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ADVENTURES IN OPENBANKING: UNDERSTANDING OAUTH AND OPENID CONNECT CLIENT ECOSYSTEMS

Pamela Dingle

Director of Identity Standards @ Microsoft

@pamelarosiedee

Disclaimer

The work I describe here was accomplished through my previous employer.

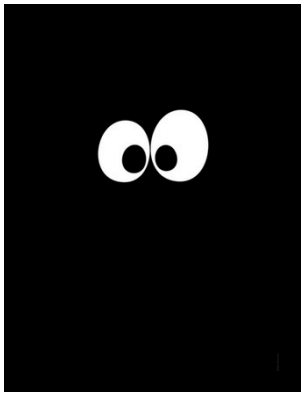
This presentation represents my personal experiences and should not be interpreted as representing any corporation.

I am proud to have the opportunity to work for and collaborate with companies that contribute time, money, and expertise to standards efforts.

Standards ❤ Interoperability

PSD2: EU Payment Services Directive v2

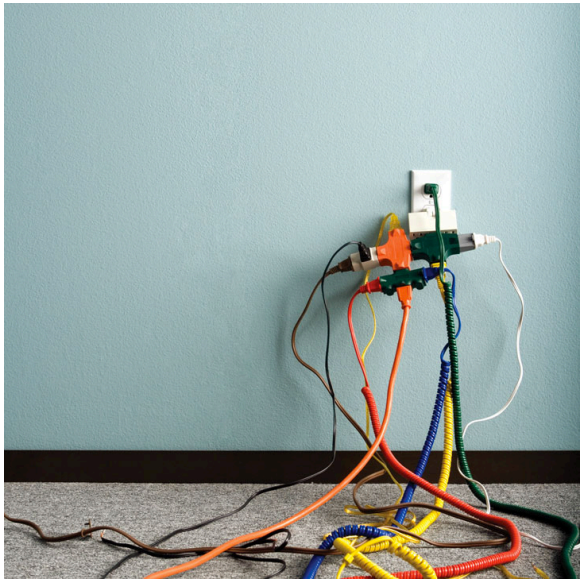
Current State:
Financial Institutions offer proprietary banking APIS (or no APIs at all)



Goal State:
Banking APIs regulated by Competent Authorities* across the EU

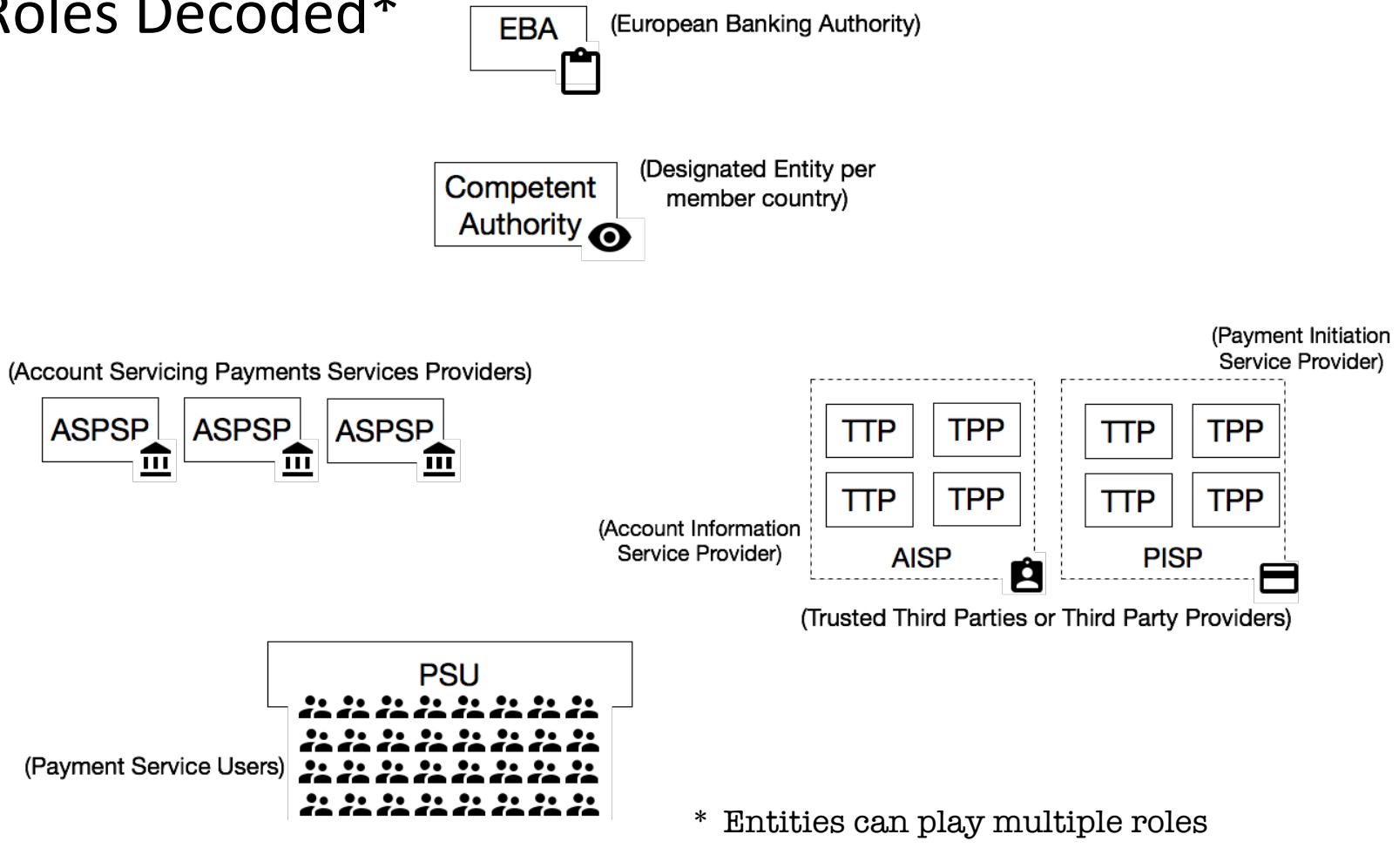
* Competent Authority: entity designated by a country to supervise & monitor compliance

PSD2 Regulatory Technical Specification (RTS) Prime Identity Directives



- Financial Institutions MUST
  - Make APIs for Payment Initiation & Account Information Sharing
  - Allow access to your banking APIS from any ‘trusted third party’ approved by the relevant Competent Authority
  - Adhere to the EU “Secure Customer Authentication RTS” (aka SCA)
  - Ask for consent! Make it intuitive! No extra barriers! Also, make each thing consented to *unbundled*! You figure it out!
- Competent Authorities MUST
  - Figure out how this all works, in time for Financial Institutions to comply

PSD2 Roles Decoded*

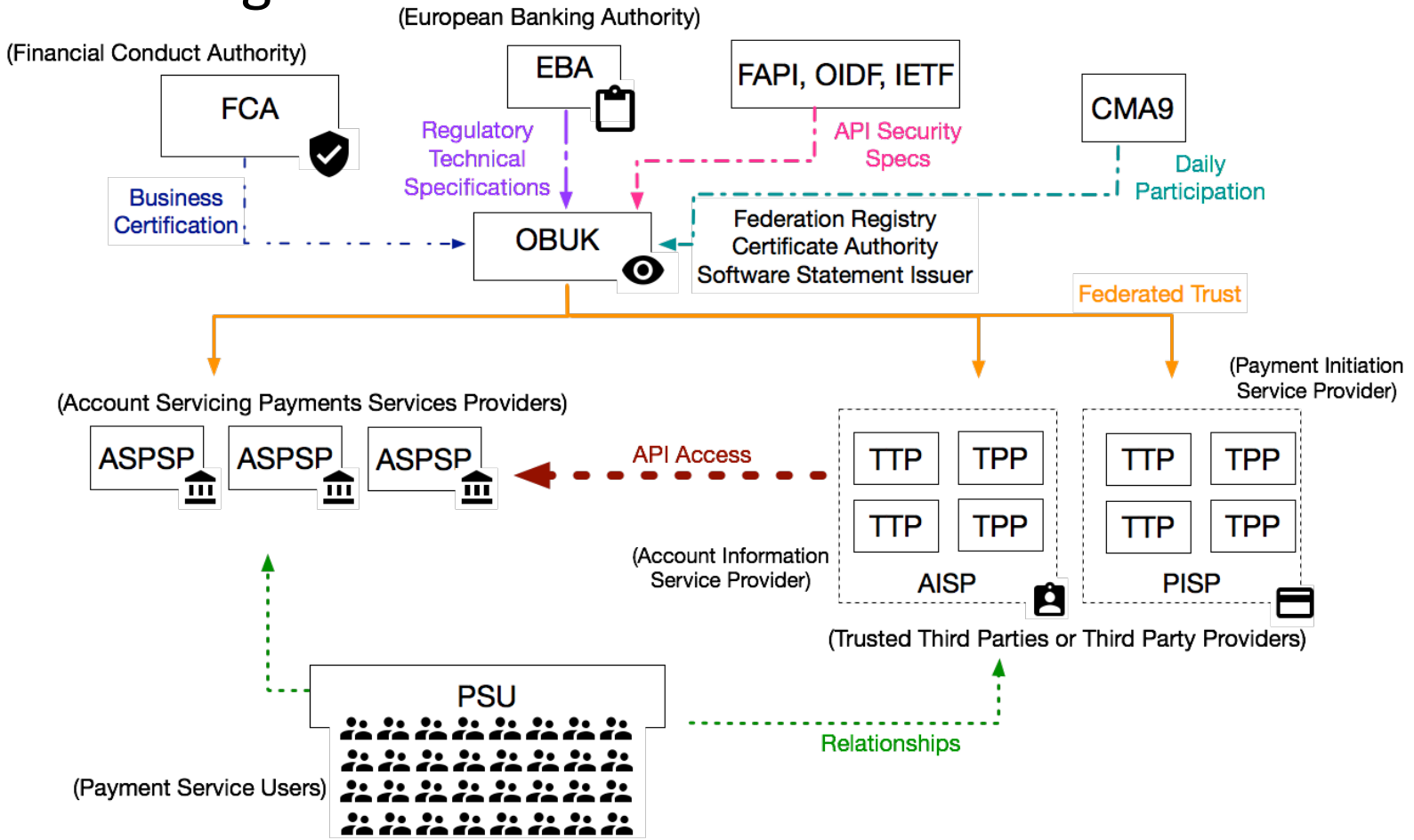


* Entities can play multiple roles

UK OpenBanking: A Competent Authority

- A jointly funded effort of the 9 largest financial institutions in the UK by parliamentary edict
  - "CMA 9" hold > 90% of the UK's financial accounts
  - Mandated to implement Jan 13 2018
  - Deadline for challenger banks is September
  - Nobody has enough time
- OBUK: https://www.openbanking.org.uk

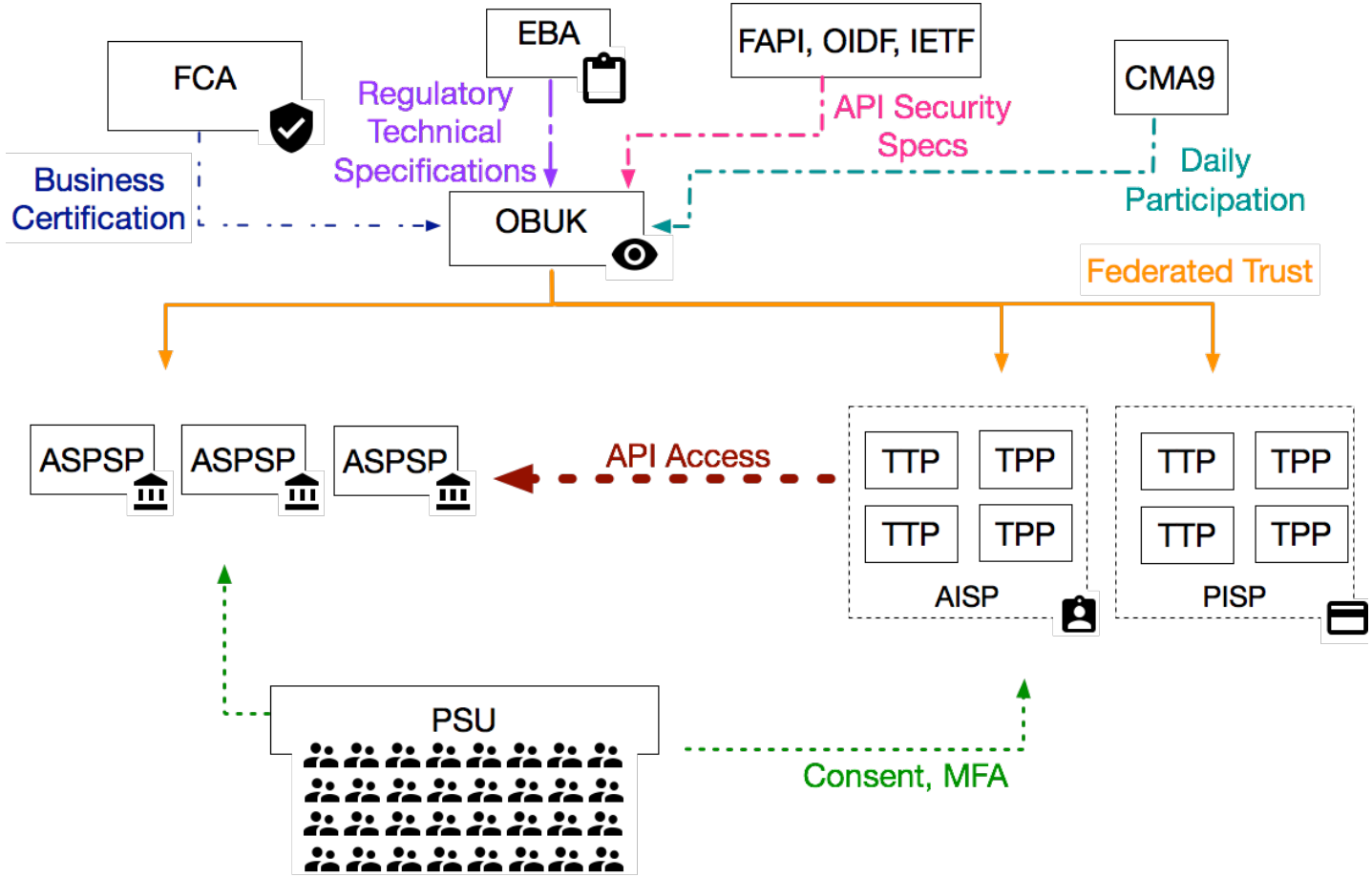
OpenBanking UK World



OpenBanking UK Invested in Standards

- OAuth2 and OpenID Connect selected
  - Participants do not have to build bespoke solutions, they can utilize off-the-shelf platforms and services (if they want to)
  - The solution naturally leverages an already mature threat model
  - Vendors can rationalize investment as serving more than just one vertical
  - The solutions are not ingrown, they receive scrutiny from everywhere

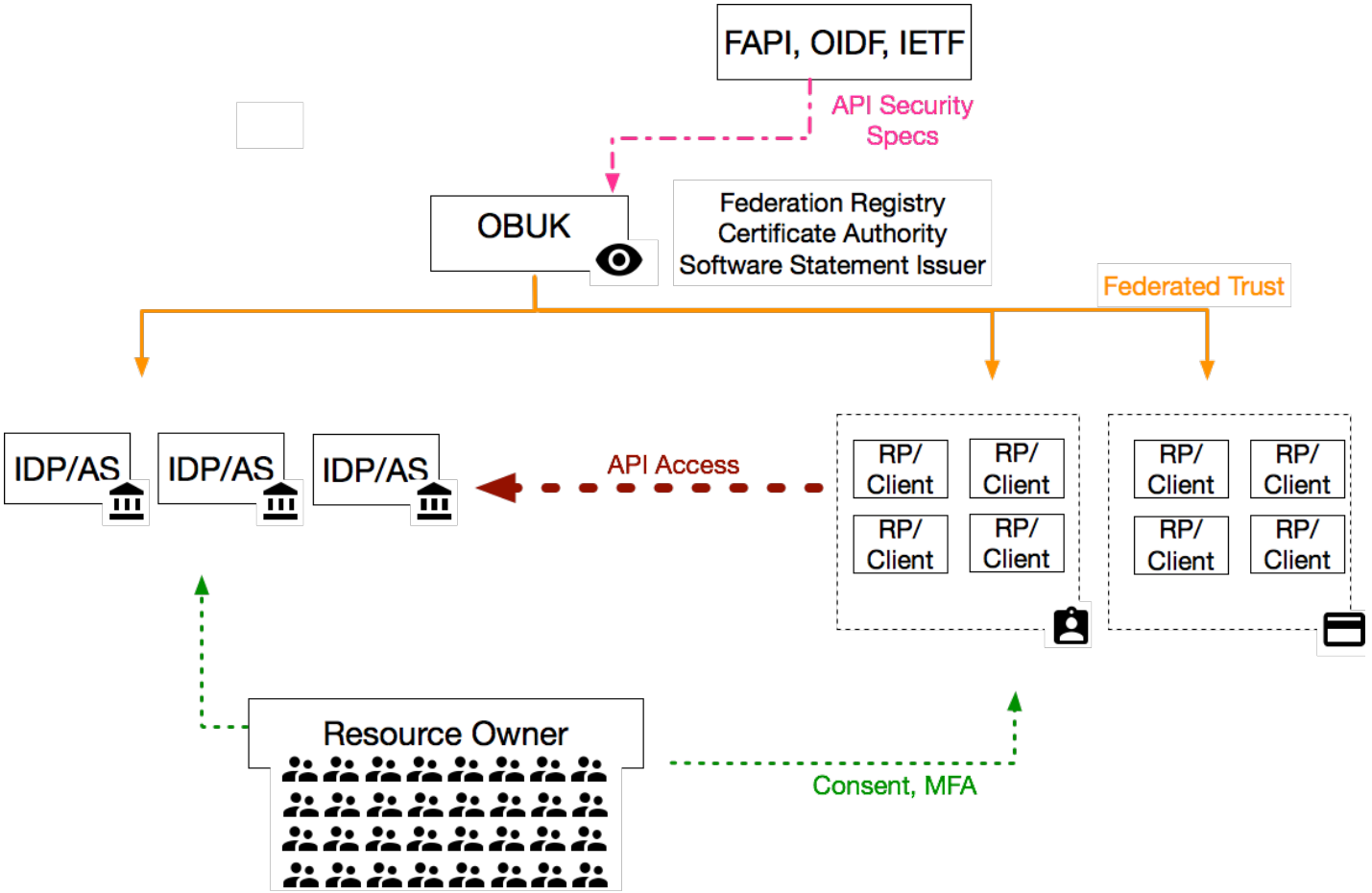
OpenBanking UK World



Why OpenID Connect?

- OAuth 2.0 standardizes a request for an access token
- OpenID Connect standardizes request and format for identity assertions
  - Format of an assertion, including issuer, destination, encryption/signing, and claims
  - An endpoint where assertion data can be accessed
  - Description of the authentication instant
  - Additional identity-grade security requirements (HTTPS)
- OpenID Connect layered on top of OAuth 2.0 makes OAuth 2.0 both interoperable and certification-capable

Standards World



FAPI Profiles

- Financial API WG at the OpenID Foundation
  - Working towards a financial API profile that can work worldwide
  - FAPI read-only and read-write profile tunes OpenID Connect
- OB Profiles (Security & Dynamic Client Registration)
  - Further profile FAPI specifically for OB
  - Initially developed by the OBIE but moved into a standards arena

Problems & Pushes: Layer 3/7 Integration

- Banks use Mutually Authenticated TLS. A lot. Everywhere.
  - Desirable as foundation to OB API Security
  - Not mature spec-wise (at the time)
    - Version 00 extension draft (now at v7)
    - Required layer 3/7 to talk
    - Group preferred MTLS and client secret
      - OAuth spec explicitly states there can be only one client authentication method
- V7 draft: https://datatracker.ietf.org/doc/draft-ietf-oauth-mtls/

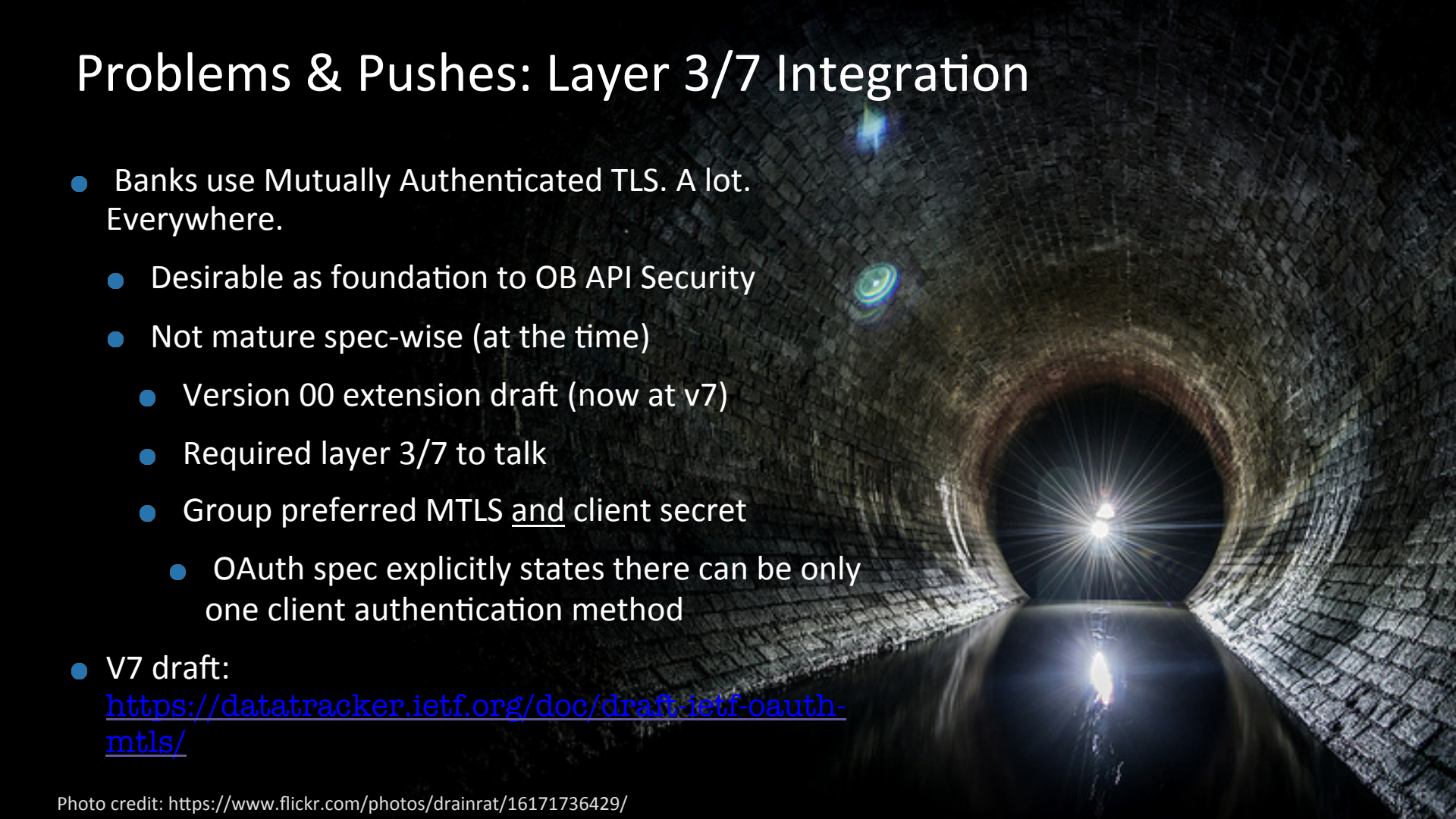


Photo credit: https://www.flickr.com/photos/drainrat/16171736429/

Problems & Pushes: Communicating Intent

- Requirement to tie incoming requests to a transaction context
- OpenID Connect Request objects allow context to be included in requests
  - Signed request objects
  - Very little vendor support at the time
  - Request objects act as hints

Problems & Pushes: Transitive Trust at Scale

- Financial Institutions are not in charge of deciding who can register a client
  - Requirement to support a possibly staggering number of independent clients in the long term
- RFC 7591 - Dynamic Client Registration
  - A standardized endpoint enabling clients to register their metadata with an authorization server in return for a client credential
  - Supports presentation of a ‘software statement’

Photo credit: www.flickr.com/photos/stincodiporco/39447341885

RFC 7591

1.3. Protocol Flow

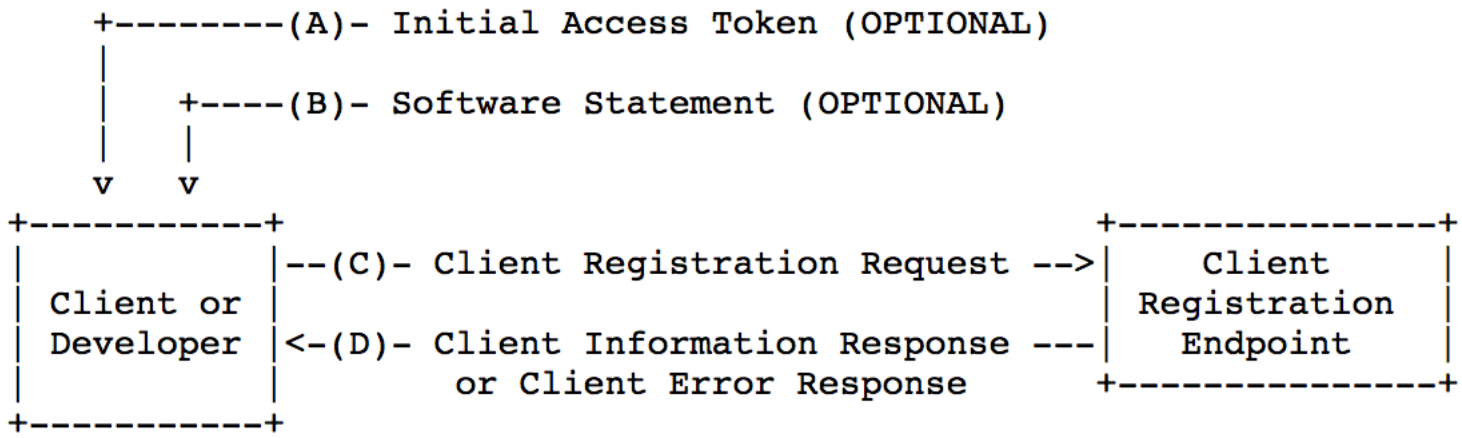
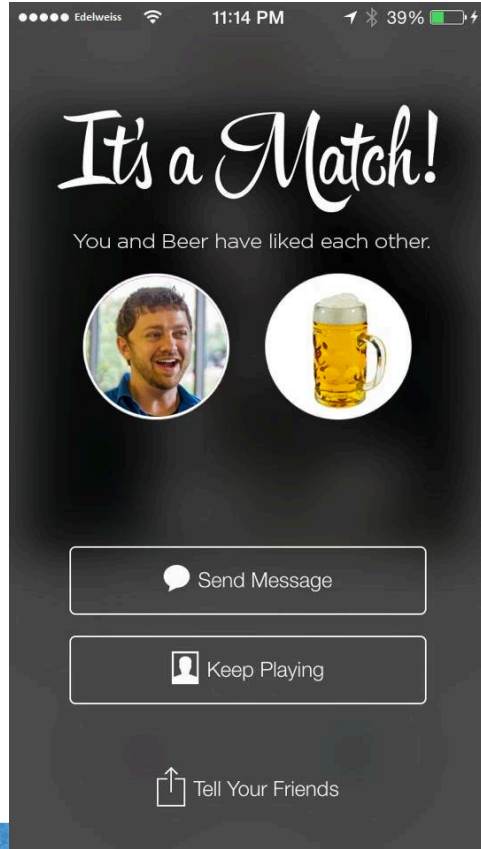


Figure 1: Abstract Dynamic Client Registration Flow

OAuth 2 & OpenID Connect Dynamic Profiles are like swiping right

Dynamic automation is all about negotiating metadata

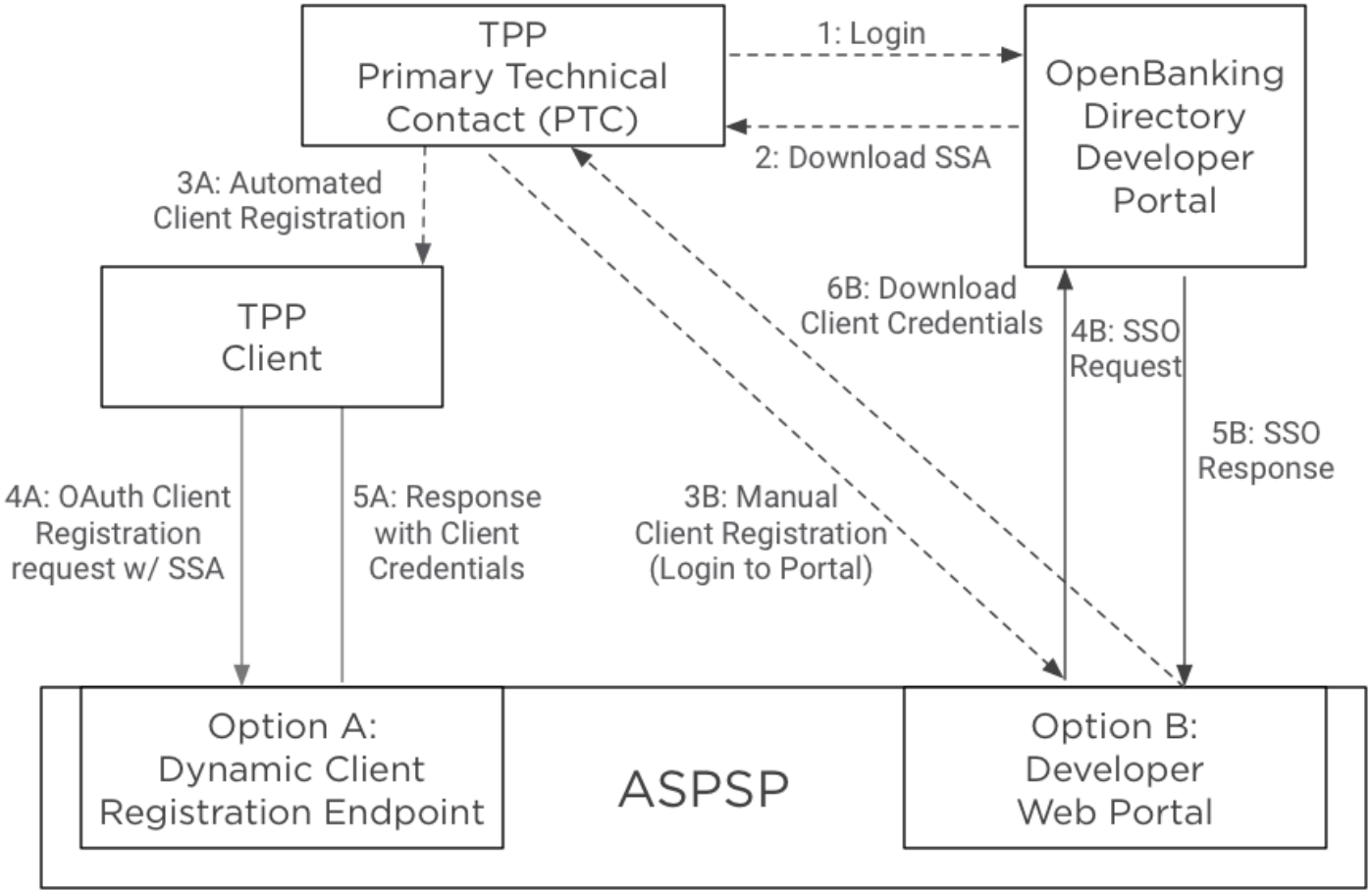
1. Supported IDP/AS capabilities are advertised at a discovery endpoint
2. A Client/RP requests a relationship with the AS/IDP by asserting metadata about itself including which of the supported capabilities it will use to engage
3. The IDP/AS responds to the request and tells the client what client_id and other metadata was registered
4. In a success situation, the Client/RP then proceeds to use the registered metadata to successfully request tokens from the IDP/AS



Software Statements constrain the Dating Pool to vetted clients

- A valid assertion from a recognized authority is the pre-requisite to making the request
- Some or all metadata comes from the assertion rather than the client request
- OpenBanking UK software statements describe 1) the authority, 2) the organization, 3) the software
- Organizations must register software and software metadata with the registry

OpenBanking Client Registration Overview (Options A, B)



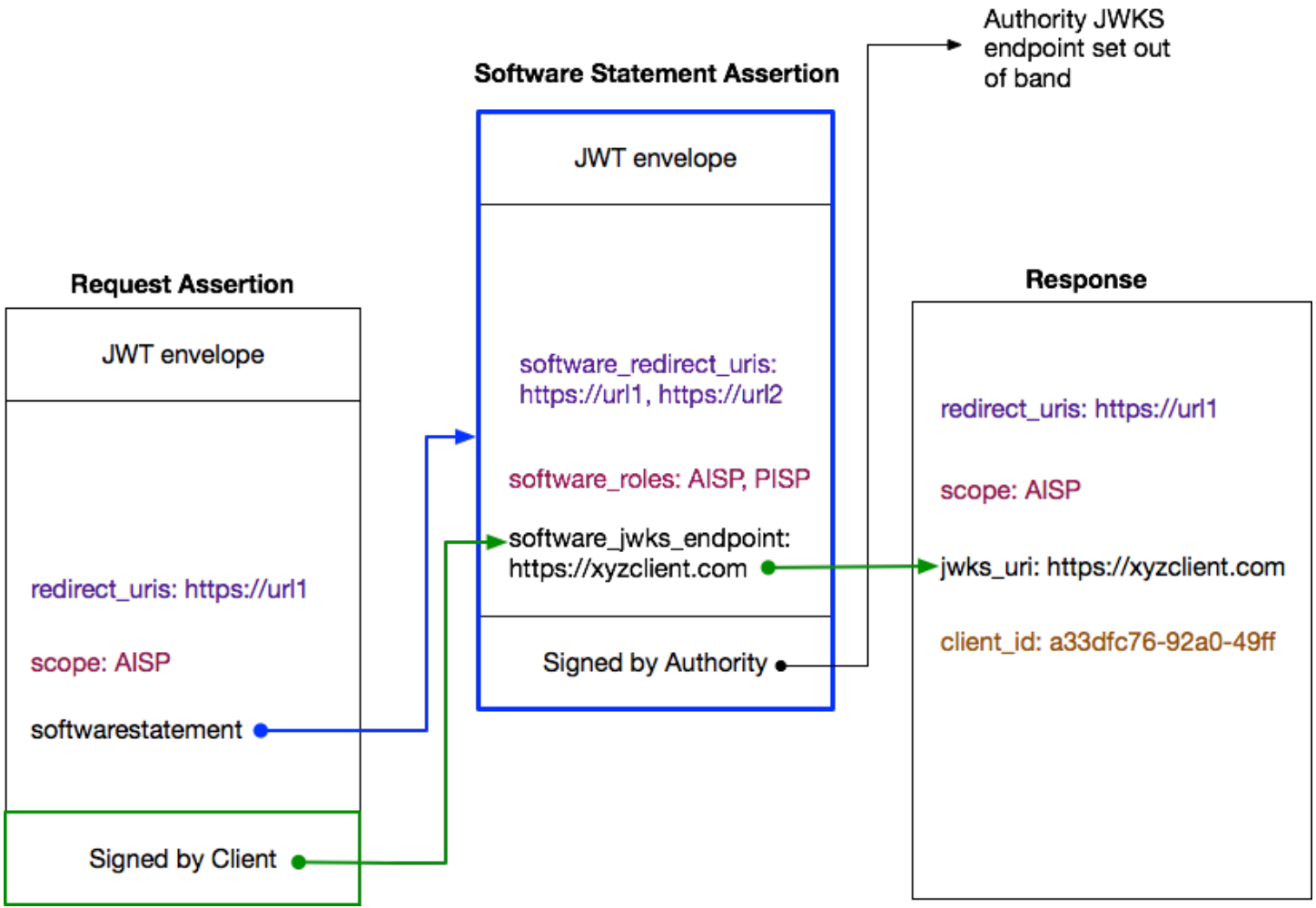
Dynamic Client Reg Challenges

- Spec development, vendor development, and developer adoption had to happen simultaneously
  - !!!
- Metadata values specified in RFC 7591 were listed as optional in the software statement
  - OpenBanking treated the software statement as a business assertion, and defined schema analogous to but not the same as RFC 7591.
  - The result is a *lot* of additional rules and mapping for the ASPSP that wants to maintain RFC 7591 compliance
- OpenBanking wanted both the request and the software statement to be assertions. RFC 7591 only specifies the request as a POST.

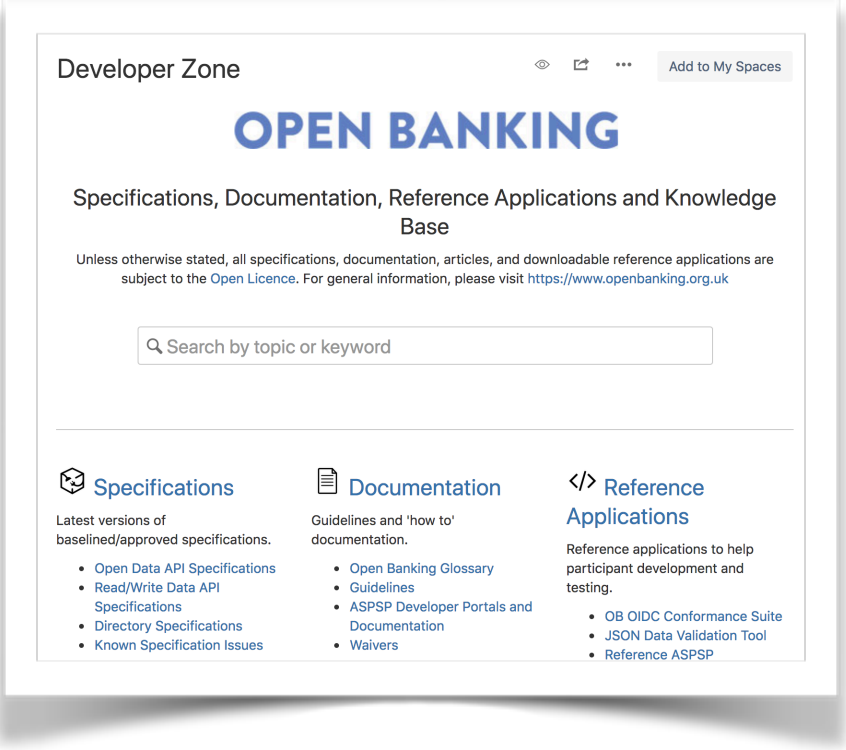
RFC 7591 Defined Metadata		OBUK Software Statement Metadata
Metadata	**Description**	
redirect_uris	Pre-authorized callback location(s)	software_redirect_uris, redirect_uris
grant_types	What is the client trading in?	
response_types	Thing returned from the authorization endpoint	
token_endpoint_auth_method	Credential used to retrieve tokens from the token endpoint	
jwks_uri	Client's public keys	software_jwks_endpoint
scope	Scopes to be used	software_roles
software_id	Unique id (by client about software)	software_id
client_name	Human readable description	software_client_name
		org_id
		org_jwks_endpoint

OBUK Example Software Statement


```
{
    "iss": "OpenBanking Ltd",
    "iat": 1492756331,
    "jti": "id12345685439487678",
    "software_id": "65d1f27c-4aea-4549-9c21-60e495a7a86f",
    "software_client_id": "OpenBanking TPP Client Unique ID",
    "software_client_name": "Amazon Prime Movies",
    "software_redirect_uris":
    [ "https://prime.amazon.com/cb", "https://prime.amazon.co.uk/cb" ],
    "software_roles": [ “PISP", "AISP" ],
    "org_id": "Amazon TPPID",
```


Authority JWKS endpoint set out of band
Software Statement Assertion
JWT envelope
software_redirect_uris: https://url1, https://url2
software_roles: AISP, PISP
software_jwks_endpoint: https://xyzclient.com
Signed by Authority
Request Assertion
JWT envelope
redirect_uris: https://url1
scope: AISP
softwarestatement
Signed by Client
Response
redirect_uris: https://url1
scope: AISP
jwks_uri: https://xyzclient.com
client_id: a33dfc76-92a0-49ff

So much excellent work



- Strong effort to work with industry
- Strong effort to educate and to be test-driven

https://openbanking.atlassian.net/wiki/spaces/DZ/overview?mode=global

- Amazing work in short timeframe

Where Might this Go?

- End-to-end open banking profile for non-browser interactions
  - Limited input and/or output
  - CIBA/FIDO/???
- Strong proof of possession
  - Based on authenticators
  - Token & Certificate Binding

Next Steps for Standards World

- Need a proper industry profile for dynamic client registration via transitive trust
  - Can Certificate-bound access tokens get rid of the current chained assertions issue (and therefore restore the profile to compliance with 7591)?
  - Can we assert a schema within software statements so that compliance gets easier
  - This should work for any authority
- Conformance should be front and CENTER

Apply UK OpenBanking to YOUR World

- Check your API Strategy
  - Are you passing user credentials on every API fetch?
  - Or are you using a standards-based API security strategy?
- How badly can your clients act?
  - Consider using the OpenID Foundation open source certification tests (even if unofficially)
- What is your client authentication mechanism?
  - Jwt-private and MTLS offer big benefits
- What is <u>your</u> version of SCA?
  - If you aren't using MFA you are in a world of hurt
    - Start with your admins if you have to

Standards ❤ You

Resources

- OpenBanking UK Developer Zone

  https://openbanking.atlassian.net/wiki/spaces/DZ/overview

- OpenBanking FAPI Profiles (in Bitbucket)

  https://bitbucket.org/openid/obuk

- OpenID Foundation Certification Page

  http://openid.net/certification

- EBA PSD2 Start Page

  https://www.eba.europa.eu/regulation-and-policy/payment-services-and-electronic-money

- Twitter - @pamelarosiedee @openid @UKOpenBanking