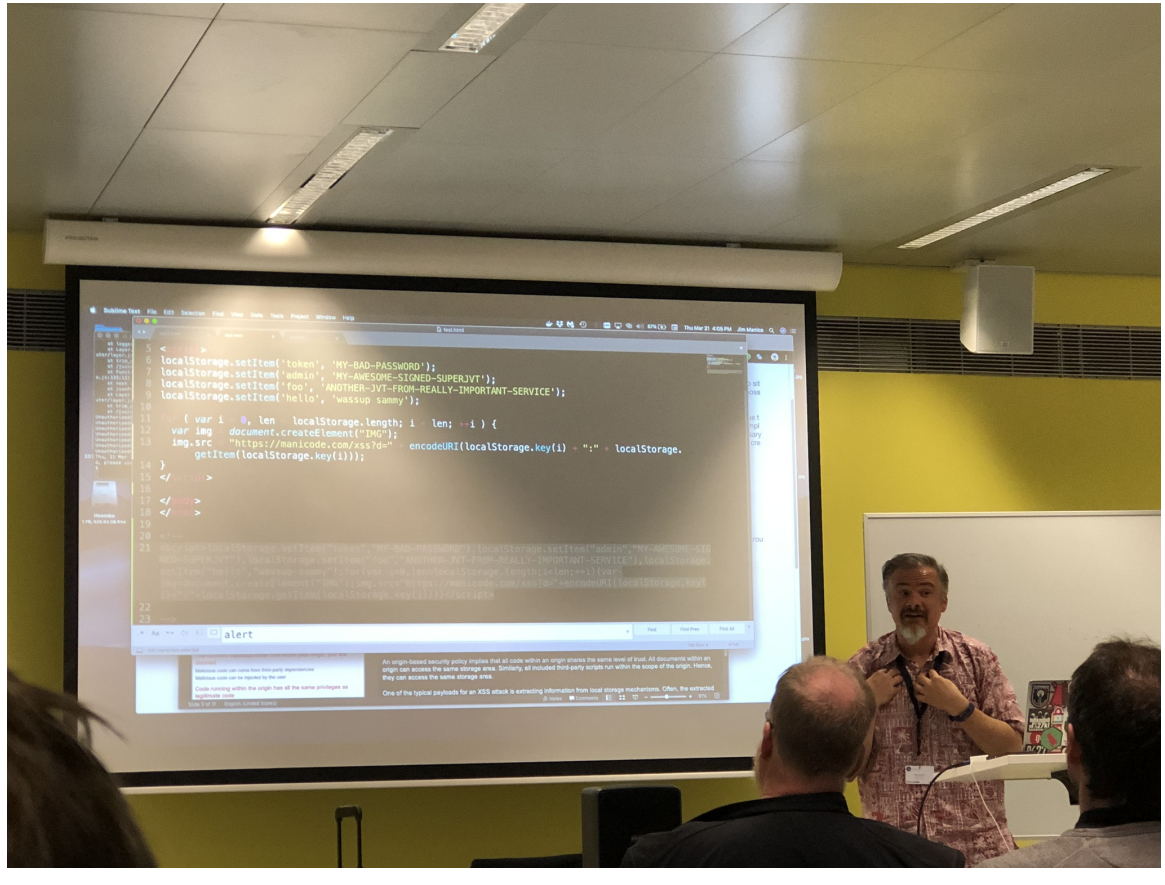
&redirect_uri=https://client.abc.com/callback

&client_id=123&client_secret=456

&code_verifier=4gth4jn78k_8

STEAL TOKENS VIA XSS

“XSS is Game-Over for OAuth 2” (Jim Manico)



OAUTH 2 ACCESS TOKEN JWT PROFILE

Vittorio Bertocci (Auth0)

JSON Web Token (JWT) Profile for OAuth 2.0 Access Tokens

OAUTH 2 ACCESS TOKEN JWT PROFILE

Required claims: iss, exp, aud, sub, client_id

Consider privacy restrictions for identity claims

Authorization claims according to SCIM Core (RFC7643):

- Groups
- Entitlements
- Roles

System for Cross-domain Identity Management (SCIM)

TOKEN BINDING

~~RFC8471: The Token Binding Protocol Version 1.0~~

~~RFC8472: (TLS) Extension for Token Binding Protocol Negotiation~~

~~RFC8473: Token Binding over HTTP~~

OAuth 2.0 Mutual TLS Client Authentication and Certificate-Bound Access Tokens

Google - Intent to Remove: Token Binding

FURTHER INTERNET-DRAFTS FOR OAUTH 2

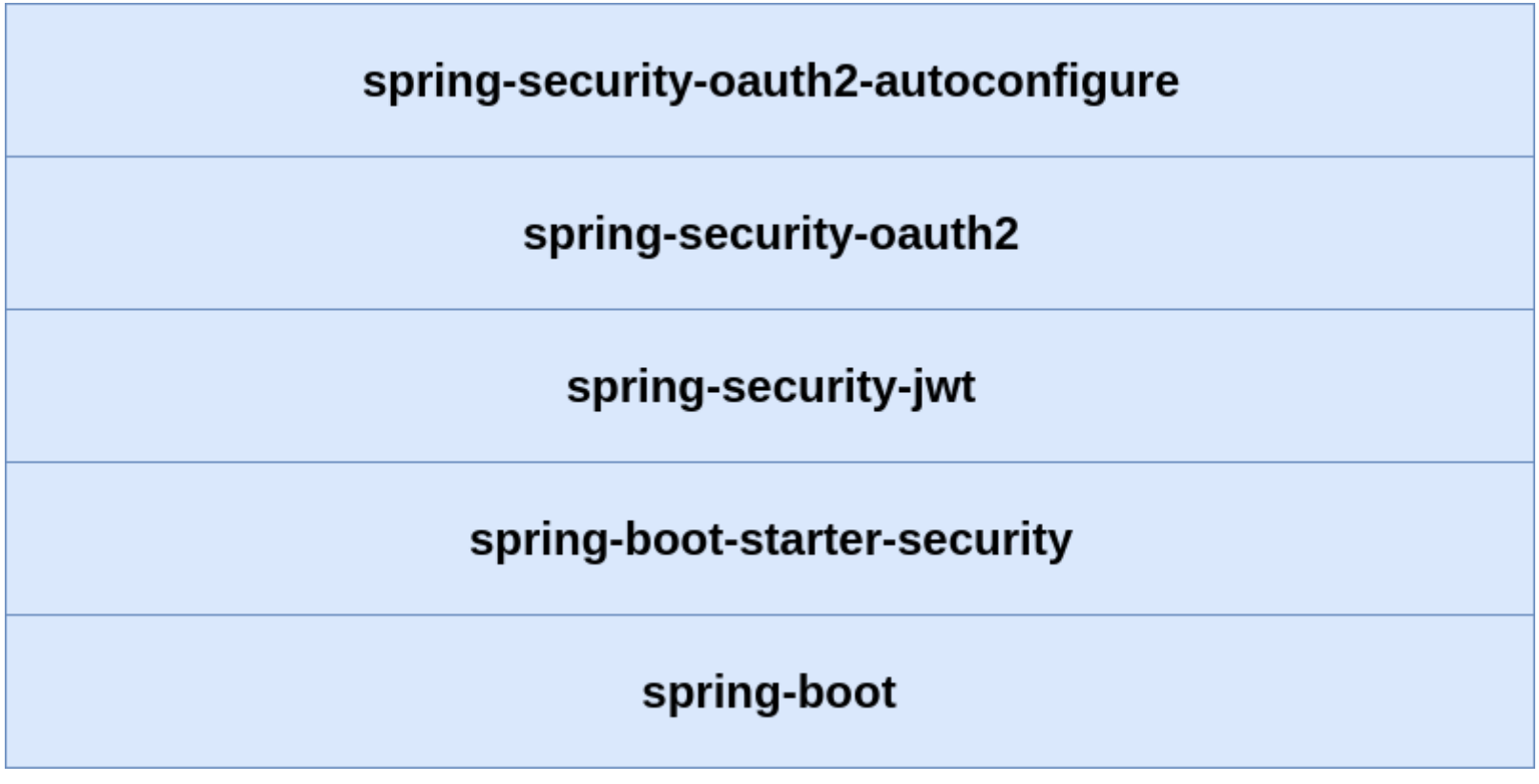
List of OAuth 2 Internet-Drafts (by date)

DEMO TIME

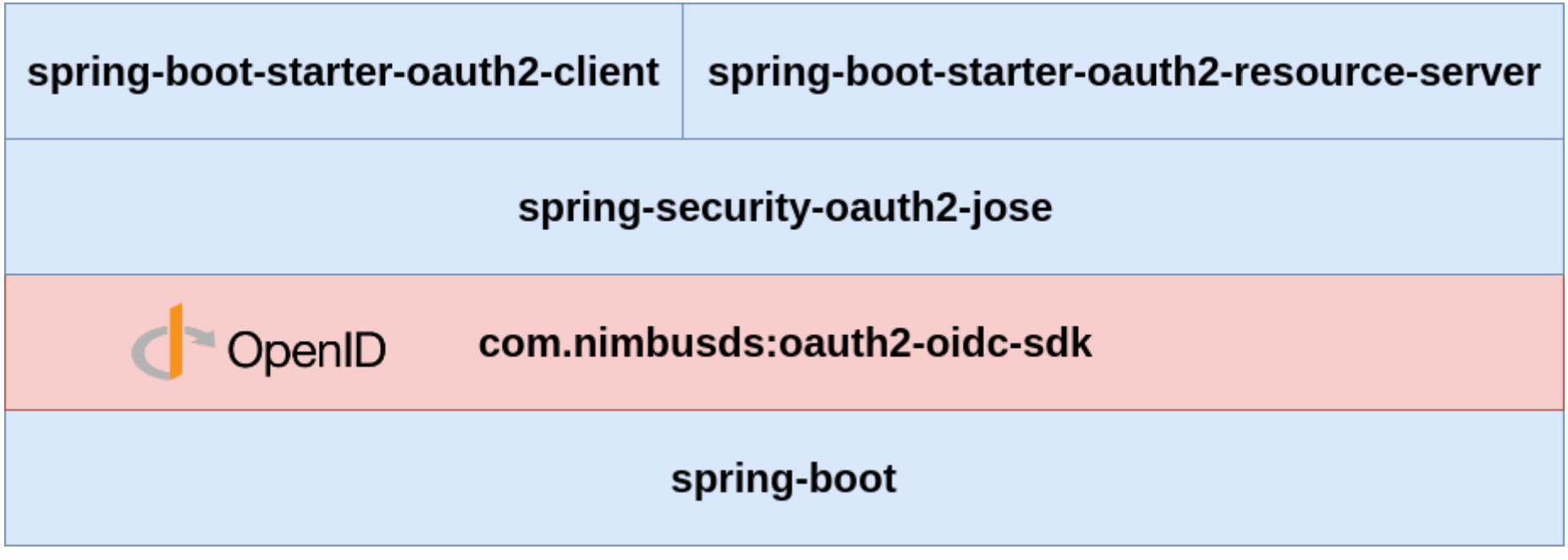
OAUTH 2.0 & OPENID CONNECT 1.0

WITH SPRING SECURITY 5

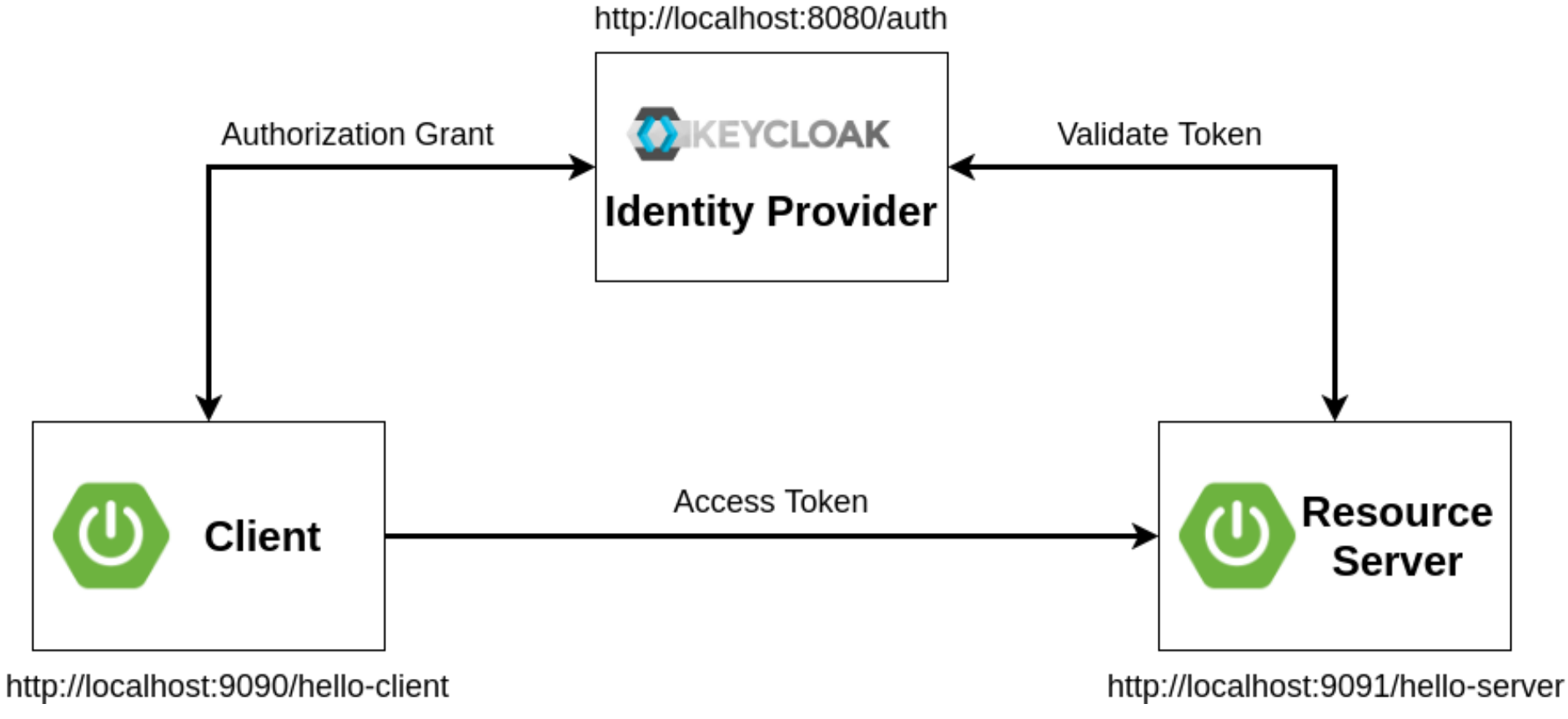
“LEGACY” SPRING SECURITY OAUTH 2 STACK



“NEW” SPRING SECURITY OAUTH 2 STACK



DEMO APPLICATION



WHAT'S NEW IN SPRING SECURITY 5.2 & 5.3

Spring Security 5.2.0.M2 Released

RELEASES JOSH CUMMINGS APRIL 16, 2019 2 COMMENTS

On behalf of the community, I'm pleased to announce the release of Spring Security 5.2.0.M2! This release includes 100+ updates. You can find the highlights below:

OAuth 2.0

gh-6446 - Client Support for PKCE

PKCE isn't just for native or browser-based apps, but for any time we want to have a public client. Spring Security 5.2 introduces a secure way for backends to authenticate as public clients.

gh-5350 - OpenID Connect RP-Initiated Logout

gh-5465 - Ability to use symmetric keys with `JwtDecoder`

gh-5397 - Ability for `NimbusReactiveJwtDecoder` to take a custom processor

gh-6513 & gh-5200 - Support for Resource Server Token Introspection

SPRING SECURITY 5.2 (08/2019)

- Client Support for PKCE
- OpenID Connect RP-Initiated Logout
- Support for OAuth 2.0 Token Introspection
- Resource Server Multi-tenancy (Servlet & Reactive)
- Use symmetric keys with JwtDecoder
- JWT Flow API in Test Support

Spring Security 5.2.0 M2 GitHub Issues
Spring Security 5.2.0 M3 GitHub Issues
Spring Security 5.2.0 RC1 GitHub Issues

OAUTH 2.0 TOKEN INTROSPECTION

Opaque Tokens

```
class ResSrvConfig extends WebSecurityConfigurerAdapter {

    @Override
    protected void configure(HttpSecurity http)
            throws Exception {
        http.oauth2ResourceServer()
                .opaqueToken()
                    .introspectionUri(this.introspectionUri)
                    .introspectionClientCredentials(
                        this.clientId, this.clientSecret);
    }
}
```

https://github.com/spring-projects/spring-security/issues/5200

RESOURCE SERVER MULTI-TENANCY

```
class ResSrvConfig extends WebSecurityConfigurerAdapter {

    @Override protected void configure(HttpSecurity http) {
        http.oauth2ResourceServer()
            .authenticationManagerResolver(
                multitenantAuthenticationManager());
    }

    @Bean AuthenticationManagerResolver<HttpServletRequest>
        multiTenantAuthMgr() {...}

    AuthenticationManager jwt() {...}
    AuthenticationManager opaque() {...}
}
```

https://github.com/spring-projects/spring-security/issues/5351
https://github.com/spring-projects/spring-security/issues/6727

USE SYMMETRIC KEYS WITH JWTDECODER

```
class ResSrvConfig extends WebSecurityConfigurerAdapter {

  @Value("${spring.security.oauth2.resourceserver.
                jwt.key-value}") RSAPublicKey key;

  @Override protected void configure(HttpSecurity http) {
    http.oauth2ResourceServer().jwt().decoder(jwtDecoder());
  }

  @Bean JwtDecoder jwtDecoder() throws Exception {
      return NimbusJwtDecoder.
              withPublicKey(this.key).build();
  }
}
```

https://github.com/spring-projects/spring-security/issues/5465

JWT FLOW API IN TEST SUPPORT

```
public class OAuth2ResourceServerTest {

    @Test
    public void testRequestPostProcessor() {
      mockMvc.perform(get("/message")
      .with(mockAccessToken().scope("message:read")))
      .andExpect(status().isOk())

      mockMvc.perform(get("/")
      .with(jwt().claim(SUB, "the-subject")))
      .andExpect(status().isOk())
    }
}
```

https://github.com/spring-projects/spring-security/issues/6634

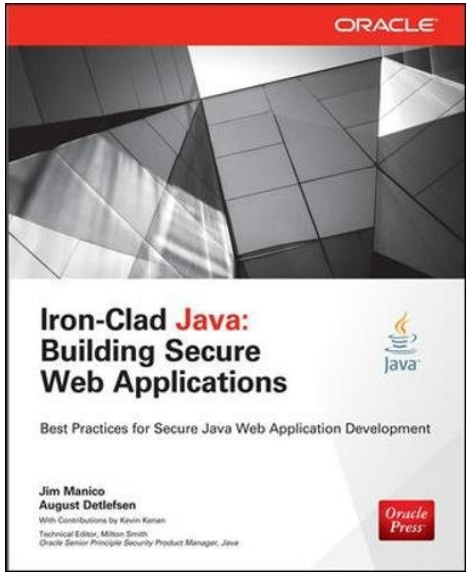
SPRING SECURITY 5.3

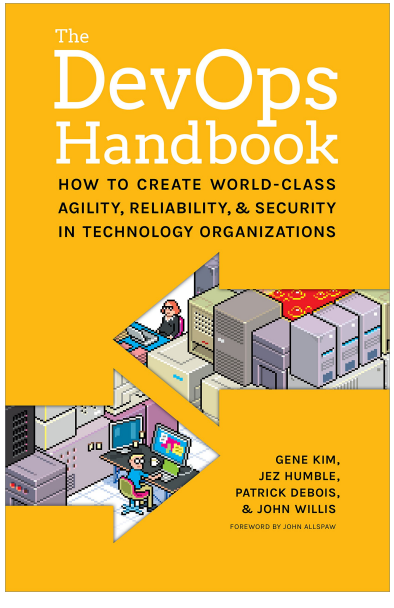
Support OAuth 2.0 Authorization Server:

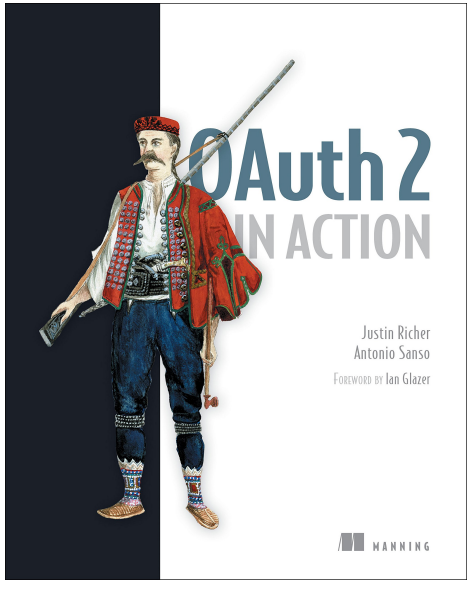
- OAuth 2.0 Authorization Code Grant
- OpenID Connect 1.0 (Authorization Code Flow)
- PKCE
- OAuth 2.0 Client Credentials Grant
- JWT Access Token format
- JWK Set Endpoint
- Opaque Access Token format
- OAuth 2.0 Token Revocation

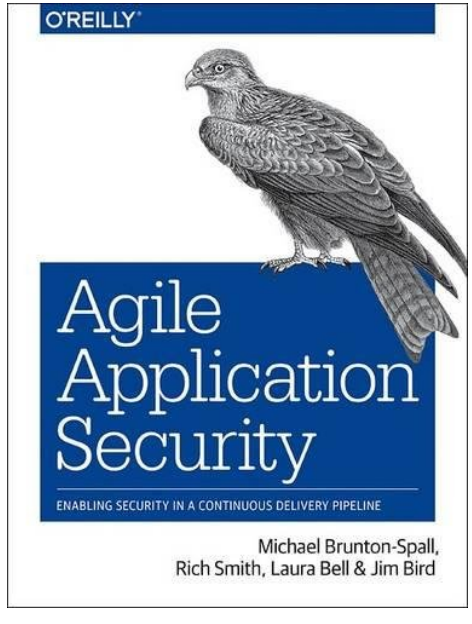
Spring Security 5.3.0 GitHub Issues

BOOK REFERENCES









Q&A

https://www.novatec-gmbh.de
https://blog.novatec-gmbh.de
andreas.falk@novatec-gmbh.de
Twitter: @andifalk

ONLINE REFERENCES

- RFC 6749: The OAuth 2.0 Authorization Framework
- RFC 6750: OAuth 2.0 Bearer Token Usage
- RFC 6819: OAuth 2.0 Threat Model and Security Considerations
- RFC 7636: Proof Key for Code Exchange (“Pixy”)
- OpenID Connect Core 1.0
- OpenID Connect Dynamic Client Registration 1.0
- OpenID Connect Discovery 1.0
- RFC 7519: JSON Web Token (JWT)
- JSON Web Token Best Current Practices
- 4. OAuth Security Workshop 2019 event web page
- Why you should stop using the OAuth implicit grant
- OAuth 2.0 Security Best Current Practice
- OAuth 2.0 for Browser-Based Apps
- OAuth 2.0 Mutual TLS Client Authentication and Certificate-Bound Access Tokens
- JSON Web Token (JWT) Profile for OAuth 2.0 Access Tokens
- Spring Security