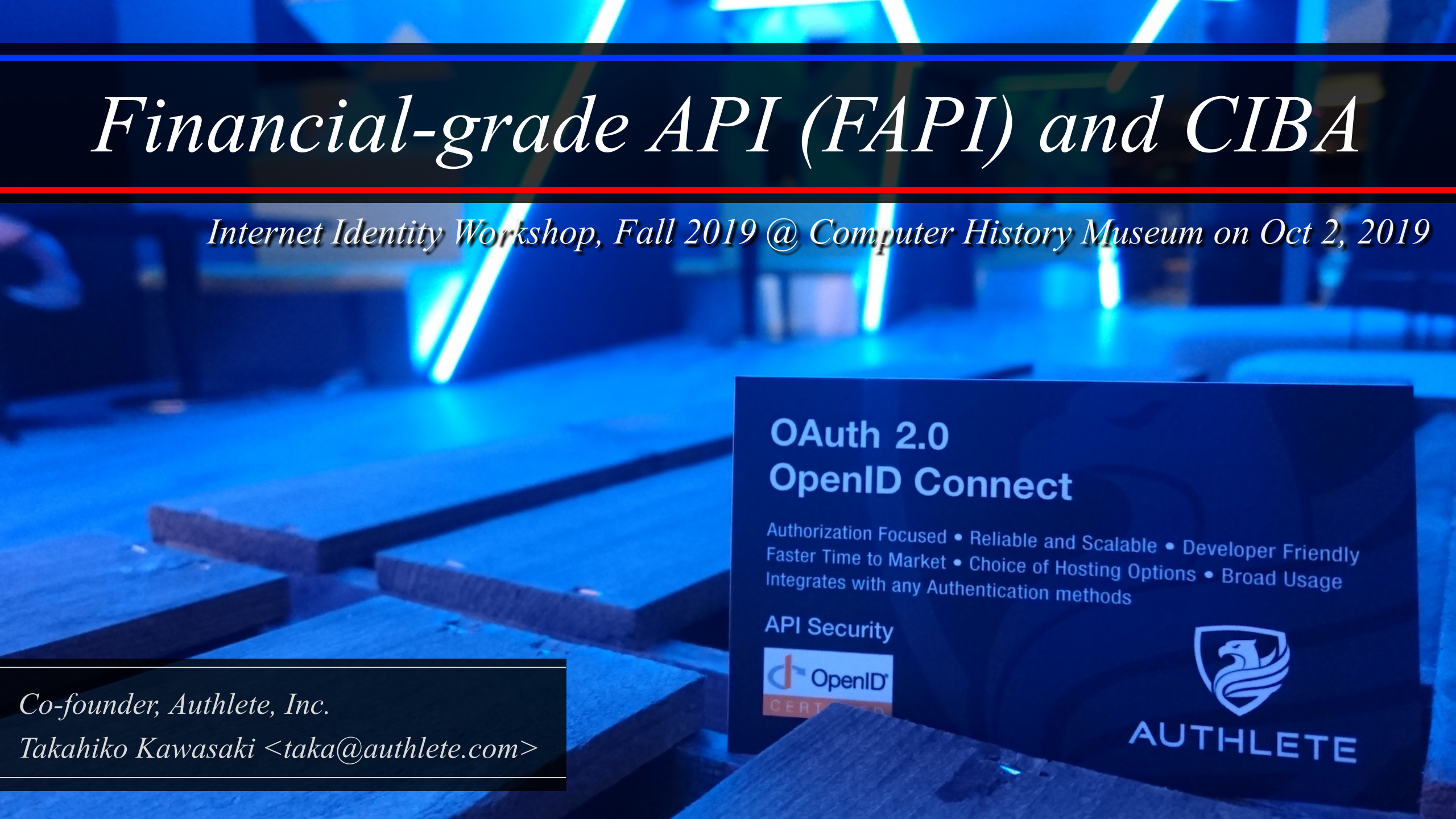
Financial-grade API (FAPI) and CIBA

Internet Identity Workshop, Fall 2019 @ Computer History Museum on Oct 2, 2019



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Chapter 1 : Financial-grade API (FAPI)

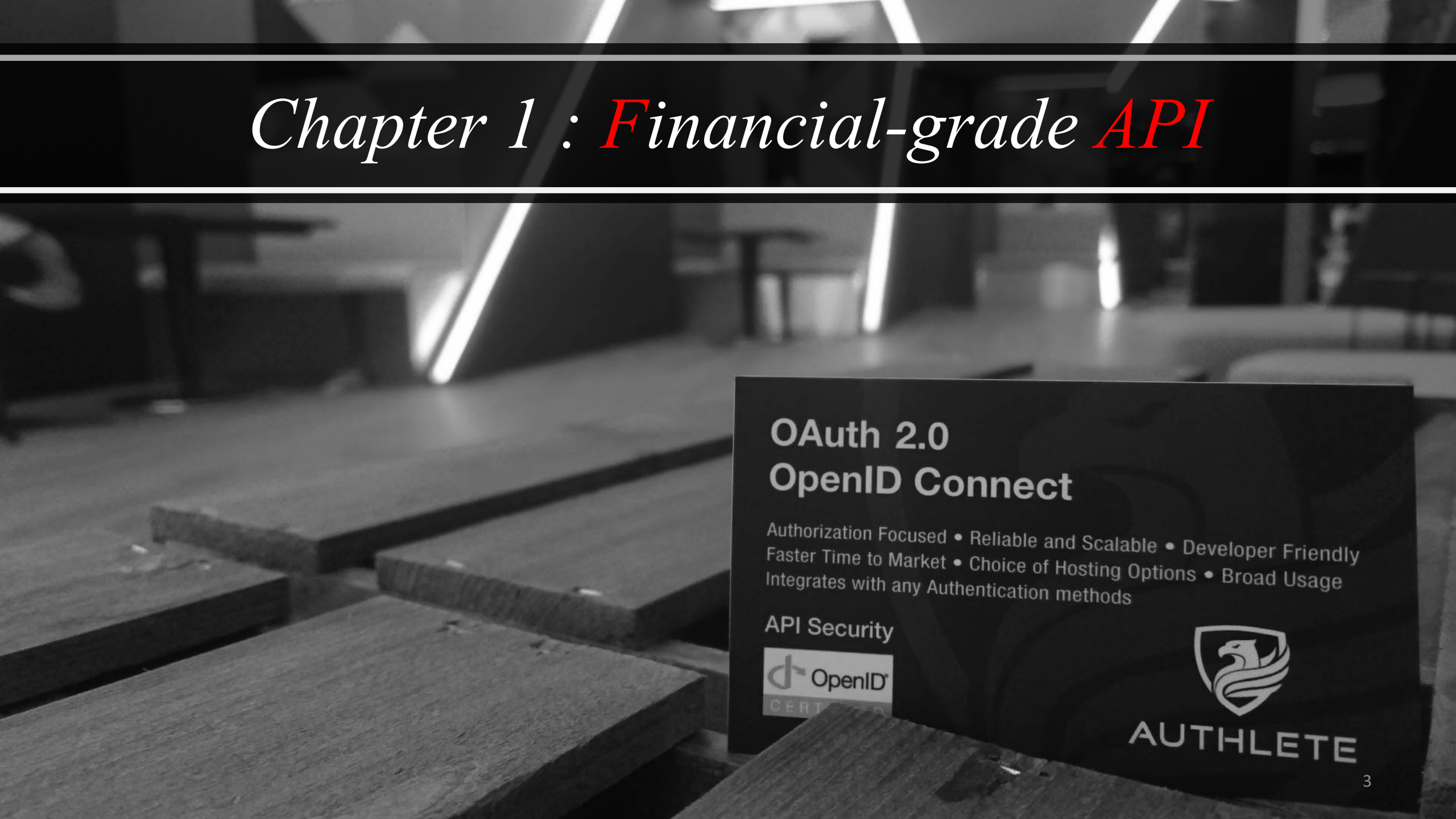
- Introduction
- Client Authentication
- Certificate-Bound Access Tokens
- JWT Secured Authorization Response Mode (JARM)

Chapter 2 : Client Initiated Backchannel Authentication (CIBA)

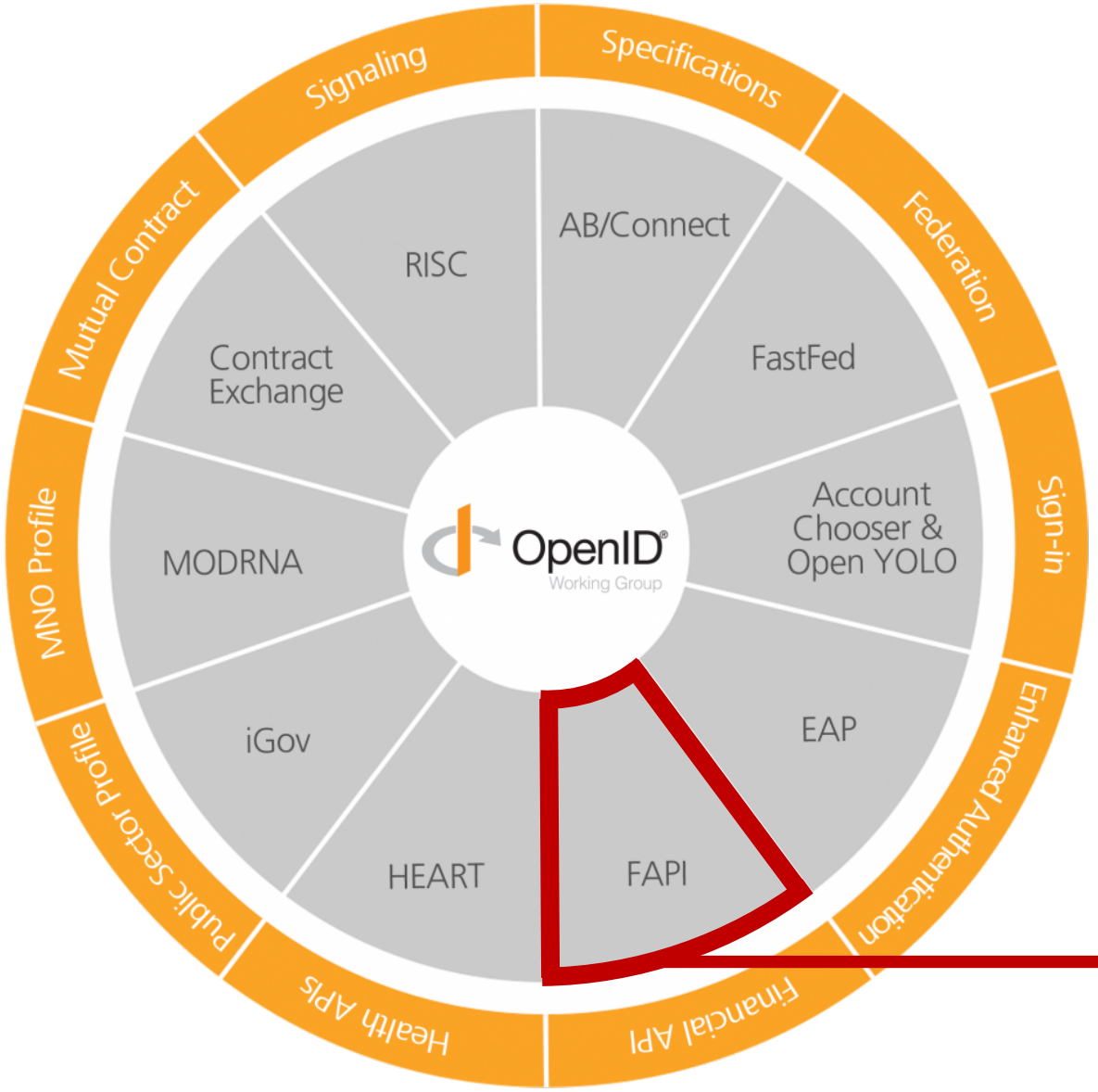
- Introduction
- CIBA POLL/PING/PUSH Modes
- CIBA Demo

Q&A and discussion

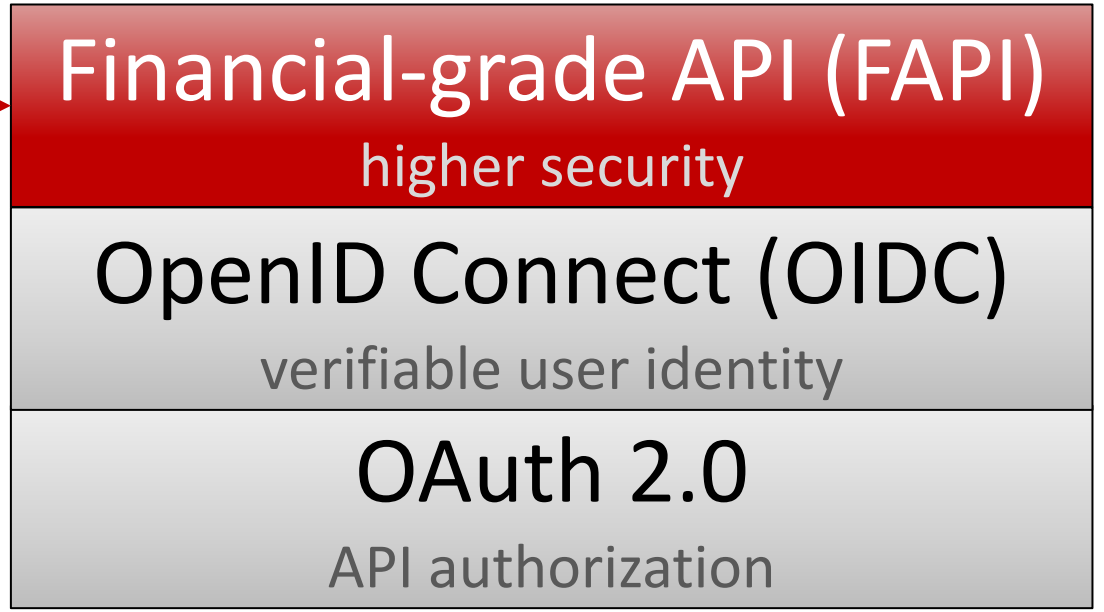
Chapter 1 : Financial-grade API



OpenID Foundation



The Financial-grade API (FAPI) Working Group has developed **Financial-grade API (FAPI)** on top of OAuth 2.0 and OpenID Connect.



History of FAPI

2017	2	Part 1 of Financial API Implementer's Draft 1
2017	7	Part 2 of Financial API Implementer's Draft 1
2018	10	Financial-grade API Implementer's Draft 2

The specification was renamed from Financial API to Financial-grade API because the specification can apply to not only the financial industry but also other industries that need high security.

FAPI Certification

OIDF started FAPI Certification Program on April 1, 2019.

Certified Financial-grade API (FAPI) OpenID Providers

These deployments have been granted certifications for these Financial-grade API (FAPI) conformance profiles:

Organization	Implementation	FAPI R/W OP w/ MTLS	FAPI R/W OP w/ Private Key
Authlete	Authlete 2.1	1-Apr-2019 [view]	1-Apr-2019 [view]
Cater Allen	CA Open Banking v1.3.0		4-Sep-2019 [view]
Coutts & company	F23		27-Sep-2019 [view]
Curity	Curity Identity Server 4.3.0	20-Sep-2019 [view]	20-Sep-2019 [view]
ForgeRock	ForgeRock Financial 3.1.0-credence		1-Apr-2019 [view]
Ozone	Ozone Sandbox v3.1	6-Jun-2019 [view]	6-Jun-2019 [view]
Ping Identity	PingFederate 9.2.3	29-May-2019 [view]	
Sainsbury's Bank PLC	Sainsbury's Bank Digital IAM Platform (version 19.8.8)		9-Aug-2019 [view]
Filip Skokan	node oidc-provider ^6.5.0	20-Aug-2019 [view]	20-Aug-2019 [view]

(as of Oct 2, 2019)

FAPI-CIBA Certification

OIDF started FAPI-CIBA Certification Program on Sep. 1, 2019.

Certified Financial-grade API Client Initiated Backchannel Authentication Profile (FAPI-CIBA) OpenID Providers

These deployments have been granted certifications for these Financial-grade API Client Initiated Backchannel Authentication Profile (FAPI-CIBA) conformance profiles:

Organization	Implementation	FAPI-CIBA OP poll w/ MTLS	FAPI-CIBA OP poll w/ Private Key	FAPI-CIBA OP Ping w/ MTLS	FAPI-CIBA OP Ping w/ Private Key
Authlete	Authlete 2.1	16-Sep-2019 [view]	16-Sep-2019 [view]	16-Sep-2019 [view]	16-Sep-2019 [view]

(as of Oct 2, 2019)

FAPI Parts

From the foreword of FAPI specification:

Financial-grade API consists of the following parts:

- *Part 1: Read-Only API Security Profile*
- *Part 2: Read and Write API Security Profile*
- *Part 3: Client Initiated Backchannel Authentication Profile*

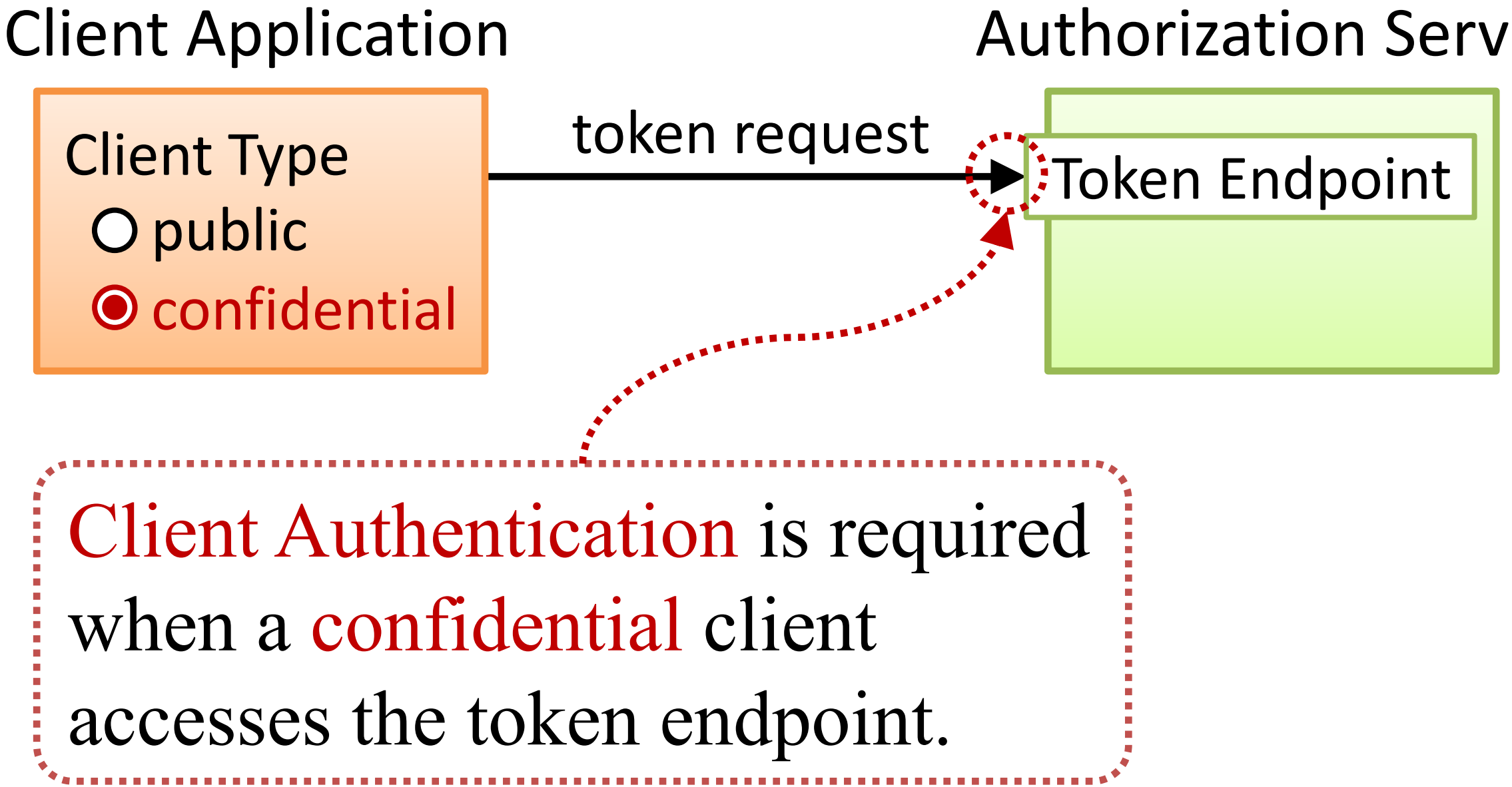
CIBA specification adds new authorization flows.

Enhanced Security

Topics covered in this talk

- ✓ Entropy Requirement for Client Secret
- ✓ JWT-Based Client Authentication
- ✓ Certificate-Based Client Authentication
- ✓ Key Size Requirement for Client Authentication
- ✓ Proof Key for Code Exchange
- ✓ Redirect URI Pre-registration
- ✓ Redirect URI Mandatory Request Parameter
- ✓ Redirect URI Exact Match
- ✓ Level of Assurance for End-User Authentication
- ✓ Explicit Consent for Requested Scopes
- ✓ Prohibition of Authorization Code Reuse
- ✓ Scope Mandatory Response Parameter
- ✓ Entropy Requirement for Access Token
- ✓ Access Token Revocation
- ✓ Claimed HTTP Scheme URI Redirection
- ✓ Prohibition of Access Token in Query Part
- ✓ Detached Signature
- ✓ State Hash
- ✓ Certificate-Bound Access Token
- ✓ Token Binding
- ✓ Request Object Mandatory Request Parameter
- ✓ Request Object including All Request Parameters
- ✓ Request Object EXP Claim
- ✓ Request Object Mandatory Signing
- ✓ Essential ACR Claim
- ✓ JWT Secured Authorization Response Mode
- ✓ TLS Cipher Suite Restriction
- ✓ JWS Signature Algorithm Restriction

Client Authentication


Client Application
Authorization Server
Client Type
public
confidential
token request
Token Endpoint
Client Authentication is required when a confidential client accesses the token endpoint.

The traditional ways described in RFC 6749 use Client ID and Client Secret for client authentication.

1. Basic Authentication (`client_secret_basic`)

`"{Client ID}:{Client Secret}"` → Encode by BASE64

```
POST {Token Endpoint} HTTP/1.1
Host: {Authorization Server}
Authorization: Basic {BASE64-encoded Credentials}
Content-Type: application/x-www-form-urlencoded

(abbrev)
```

2. Form Parameters (client_secret_post)

```
POST {Token Endpoint} HTTP/1.1
Host: {Authorization Server}
Content-Type: application/x-www-form-urlencoded

client_id={Client ID}&
client_secret={Client Secret}&
(abbrev)
```

These traditional ways (client_secret_basic and client_secret_post) are not allowed in FAPI.

Client Authentication Method	Part 1	Part 2
client_secret_basic (traditional)	✗	✗
client_secret_post	✗	✗
client_secret_jwt (JWT-based)	○	✗
private_key_jwt	○	○
tls_client_auth (certificate-based)	○	○
self_signed_tls_client_auth	○	○

JWT-based Client Authentication (RFC 7523)

- ✓ Generate JWT and pass it to the token endpoint instead of passing a pair of client ID & client secret directly.
- ✓ The JWT is passed as the value of `client_assertion`.
- ✓ The JWT is signed using either
  - (a) the client's client secret (`client_secret_jwt`), or
  - (b) the client's private key (`private_key_jwt`).

```
POST {Token Endpoint} HTTP/1.1
Host: {Authorization Server}
Content-Type: application/x-www-form-urlencoded

client_assertion_type=
  urn:ietf:params:oauth:client-assertion-type:jwt-bearer&
client_assertion={JWT}&
(abbrev)
```

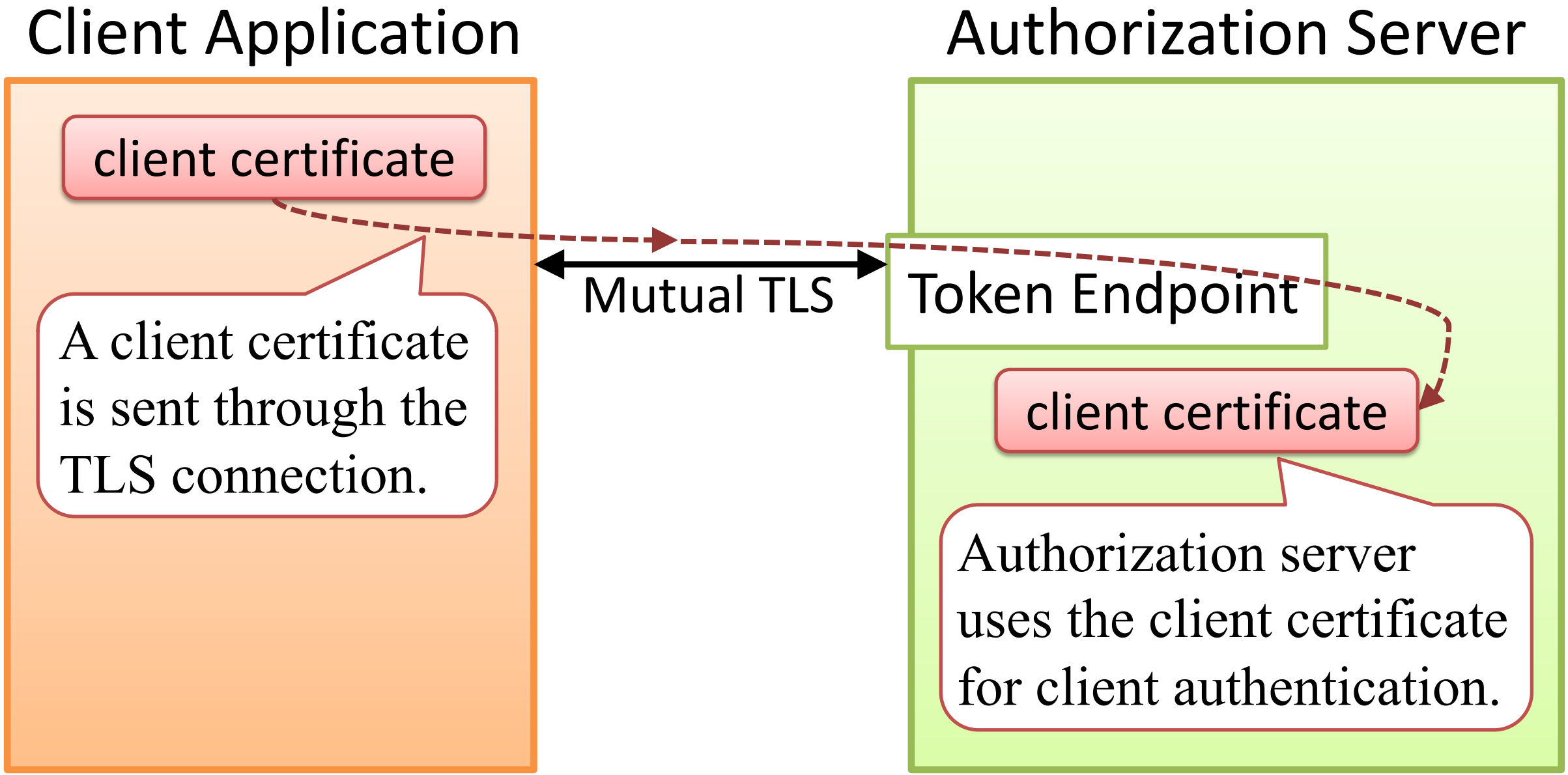
payload

```
{
  "iss": "{Client ID}",
  "sub": "{Client ID}",
  "aud": "{Token Endpoint}",
  "jti": "{JWT ID}",
  "exp": {Expiration Time},
  "iat": {Issue Time}
}
```

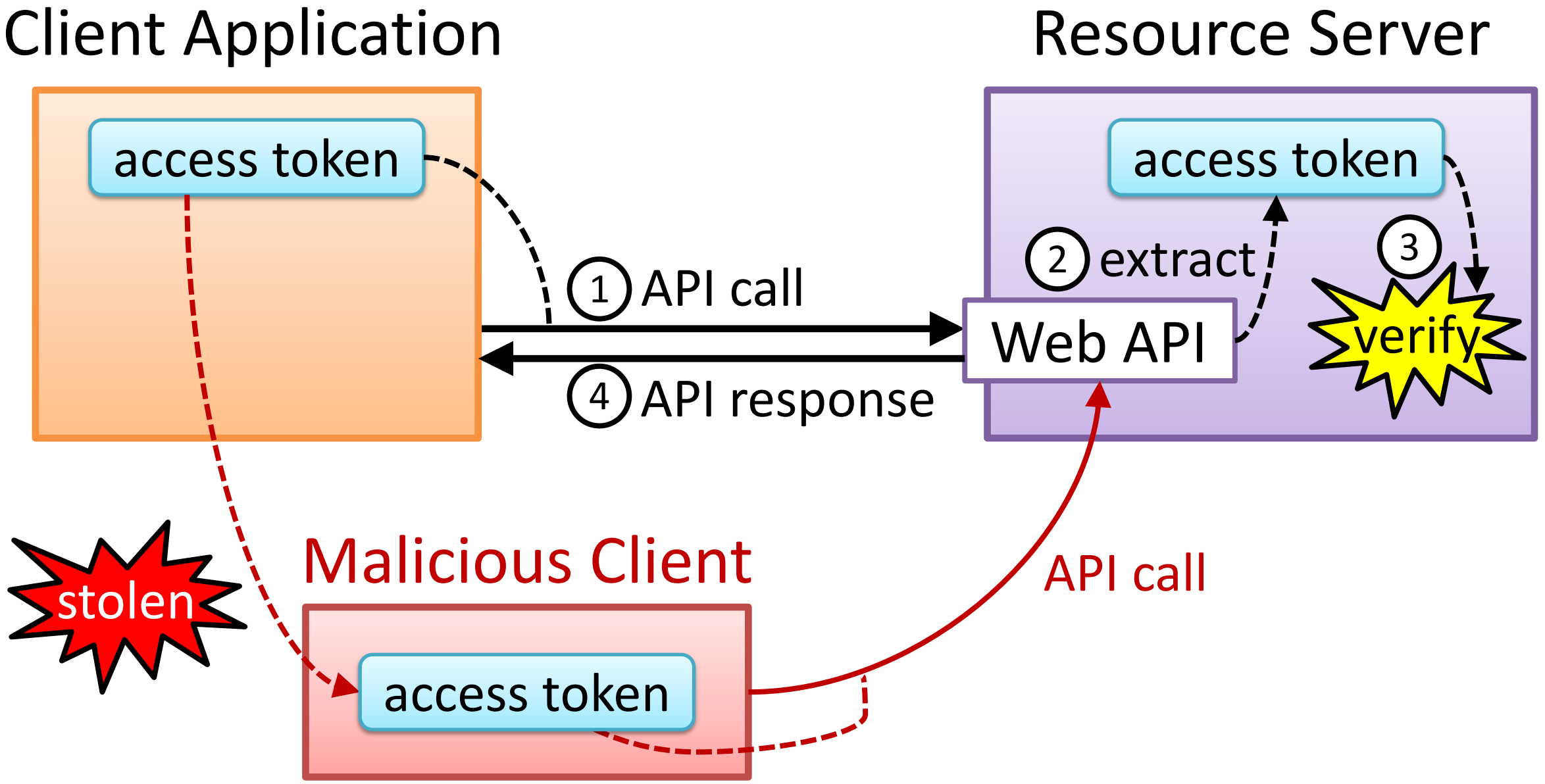
The `iss` claim and the `sub` claim in the JWT hold the client ID.

Certificate-based Client Authentication

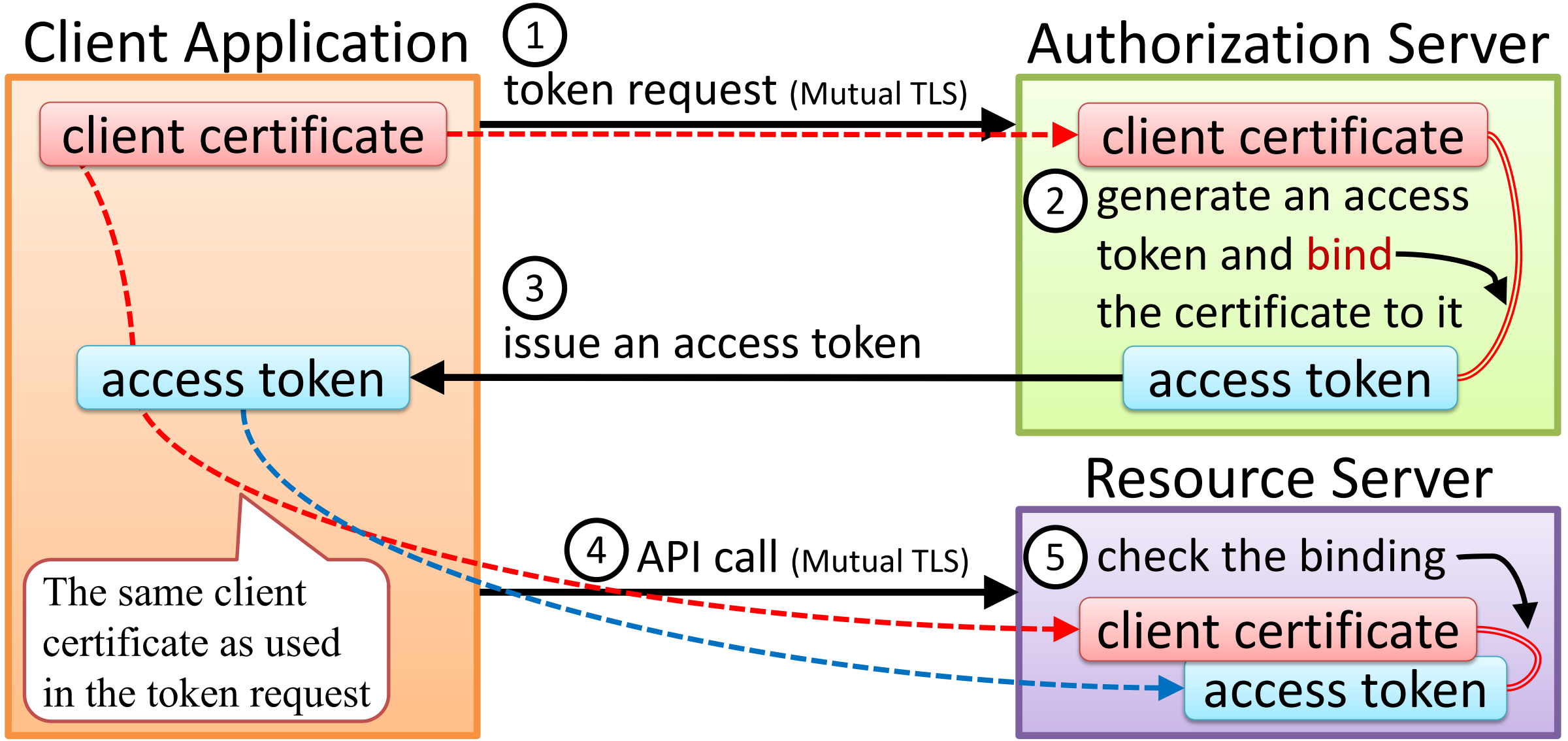
- ✓ Establish mutual TLS connection to the token endpoint.
- ✓ The client certificate presented in the connection is used for client authentication.
- ✓ The client certificate is either
  - (a) PKI certificate (`tls_client_auth`), or
  - (b) self-signed certificate (`self_signed_tls_client_auth`).


Client Application
Authorization Server
client certificate
A client certificate is sent through the TLS connection.
Mutual TLS
Token Endpoint
client certificate
Authorization server uses the client certificate for client authentication.

Certificate-Bound Access Tokens


Client Application
Resource Server
access token
access token
1 API call
2 extract
3
verify
Web API
4 API response
stolen
Malicious Client
API call
access token

Certificate-Bound Access Token



JWT Secured Authorization Response Mode (JARM)

JARM is a specification to pack response parameters from the authorization endpoint into a JWT.

In normal cases

```
HTTP/1.1 302 Found
Location: https://client.example.com/callback?
  code={Authorization Code}&state={State}
```

In JARM

```
HTTP/1.1 302 Found
Location: https://client.example.com/callback?
  response={JWT}
```

Example of an authorization response in JARM

```
HTTP/1.1 302 Found
Location: https://client.example.com/cb?response=eyJhbGciOiJSUzI1NiIsInR5cCI6IkpXVCJ
9.eyJpc3MiOiJodHRwczovL2FjY291bnRzLmV4YW1wbGUuY29tIiwiYXVkIjoiczZCaGRSa3F0MyIsImV4cC
I6MTMxMTI4MTk3MCwiY29kZSI6IlB5eUZhdXgybzdRMFlmWEJVMzJqaHcuNUZYU1FwdnI4YWt2OUNlUkRTZD
BRQSIsInN0YXRlIjoiUzhOSjd1cWs1Zlk0RWpOdlBfR19GdHlKdTZwVXN2SDlqc1luaTlkTUFKdyJ9.HkdJ_
TYgwBBj10C-aWuNUiA062Amq2b0_oyuc5P0aMTQphAqC2o9WbGSkpfuHVBowlb-zJ15tBvXDIABL_t83q6aj
vjtq_pqsByiRK2dLVdUwKhW3P_9wjvI0K20gdoTNbNlP9Z41mhart4BqraIoI8e-L_EfAHfhCG_DDDv7Yg
```

Decoded payload

```
{
  "iss": "https://accounts.example.com",
  "aud": "s6BhdRkqt3",
  "exp": 1311281970,
  "code": "PyyFaux2o7Q0YfXBU32jhw.5FXSQpvr8akv9CeRDSd0QA",
  "state": "S8NJ7uqk5fY4EjNvP_G_FtyJu6pUsvH9jsYni9dMAJw"
}
```

To use JARM, include the `response_mode` parameter with `*.jwt`.

```
response_mode=query.jwt
              |fragment.jwt
              |form_post.jwt
              |jwt
```

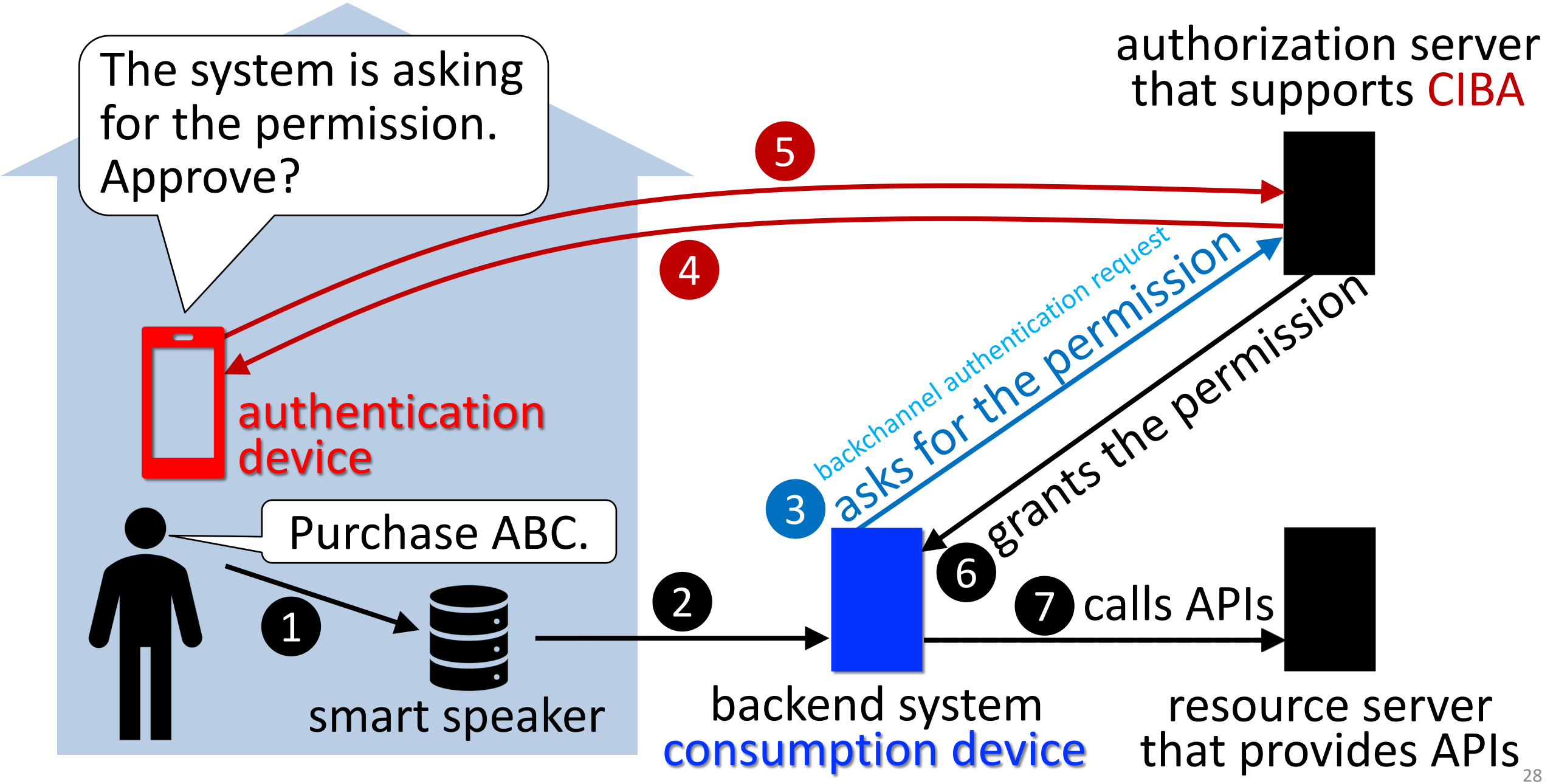
```
GET {Authorization Endpoint}
  ?response_type={Response Type}
  &client_id={Client ID}
  &response_mode=jwt
  HTTP/1.1
Host: {Authorization Server}
```

Chapter 2 : Client Initiated Backchannel Authentication

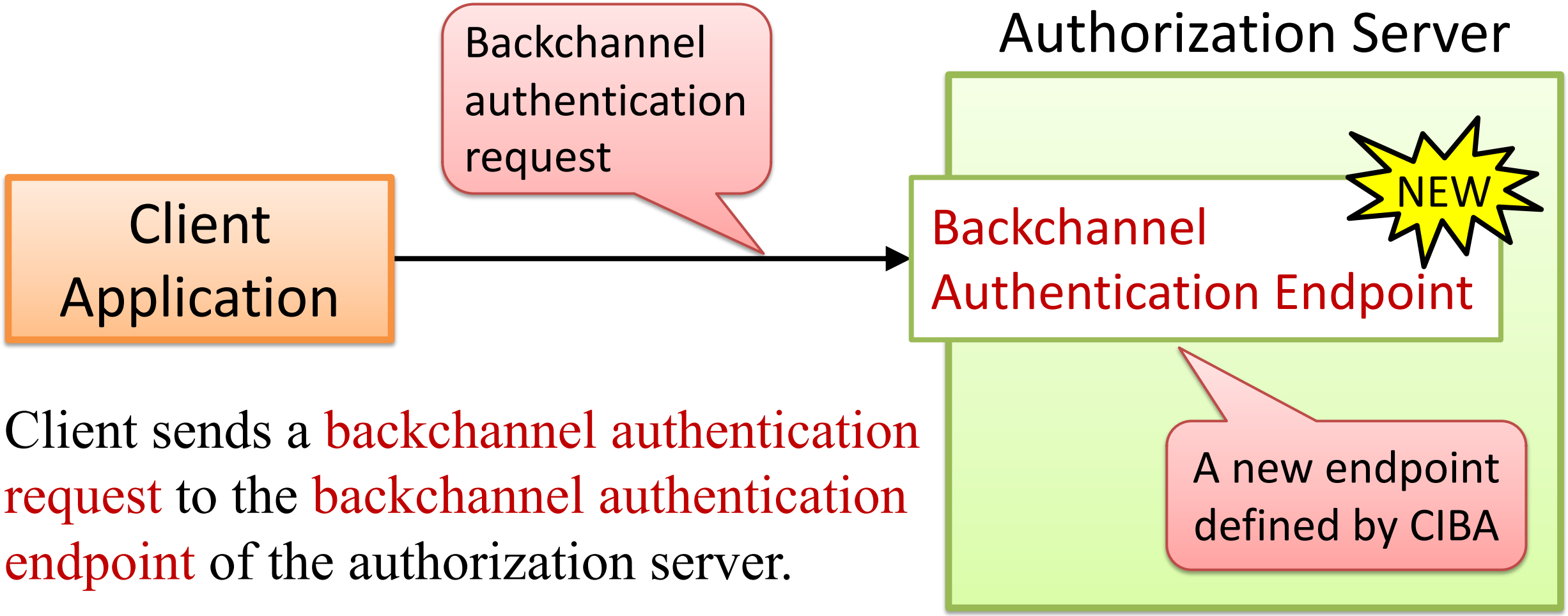
CIBA (Client Initiated Backchannel Authentication) defines new authorization flows.

1	CIBA POLL Mode
2	CIBA PING Mode
3	CIBA PUSH Mode

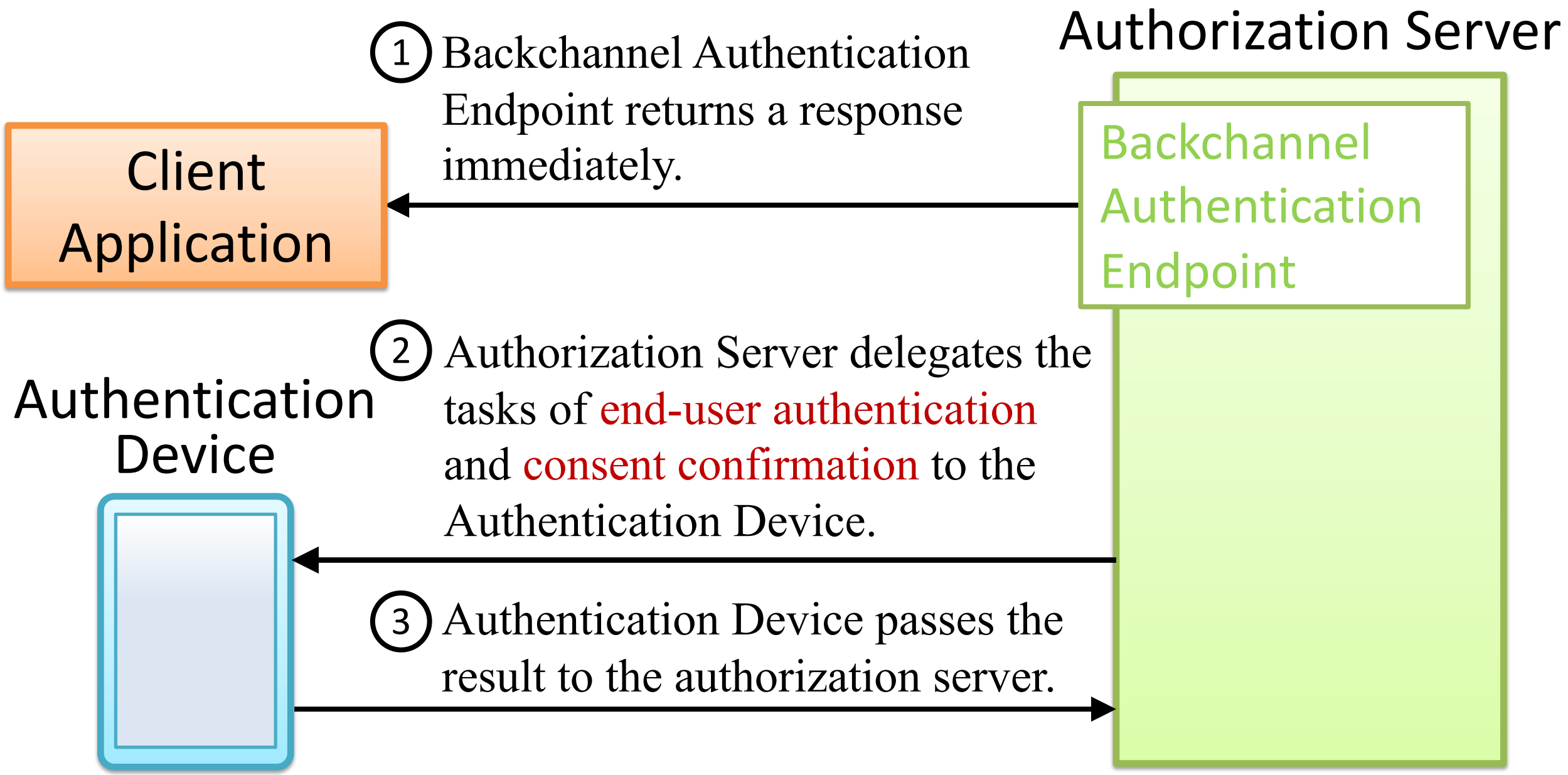
The flows enable to separate the authentication device on which a user is authenticated and API authorization is granted from the consumption device on which a client application that calls APIs runs.


The system is asking for the permission. Approve?
authorization server that supports CIBA
5
4
authentication device
backchannel authentication request
3
asks for the permission
grants the permission
6
Purchase ABC.
1
2
7
calls APIs
smart speaker
backend system
consumption device
resource server that provides APIs

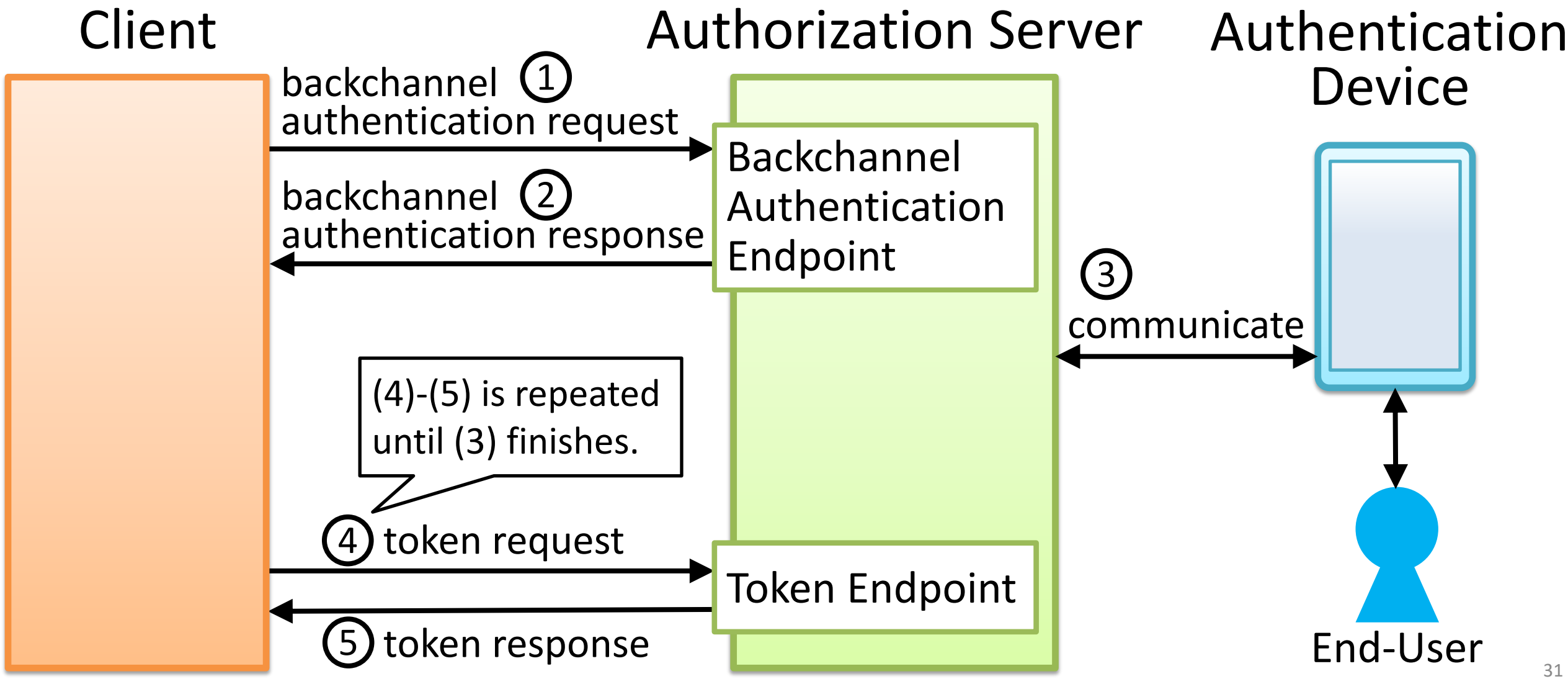
Every CIBA flow starts from a backchannel authentication request.



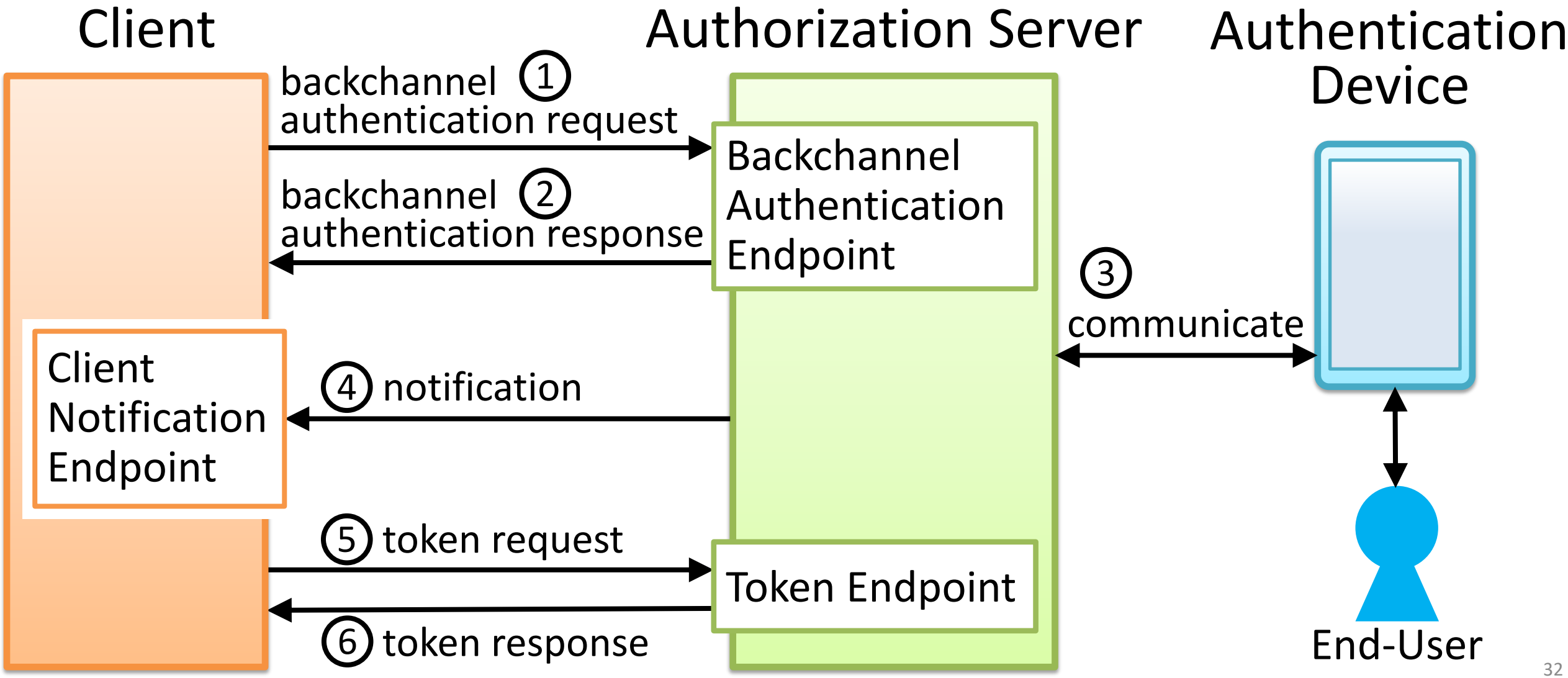
Client sends a backchannel authentication request to the backchannel authentication endpoint of the authorization server.


Authorization Server
1 Backchannel Authentication Endpoint returns a response immediately.
Client Application
Backchannel Authentication Endpoint
2 Authorization Server delegates the tasks of end-user authentication and consent confirmation to the Authentication Device.
Authentication Device
3 Authentication Device passes the result to the authorization server.

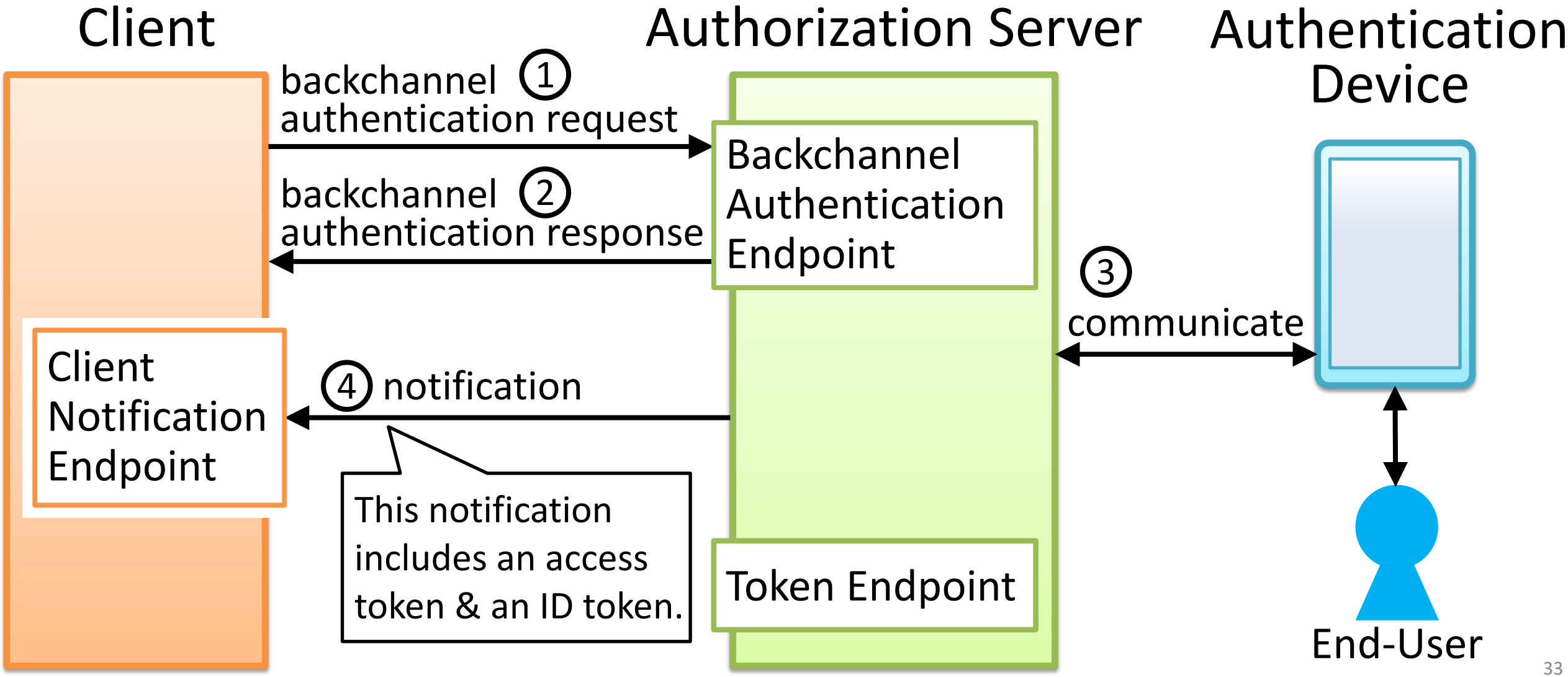
CIBA POLL mode



CIBA PING mode



CIBA PUSH mode



References

Specifications

- ✓ **Financial-grade API, Part 1: Read-Only Security Profile**
  https://openid.net/specs/openid-financial-api-part-1-ID2.html
- ✓ **Financial-grade API, Part 2: Read and Write API Security Profile**
  https://openid.net/specs/openid-financial-api-part-2-ID2.html
- ✓ **Financial-grade API: JWT Secured Authorization Response Mode for OAuth 2.0 (JARM)**
  https://openid.net/specs/openid-financial-api-jarm-ID1.html
- ✓ **OpenID Connect Client Initiated Backchannel Authentication Flow – Core 1.0**
  https://openid.net/specs/openid-client-initiated-backchannel-authentication-core-1_0.html
- ✓ **OAuth 2.0 Mutual TLS Client Authentication and Certificate Bound Access Tokens**
  https://datatracker.ietf.org/doc/draft-ietf-oauth-mtls/
- ✓ **RFC 7523 – JSON Web Token (JWT) Profile for OAuth 2.0 Client Authentication and Authorization Grants**
  https://tools.ietf.org/html/rfc7523

Articles

- ✓ **Financial-grade API (API), explained by an implementer**
  https://medium.com/@darutk/financial-grade-api-fapi-explained-by-an-implementer-d09fcf2ff932
- ✓ **"CIBA", a new authentication/authorization technology in 2019, explained by an implementer**
  https://medium.com/@darutk/ciba-a-new-authentication-authorization-technology-in-2019-explained-by-an-implementer-d1e0ac1311b4
- ✓ **OAuth 2.0 Client Authentication**
  https://medium.com/@darutk/oauth-2-0-client-authentication-4b5f929305d4

Others

- ✓ **Financial-grade API (FAPI) Working Group**
  https://openid.net/wg/fapi/
- ✓ **Official Conformance Suite**
  https://gitlab.com/openid/conformance-suite

Thank You

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