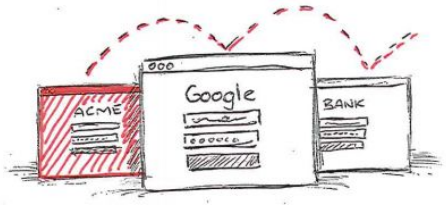
fido alliance | simpler stronger authentication

U2F - Universal 2nd Factor

Alexei Czeskis
(Google)


password
server

password == bearer token



REUSED

PHISHED

INTERCEPTED

KEYLOGGED

Today's solution: One time codes: SMS or Device

SMS USABILITY

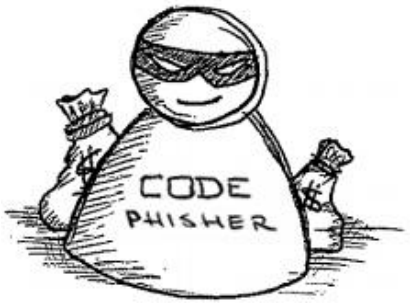
Coverage Issues - Delay - User Cost

DEVICE USABILITY

One Per Site - Expensive - Fragile

USER EXPERIENCE

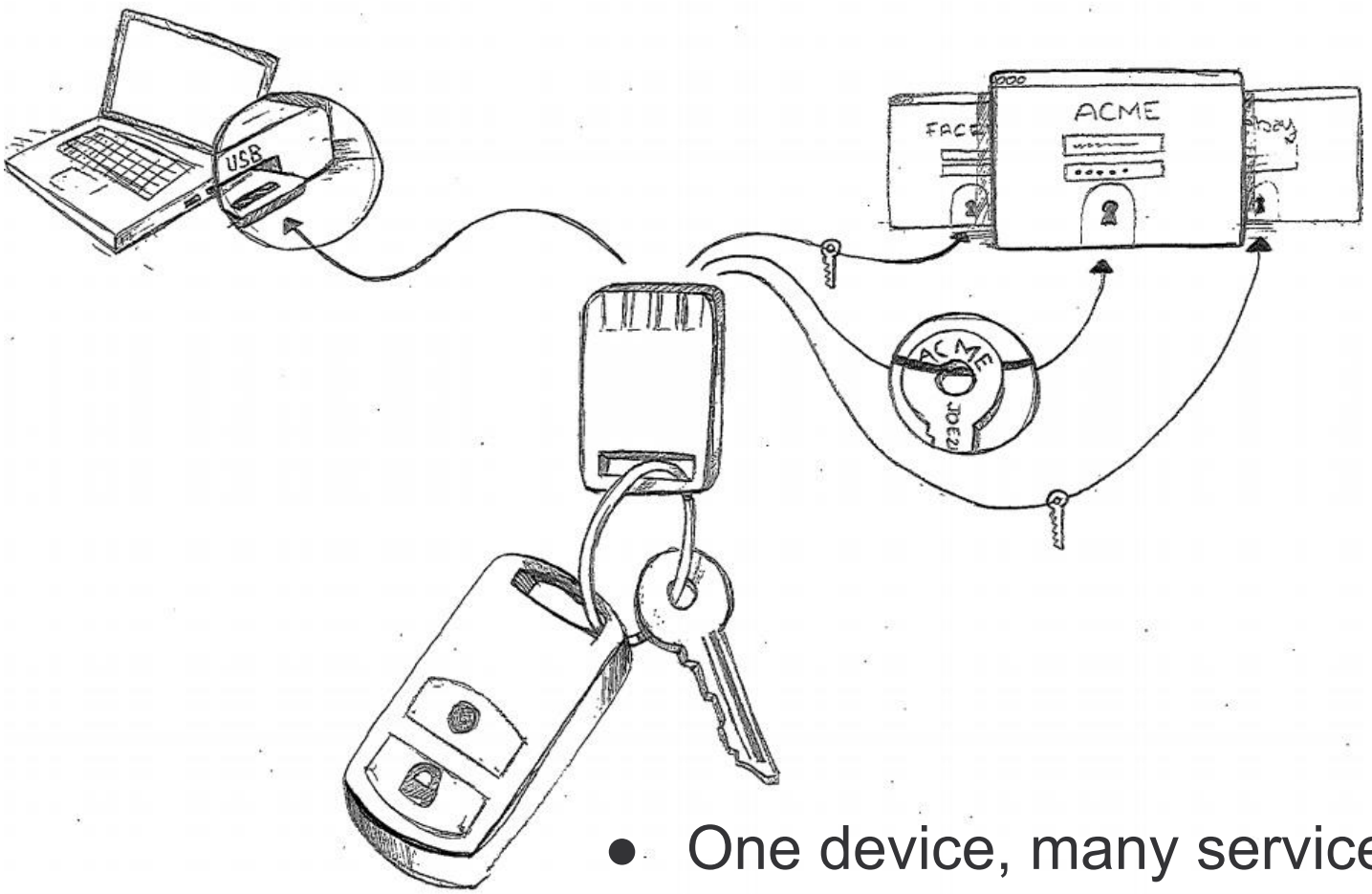
Users find it hard



PHISHABLE

Easy to steal

The U2F solution: How it works



- One device, many services
- Easy: Insert and press button
- Safe: Un-phishable Security

U2F Protocol

Core idea: Standard public key cryptography:

- User's device mints new key pair, gives public key to server
- Server asks user's device to sign data to verify the user.
- **One device, many services, "bring your own device" enabled**

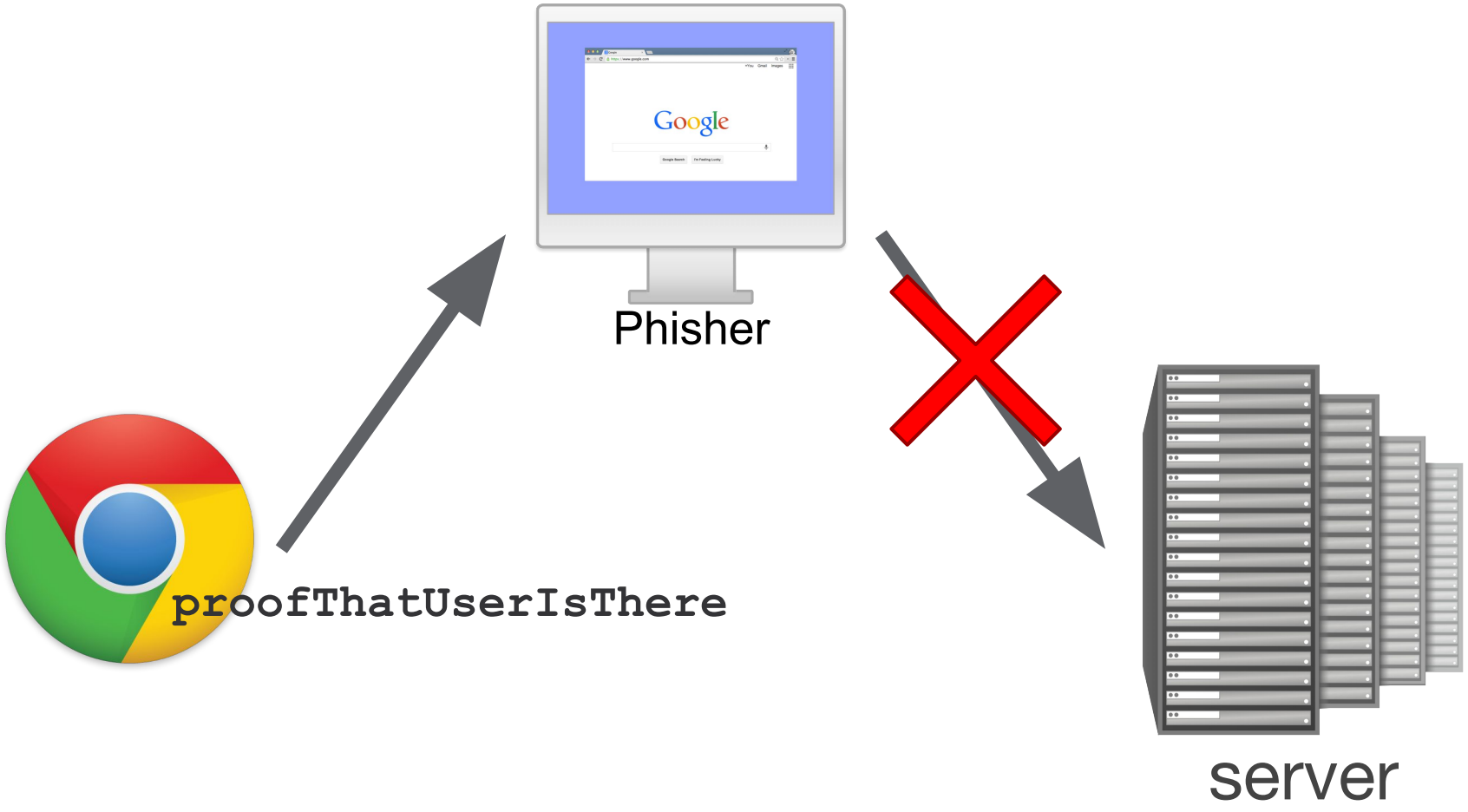
Lots of refinement for this to be consumer facing:

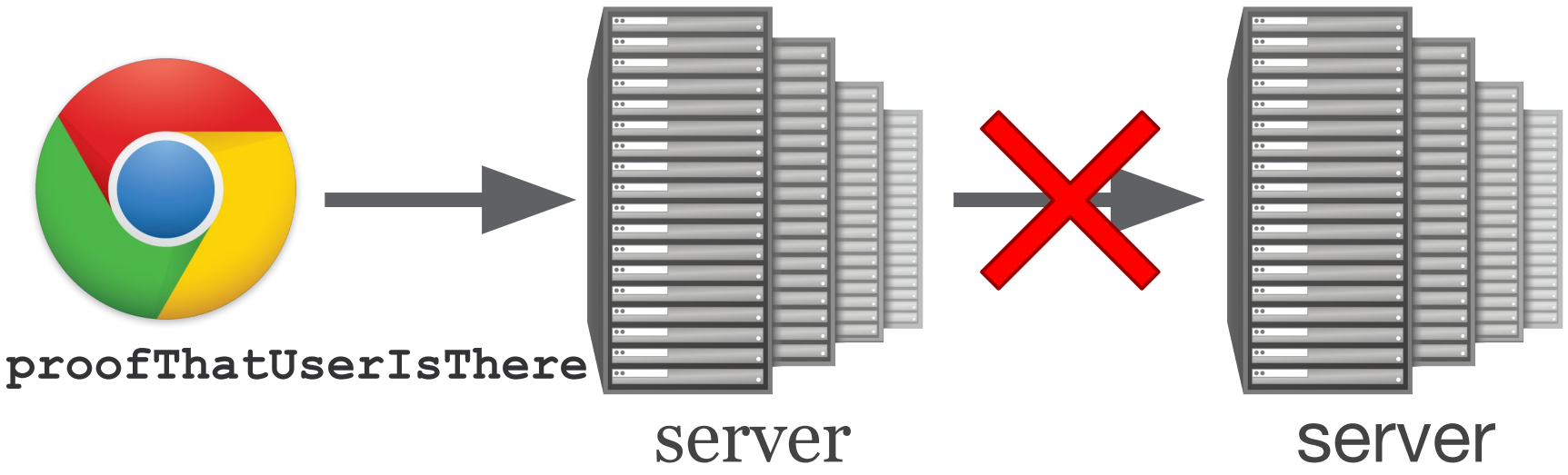
- **Privacy**: Site Specific Keys, No unique ID per device
- **Security:** No phishing, man-in-the-middles
- **Trust:** Verify who made the device
- **Pragmatics**: Affordable today, ride hardware cost curve down
- **Speed for user:** Fast crypto in device (Elliptic Curve)

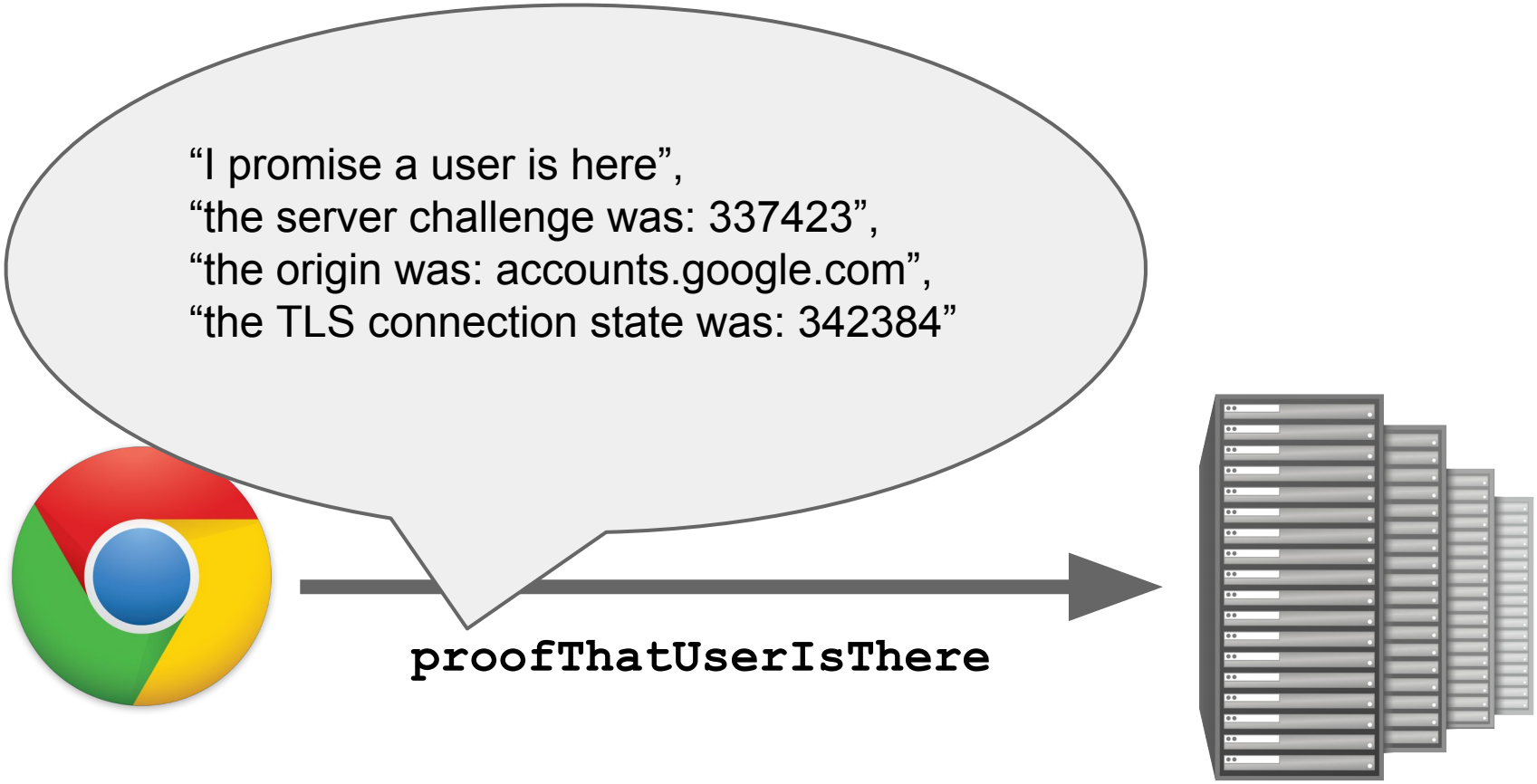
Think "Smartcard re-designed for modern consumer web"

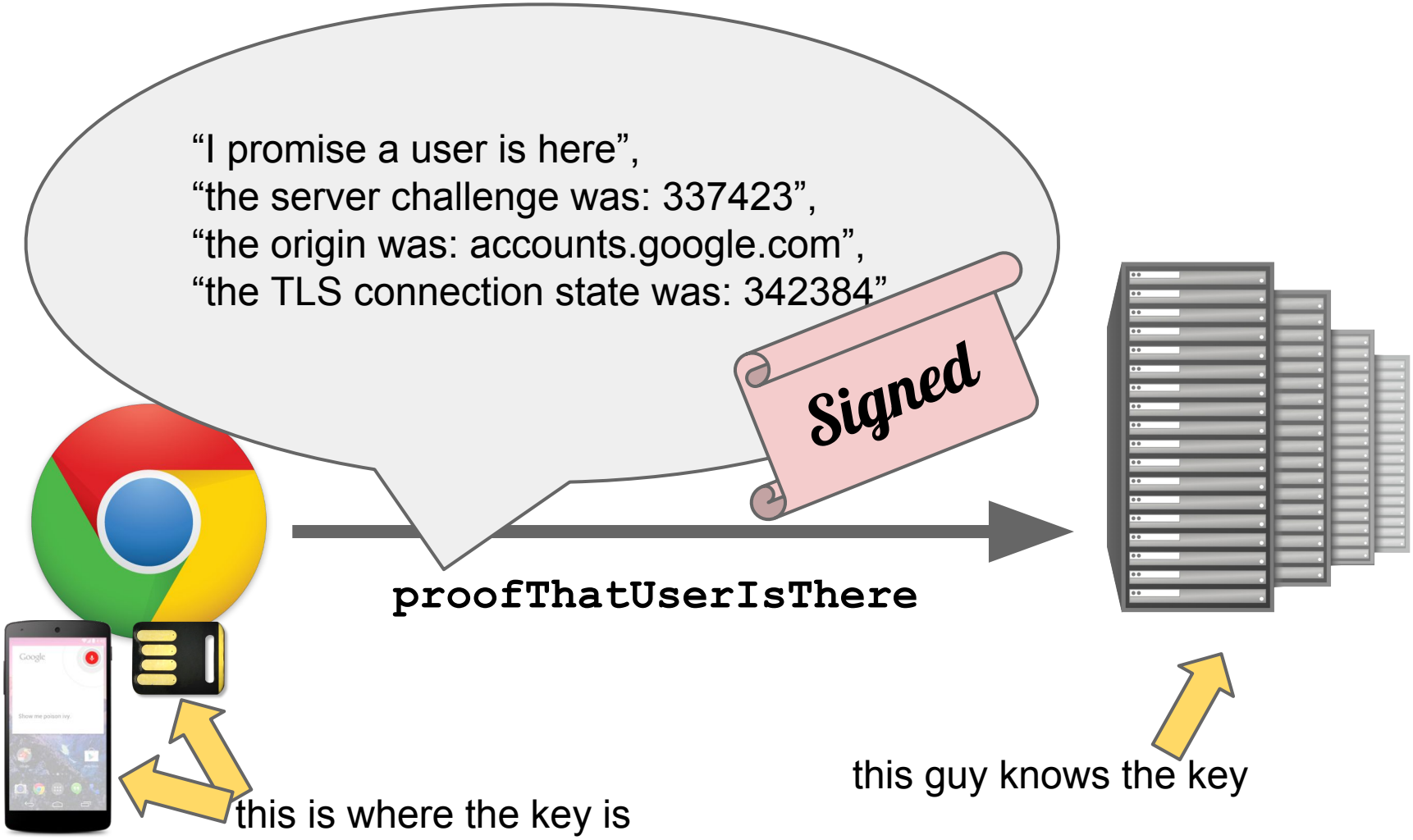
DEMO

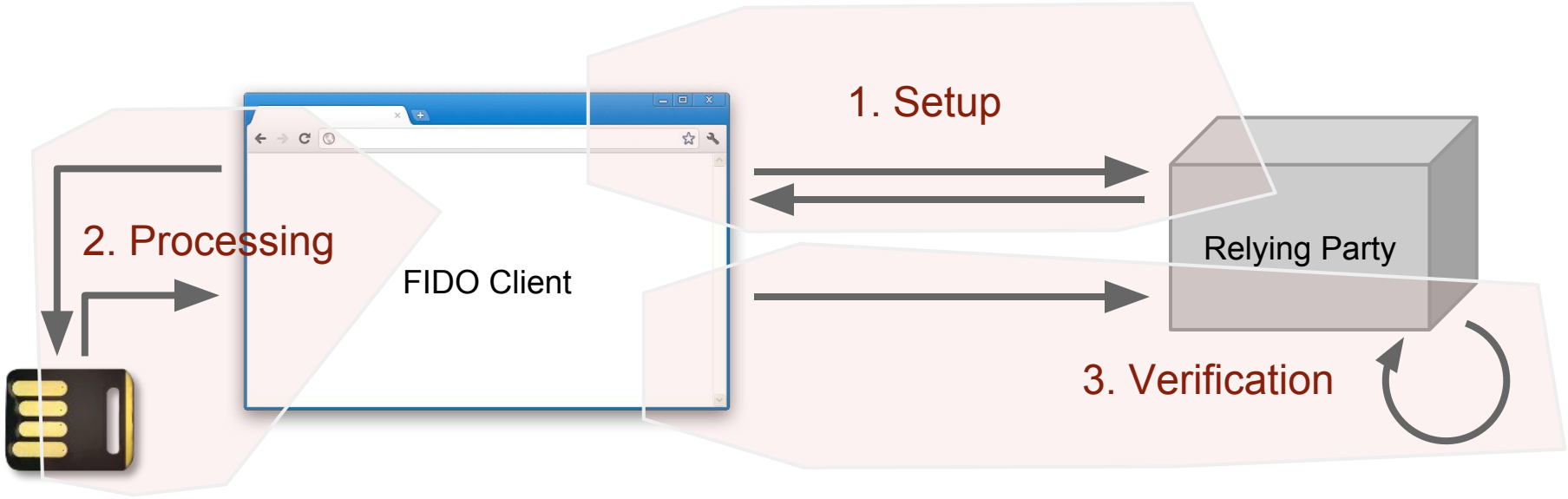

password
server


Google
Phisher
proofThatUserIsThere
server

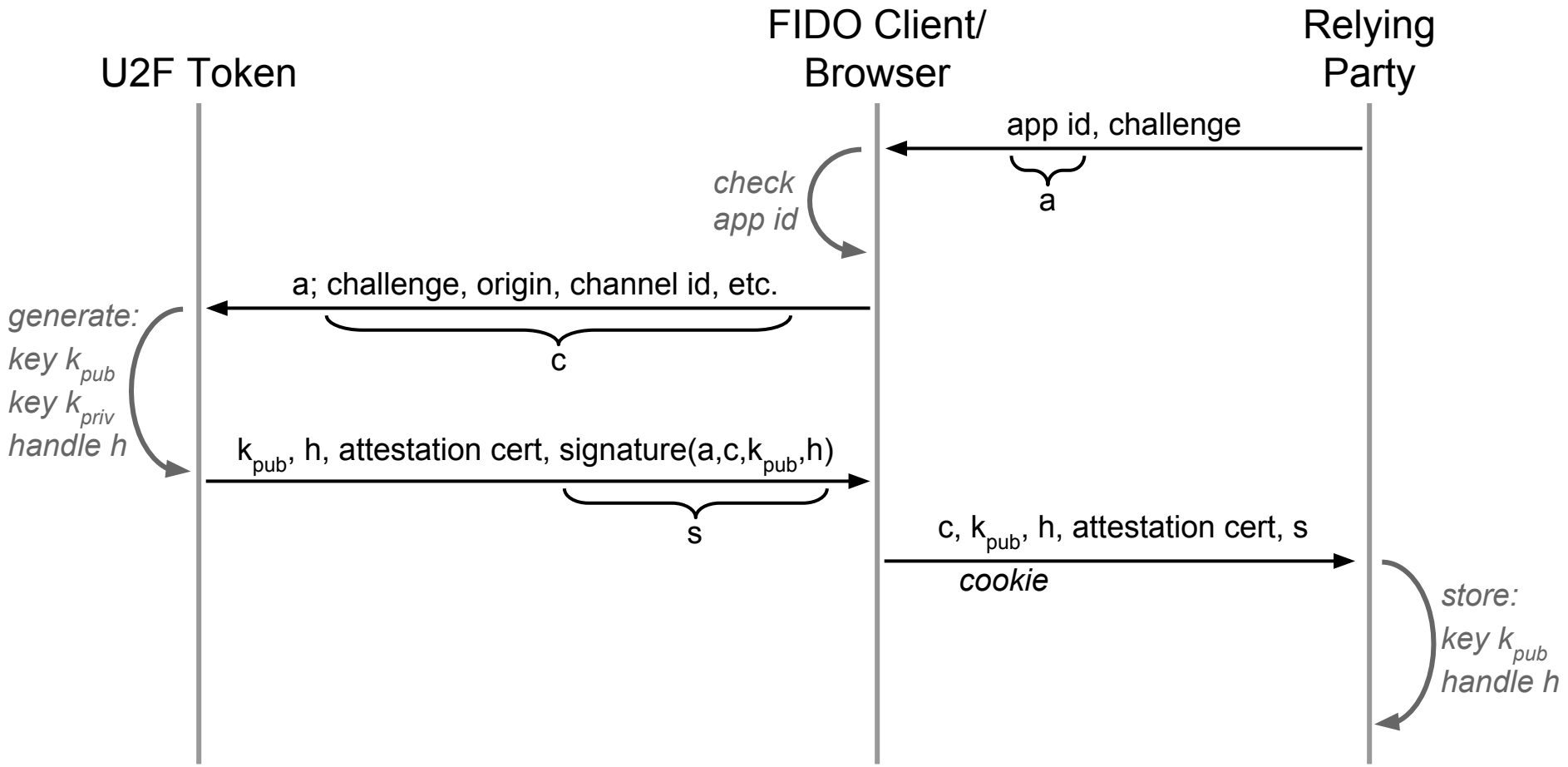

proofThatUserIsThere
server
server


“I promise a user is here”,
“the server challenge was: 337423”,
“the origin was: accounts.google.com”,
“the TLS connection state was: 342384”
proofThatUserIsThere

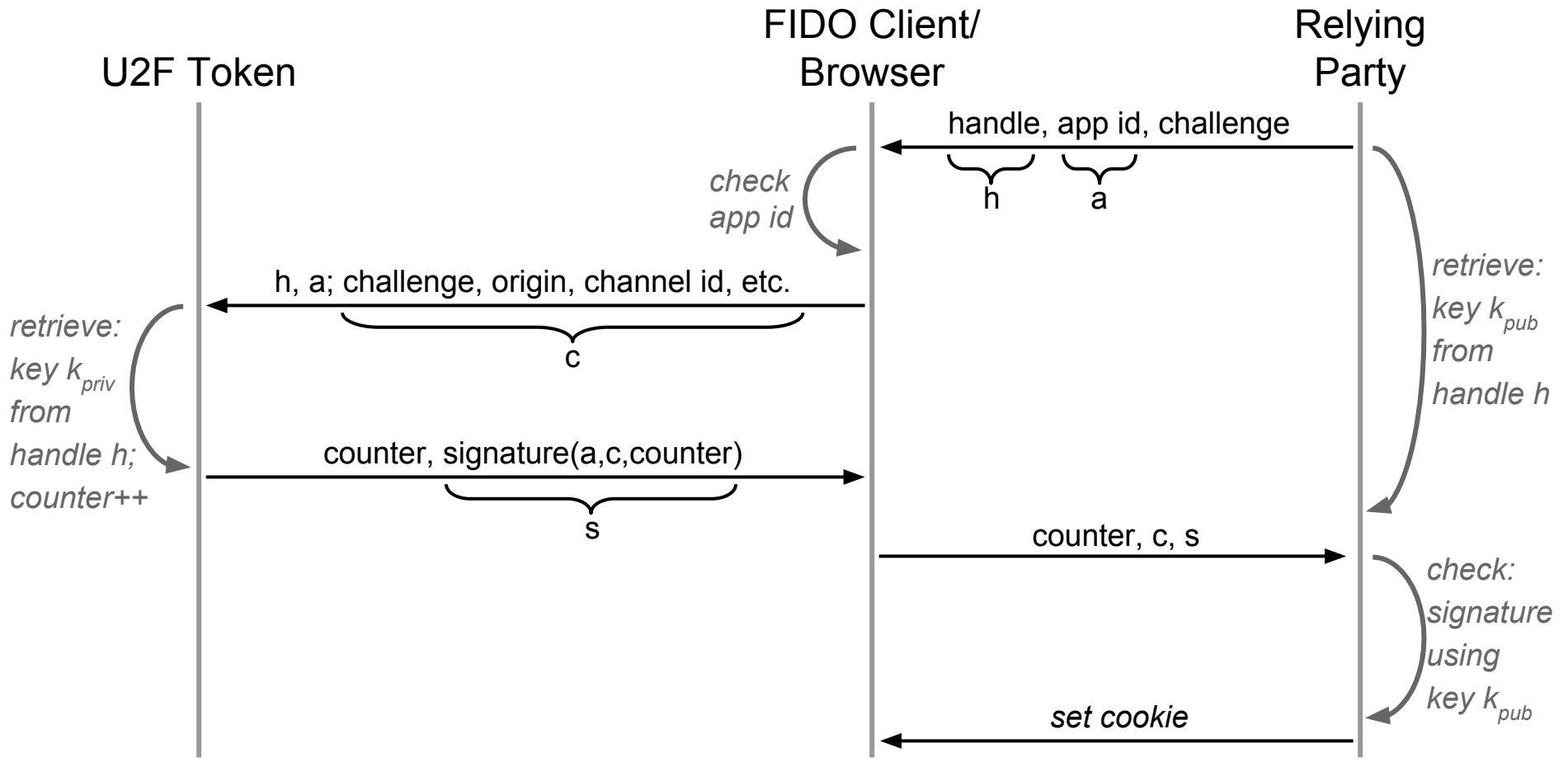

"I promise a user is here",
"the server challenge was: 337423",
"the origin was: accounts.google.com",
"the TLS connection state was: 342384"
Signed
proofThatUserIsThere
this is where the key is
this guy knows the key


1. Setup
2. Processing
FIDO Client
Relying Party
3. Verification

Registration



Authentication



User Presence API

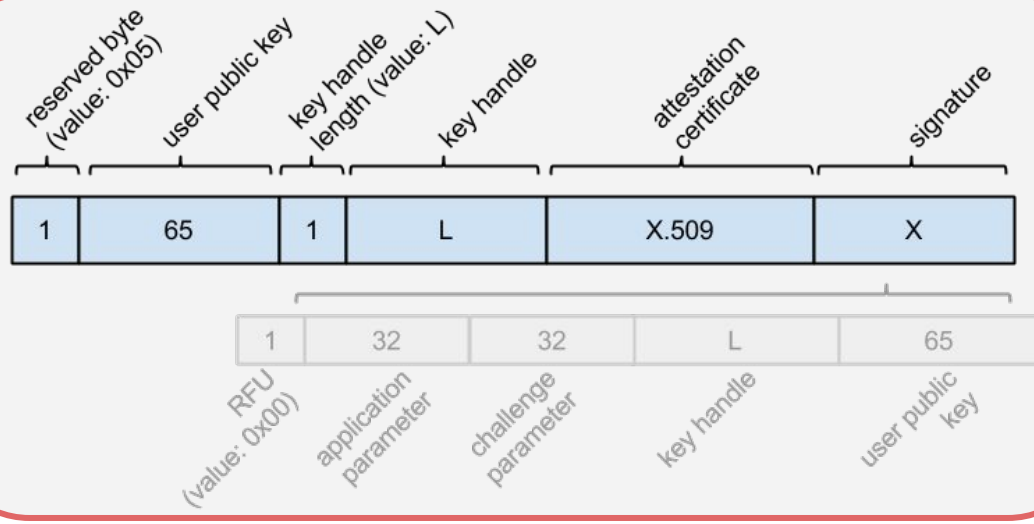
```
u2f.register([{
    'version' : 'U2F_V2',
    'challenge': 'KSDJsdASAS-AIS_AsS',
    'appId': 'https://www.google.com/facets.json'
  }], callback);

callback = function(response) {
  sendToServer(
    response['clientData'],
    response['registrationData']);
};
```

User Presence API

```
u2f                                                    .json'
  }
callback = fu                 (resp
  sendToServer(
    response['clientD
    response['registrat
};
```

```
{
  "typ":"register",
  "challenge":"KSDJsdASAS-AIS_AsS",
  "cid_pubkey": {
    "kty":"EC",
    "crv":"P-256",
    "x":"HzQwlfXX7Q4S5MtCRMzPO9tOyWjBqRl4tJ8",
    "y":"XVguGFLIZx1fXg375hi4-7-BxhMljw42Ht4"
  },
  "origin":"https://accounts.google.com"
}
```



User Presence API

```
u2f.sign([{
     'version' : 'U2F_V2',
     'challenge': 'KSDJsdASAS-AIS_AsS',
     'appId': 'https://www.google.com/facets.json',
     'keyHandle': 'JkjhdsfkjSDFKJ_ld-sadsAJDKLSAD'
  }], callback);

callback = function(response) {
  sendToServer(
    response['clientData'],
    response['signatureData'],
    response['keyHandle']);
};
```

User Presence API

```
u2f.sign([{
     'version' : 'U2
     'challenge': 'R
     'appId': 'https
     'keyHandle': 'J
  }], callback);

callback = function(r      se) {
  sendToServer(
    response['clientData'],
    response['signatureData'],
    response['keyHandle']);
};
```

```
{
  "typ":"authenticate",
  "challenge":"KSDJsdASAS-AIS_AsS",
  "cid_pubkey": {
    "kty":"EC",
    "crv":"P-256",
    "x":"HzQwlfXX7Q4S5MtCRMzPO9tOyWjBqRl4tJ8",
    "y":"XVguGFLIZx1fXg375hi4-7-BxhMljw42Ht4"
  },
  "origin":"https://accounts.google.com"
}
```

What if…
...I want to accept U2F logins?

- Browser: Call JS APIs
  - native APIs since Chrome 41+
- Server: Implement registration flow
  - decide how to handle attestation certificates
  - verify registration response
  - store public key, key handle with user account
- Server: Implement login flow
  - check username/password, look up key handle
  - verify authentication response (origin, signature, counter, …)
- Check your account recovery flow

What if…
...I want to offer a USB U2F token?

- Implement ECDSA P-256
- Implement counter
- Decide on key handle strategy
  - must recover private key, app id
- Implement USB framing spec
- No responses without user presence!
  - check that app id matches

What if…
...I want to offer a NFC/BLE/... token?

- Recently voted into Implementation Draft Status
  - Available on FIDO website
- Come join FIDO!

What if…
...I have a different token form factor?

- Come join FIDO!

Next Steps

Read the Specs: https://fidoalliance.org/specifications/download/ (U2F)

Get the Reference Source: https://github.com/google/u2f-ref-code/

Play with the Demo server: https://u2fdemo.appspot.com/

Get a Device: http://smile.amazon.com/ (search for *u2f*)

Thanks!