PIKA: Proof of Issuer Key Authority

OAuth interim meeting
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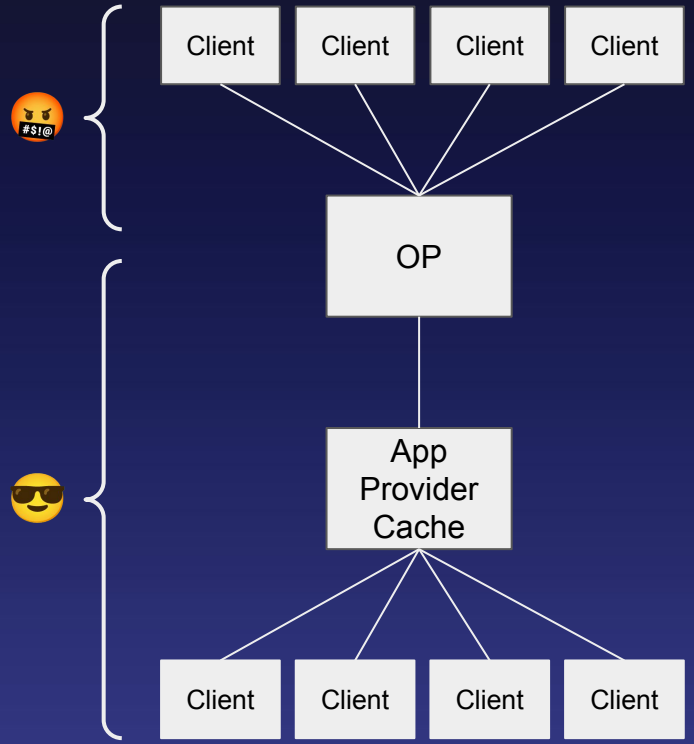
Today's JWT lifecycle can sometimes be problematic

What if JWK Set is unavailable?

- Key has been rotated
- Server is down

Use case: Applications using Verifiable Credentials

- Application software directly verifying signatures from OP when joining a session
  - No real caching of OP keys
  - Highly sensitive to OP downtime or latency
  - Many hits to JWK set endpoint from distributed relying parties
- Goal: Have app server fetch OP keys once and redistribute them to all relying parties
  - … without trusting the app server!



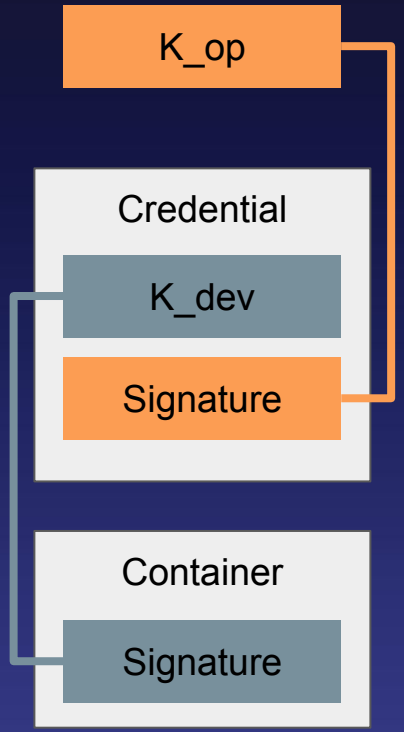
Use case: Durable Signing (e.g. of Containers)

Goal: App wants to know that at some past time T:

- Container was signed by Developer with K_dev
- OP signed a credential using K_op associating K_dev with Developer
  - E.g., VC or OpenPubkey PK Token

Solution (partial):

- Assume a time-stamping authority TSA attesting “X existed at time T”
- TSA can prove that K_op and credential *existed* at time T
- **How can we verify that the OP was using key K_op at time T? (*“issuer key authority”*)**



PIKA Chain of Trust

Given similar requirements to OpenID Federation, we re-use the Federation Historical Keys Response format as a base format for PIKAs.

Sample PIKA

```
JWT Header:
   {
     "alg": "ES256",
     "typ": "JWT",
     "x5c": ["MII..."]
   }

   JWT Payload:
   {
     "iss": "https://server.example.com",
     "iat": 123972394272,
     "exp": 124003930272,
     "keys":
       [
         {
           "kty": "EC",
           "crv": "P-256",
           "alg": "ES256"
           "x": "qiGKLwXRJmJR_AOQpWOHXLX5uYIfzvPwDurWvmZBwvw",
           "y": "ip8nyuLpJ5NpriZzCVKiG0TteqPMkrzfNOUQ8YzeGdk"
           "kid": "2HnoFS3YnC9tjiCaivhWLVUJ3AxwGGz_98uRFaqMEEs",
           "iat": 123972394872,
           "exp": 123974395972
         },
         {
           "kty": "RSA",
           "n": "ng5jr...",
           "e": "AQAB",
           "kid": "8KnoFS3YnC9tjiCaivhWLVUJ3AxwGGz_98uRFaqMJJr",
           "iat": 123972394872,
           "exp": 123974394972
           "revoked": {
             "revoked_at": 123972495172,
             "reason": "keyCompromise",
             "reason_code": 1
           }
         }
       ]
   }

   JWT Signature:
   // Signature over JWT Header and Claims, as defined in RFC 7519
```

X.509 certificates chain to root of WebPKI

Validity interval of the PIKA

OP key

Validity interval for *signing* with OP's key

Another OP key

Signature using key in X.509 cert

Results of Adoption Call v1

Core value / interest in solving the problem: ✅

Issue 1: Use of PKI at the application layer (“x5c”)

- … as opposed to at the transport layer, for HTTPS
- PIKA bucks the long term trend away from X.509 at the application layer
  - JWK, OpenID Connect, OpenID Federation, etc.
- Need to make sure that systems using PIKA have a clear upgrade/interop path to alternatives to application-level certificates (e.g., OpenID Federation)

Issue 2: Security considerations using Web PKI certificates for PIKA signing

- Web servers might have different risks than PIKA-signing servers
- Compromise of a web server could allow the issuer to sign a PIKA
- Solution space: domain name prefix, lifetime limitation, …

Adoption Call v2?

Core value / interest in solving the problem: ✅

Do we have enough clarity to believe the issues are solvable?