RSAConference2018
San Francisco | April 16 – 20 | Moscone Center

SESSION ID: SEM-M04

IDENTITY AND ACCESS MANAGEMENT:
Past/present/future, SAML, OAuth, FIDO, OIDC, other acronyms, and emerging trends

Brian Campbell

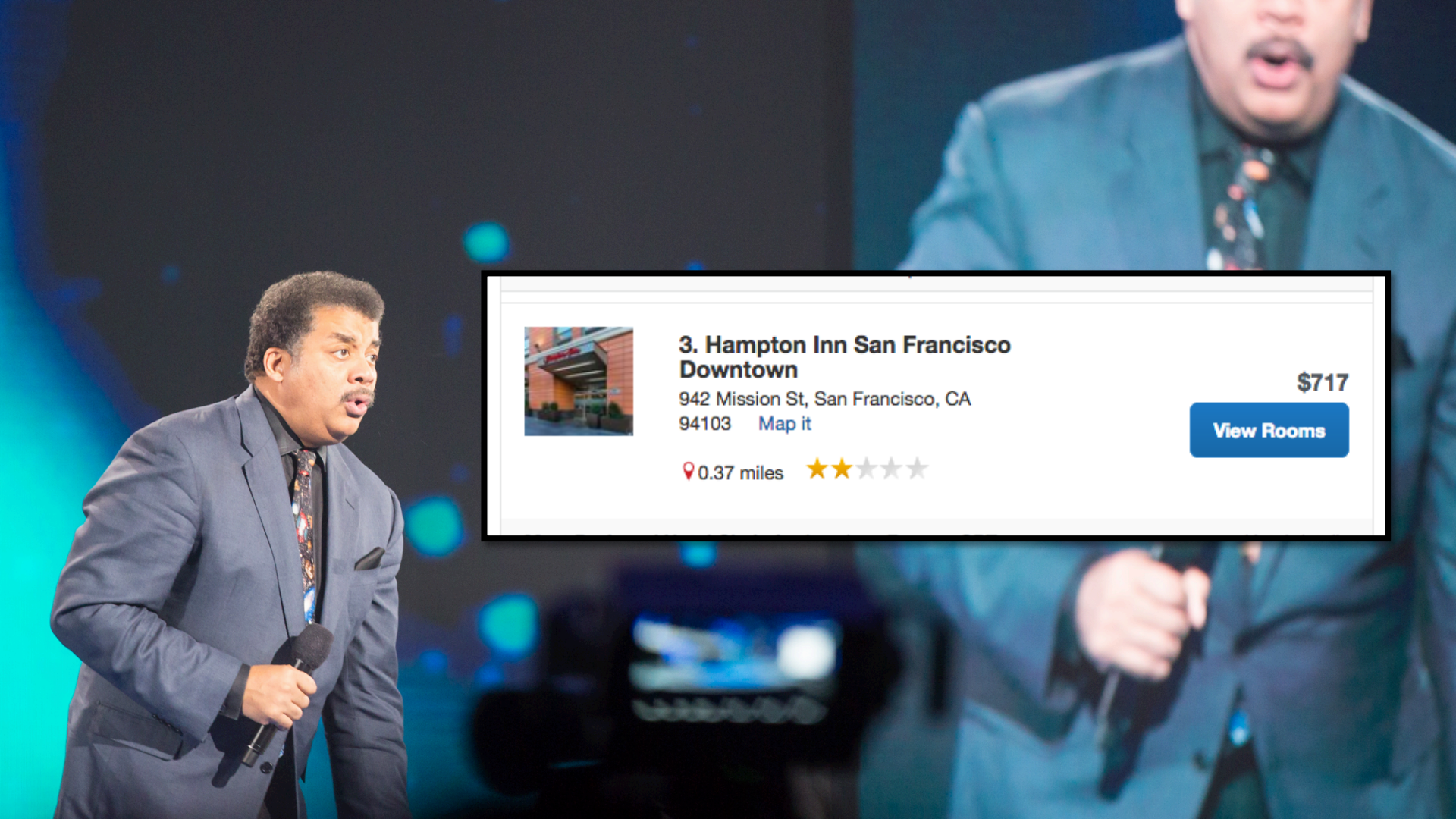
Distinguished Engineer
Ping Identity
@__b_c

About Me:

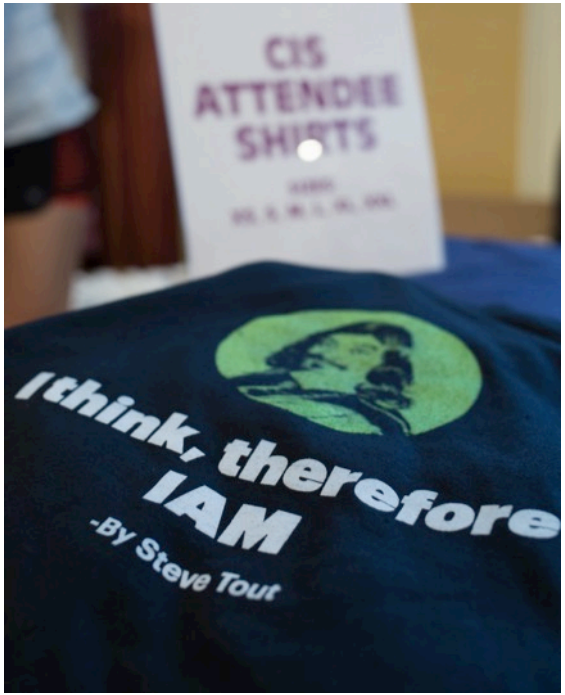
Distinguished Engineer at Ping Identity

Likes to take pictures


Welcome to
#RSAC!
00:00:17
RSAConference2017


3. Hampton Inn San Francisco Downtown
942 Mission St, San Francisco, CA
94103 Map it
0.37 miles
$717
View Rooms

I am going to talk about IAM



Identity and

Access

Management

let the right people access what they need

keep the wrong people out

1961: Password Invented

Back Where It All Begins

- Okay, passwords are ancient
- But first known computer use was in ‘61
  - at MIT for the Compatible Time-Sharing System
    - each user had a private set of files and allotment of computing time
- Even back then IAM was about the right people having access to the right things at the right time
- System defeated just one year later
  - request to print the password file offline

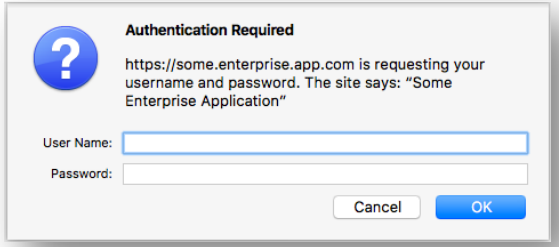
Sixteen years later I was born

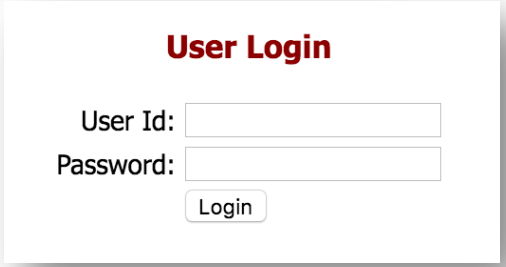
(not actually me)

And I’m a little hazy on what happened in that time

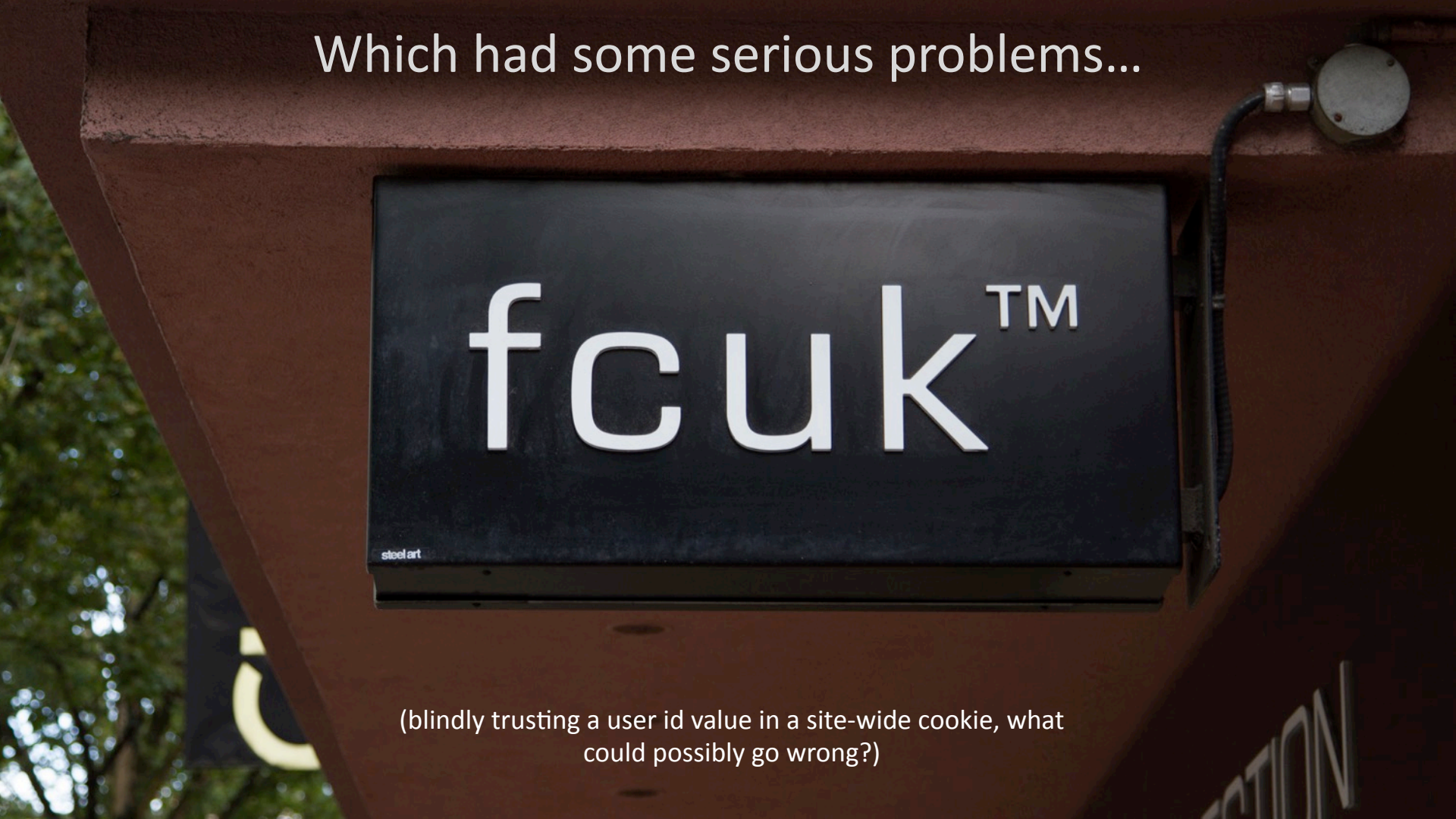
Twenty-Some Years Later

- The World Wide Web is Now a Thing
- HTTP Basic Authentication
  - Per application credentials
  - Centralized LDAP
  - credentials sent & checked on every request
- HTML form based login
  - Cookie based session established from login
  - Typically opaque value referencing server side memory
- Around this time I'd write my first single sign-on system…





Which had some serious problems…



(blindly trusting a user id value in a site-wide cookie, what could possibly go wrong?)

Luckily, competent people were also working on it

- Web Access Management (WAM) Products/Solutions
  - Single sign-on, authorization policy, and authentication management
  - Web sever agent (but sometimes also reverse proxies)
  - Domain-wide cookie (but secured unlike mine)
  - Centralized policy server
  - Typically deployed in
    - Large consumer web sites
    - Enterprise applications behind the firewall
  - Cross-domain solutions existed but proprietary & non-interoperable

Cross Domain Standardization Efforts Also Underway

OASIS

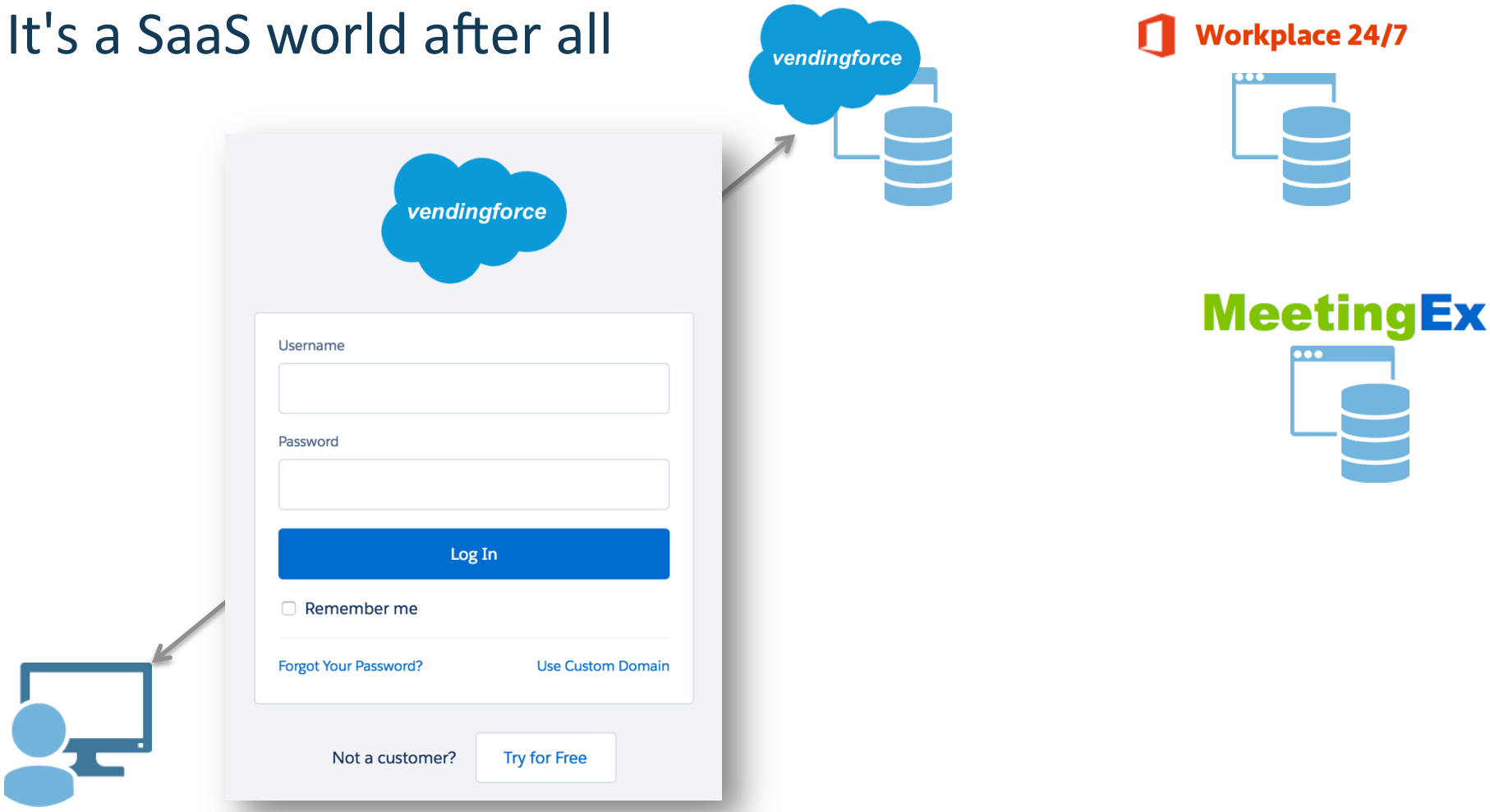
SAML 1.0, 1.1 & 2.0

LIBERTY ALLIANCE PROJECT

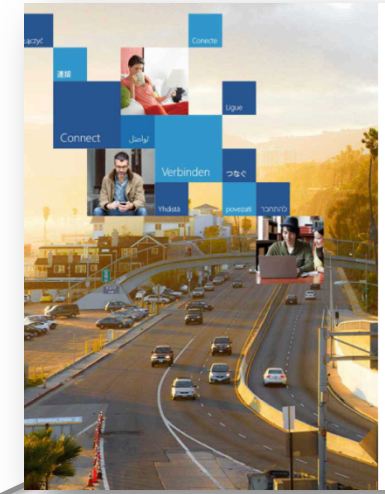
ID-FF 1.0, 1.1 & 1.2


A few years later sees the rise
of SaaS (as we know it now)
thecloud
accelerating the need for
cross-domain single sign-on

It's a SaaS world after all



It's a SaaS world after all



Workplace 24/7

Work or school, or personal Workplace account

Email or phone

Password

Keep me signed in

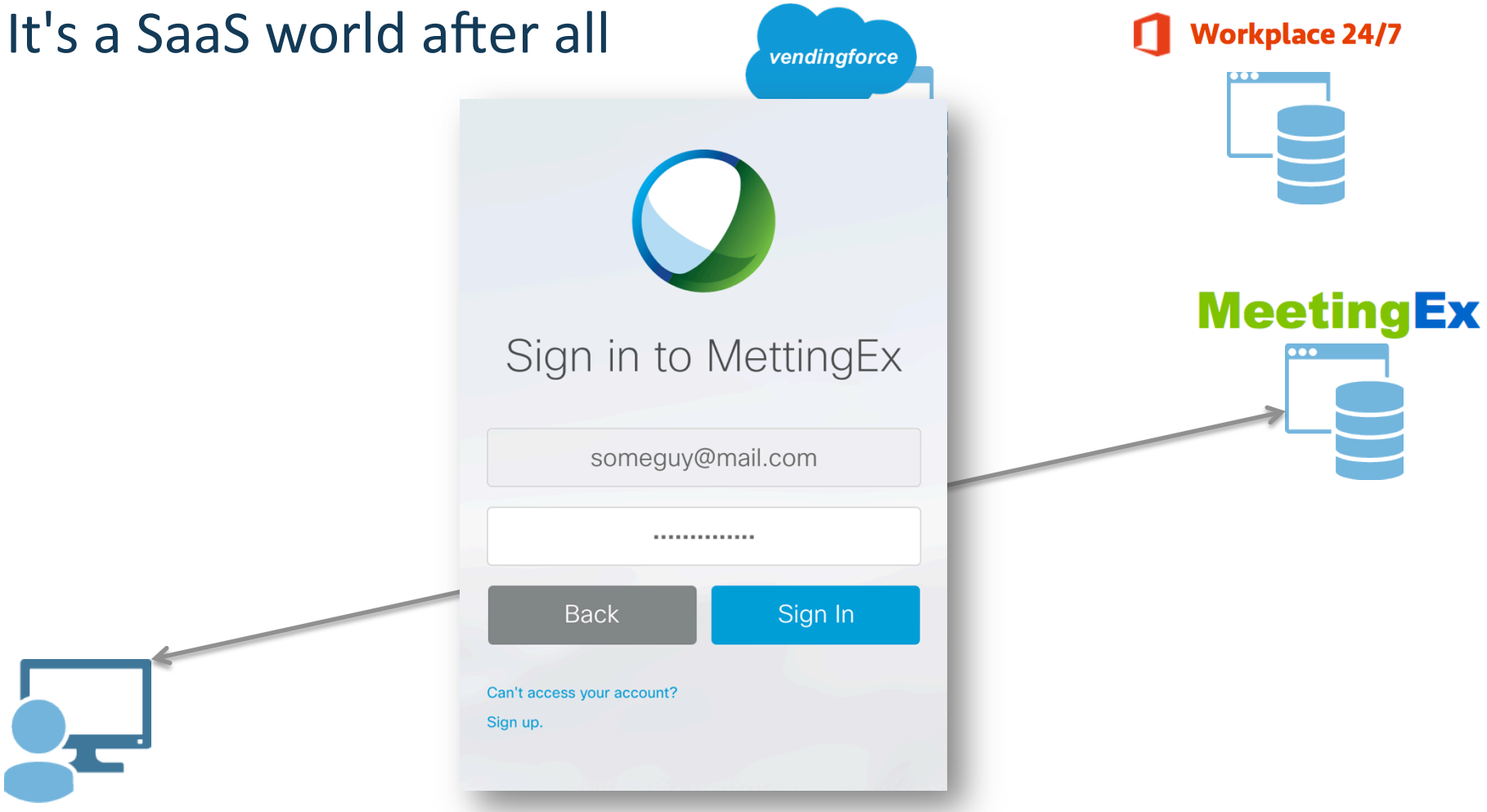
Sign in

vendingforce

Workplace 24/7

MeetingEx

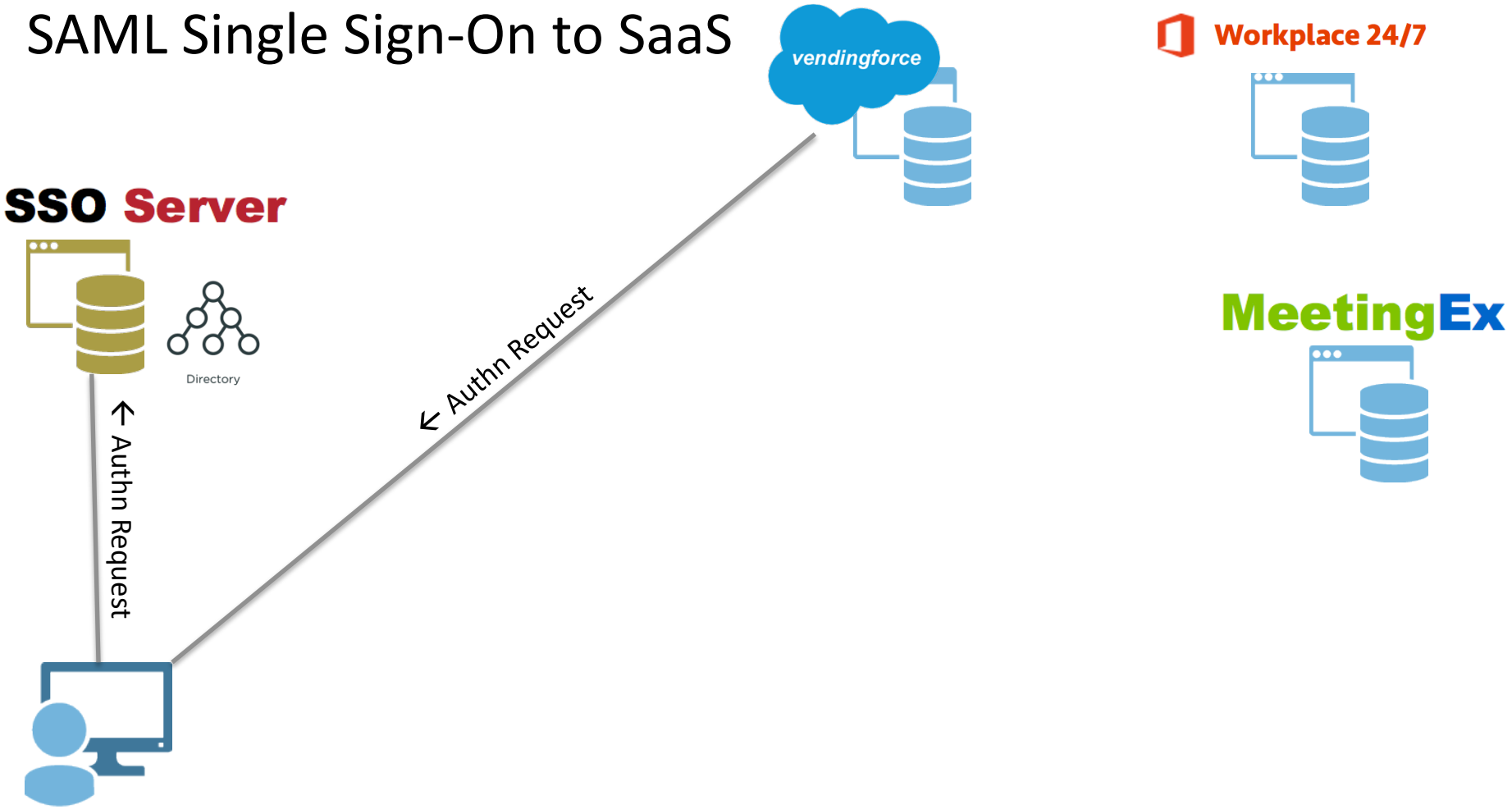
It's a SaaS world after all



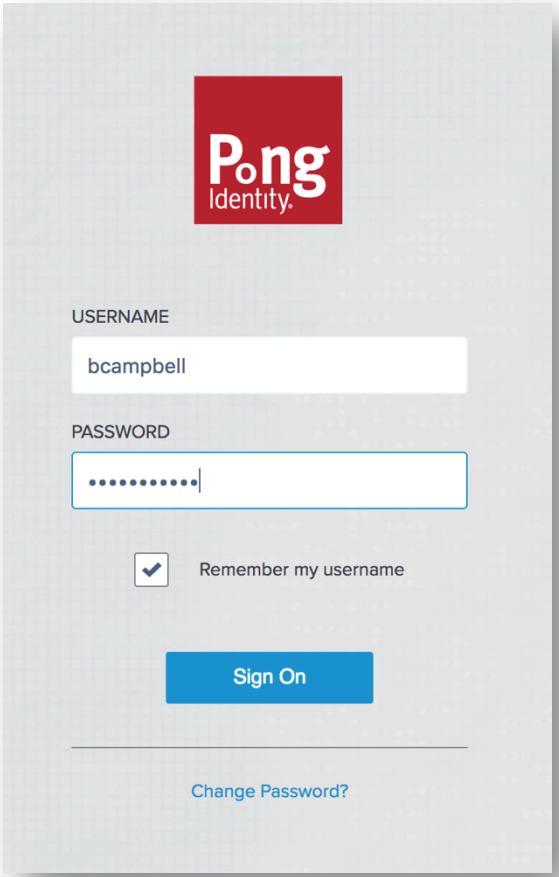

How does that make
you feel?

- Too many damn Passwords
- Inconsistent policies
- Stronger authentication, if any, is per SaaS

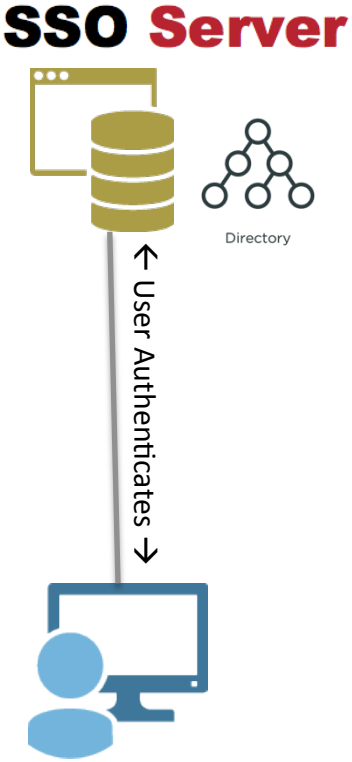
SAML Single Sign-On to SaaS

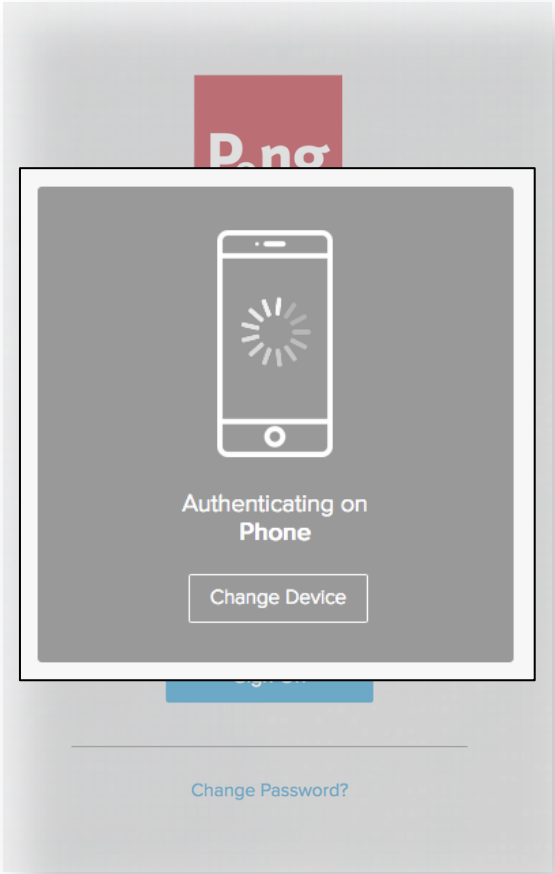


SAML Single Sign-On to SaaS

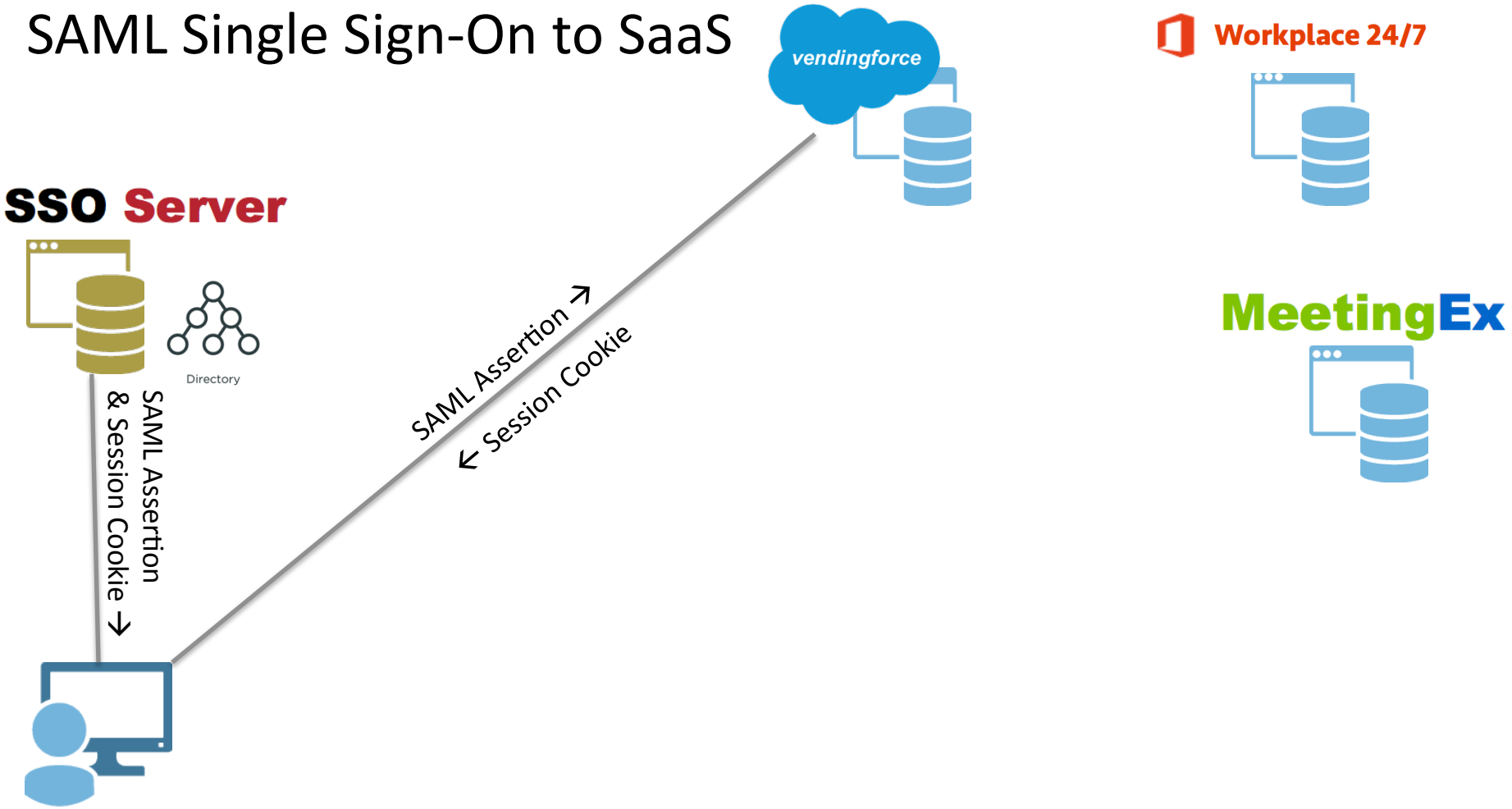


SAML Single Sign-On to SaaS

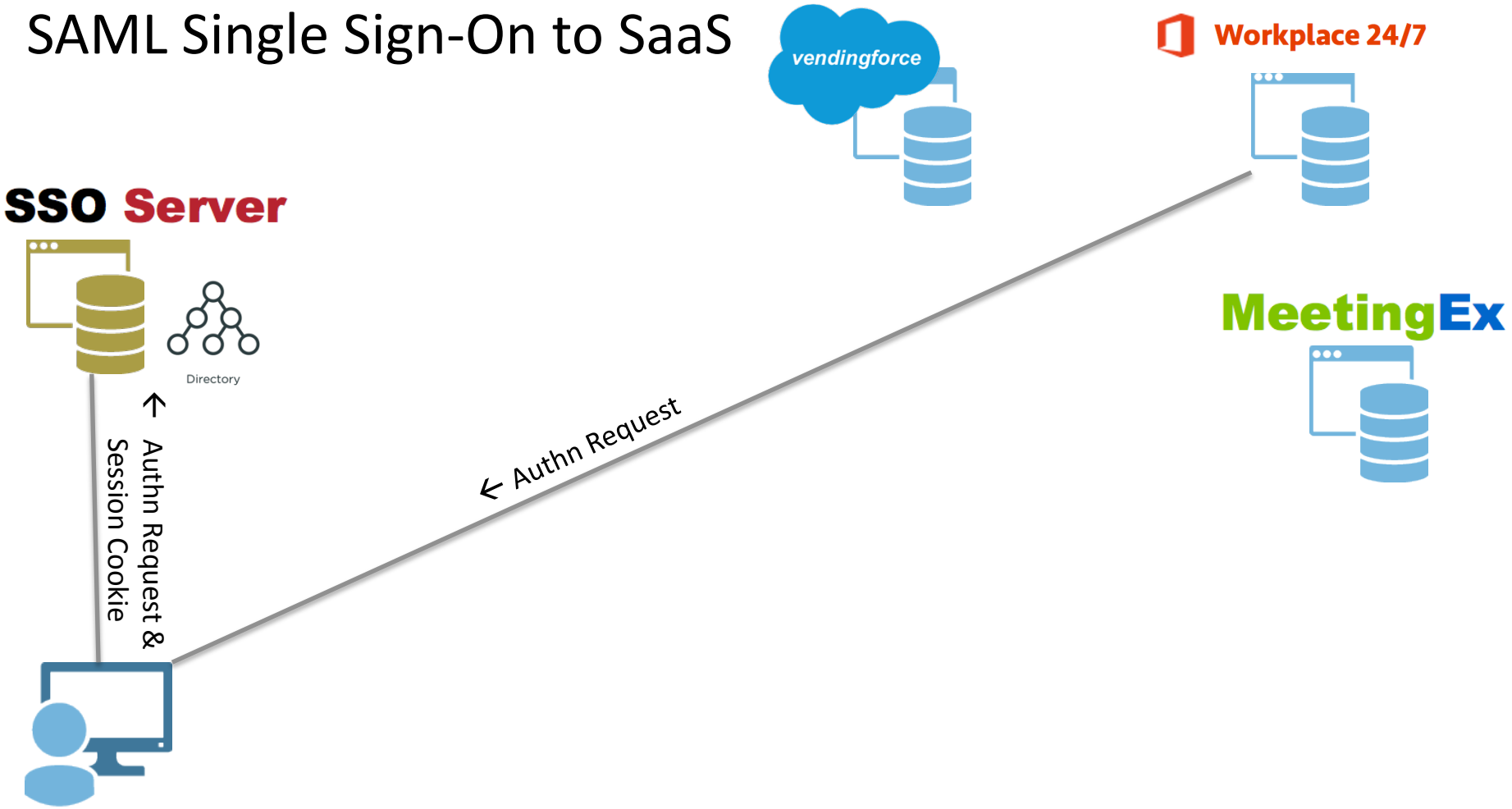




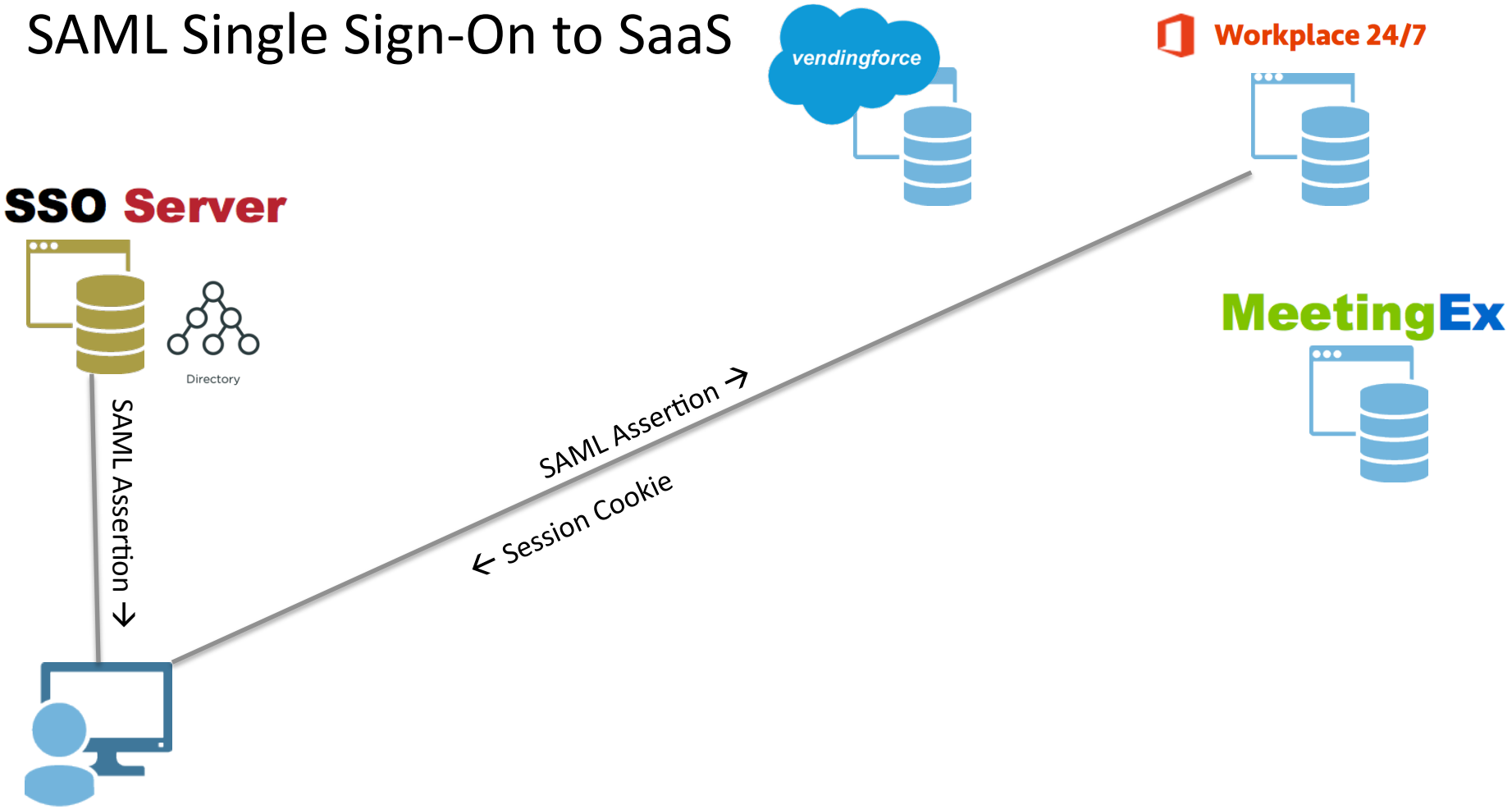
SAML Single Sign-On to SaaS



SAML Single Sign-On to SaaS



SAML Single Sign-On to SaaS



SAML Single Sign-On to SaaS

et cetera, et cetera, et cetera, etc.

SAML: XML standard for exchanging security & identity information

```
<saml:Assertion ID="y2bvAdFrnRNvnm103yjiimgjhw7" IssueInstant="2016-12-05T21:38:44.771Z”
         Version="2.0” xmlns:saml="urn:oasis:names:tc:SAML:2.0:assertion">
  <saml:Issuer>https://pongidentity.com</saml:Issuer>
  <ds:Signature xmlns:ds="http://www.w3.org/2000/09/xmldsig#"><ds:SignedInfo>
      <ds:CanonicalizationMethod Algorithm="http://www.w3.org/2001/10/xml-exc-c14n#"/>
      <ds:SignatureMethod Algorithm="http://www.w3.org/2001/04/xmldsig-more#rsa-sha256"/>
      <ds:Reference URI="#y2bvAdFrnRNvnm103yjiimgjhw7"><ds:Transforms>
          <ds:Transform Algorithm="http://www.w3.org/2000/09/xmldsig#enveloped-signature"/>
          <ds:Transform Algorithm="http://www.w3.org/2001/10/xml-exc-c14n#"/></ds:Transforms>
        <ds:DigestMethod Algorithm="http://www.w3.org/2001/04/xmlenc#sha256"/>
        <ds:DigestValue>zsB4Oo4ebepuGBJ3FC7z6qRei5d4DWjQlEqhJhEu/+4=</ds:DigestValue>
      </ds:Reference></ds:SignedInfo><ds:SignatureValue>gZbkpGU[...omitted...]o2riMFGnTraY=</ds:SignatureValue></ds:Signature>
  <saml:Subject>
    <saml:NameID Format="rn:oasis:names:tc:SAML:1.1:nameid-format:unspecified">bcampbell</saml:NameID>
    <saml:SubjectConfirmation Method="urn:oasis:names:tc:SAML:2.0:cm:bearer">
      <saml:SubjectConfirmationData Recipient="https://workplace247.com/ACS" NotOnOrAfter="2016-12-05T21:48:44.771Z"/>
    </saml:SubjectConfirmation></saml:Subject>
  <saml:Conditions NotBefore="2016-12-05T21:33:44.771Z" NotOnOrAfter="2016-12-05T21:48:44.771Z">
    <saml:AudienceRestriction><saml:Audience>urn:federation:workplace-24-7</saml:Audience></saml:AudienceRestriction>
  </saml:Conditions>
  <saml:AuthnStatement SessionIndex="y2bvAdFrnRNvnm103yjiimgjhw7" AuthnInstant="2016-12-05T21:27:35.000Z">
   <saml:AuthnContext>
    <saml:AuthnContextClassRef>urn:oasis:names:tc:SAML:2.0:ac:classes:Password</saml:AuthnContextClassRef>
   </saml:AuthnContext>
  </saml:AuthnStatement>
  <saml:AttributeStatement xmlns:xs="http://www.w3.org/2001/XMLSchema" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <saml:Attribute Name="fname" NameFormat="urn:oasis:names:tc:SAML:2.0:attrname-format:basic">
      <saml:AttributeValue xsi:type="xs:string">Brian</saml:AttributeValue></saml:Attribute>
    <saml:Attribute Name="lname" NameFormat="urn:oasis:names:tc:SAML:2.0:attrname-format:basic">
      <saml:AttributeValue xsi:type="xs:string">Campbell</saml:AttributeValue></saml:Attribute>
    <saml:Attribute Name="email" NameFormat="urn:oasis:names:tc:SAML:2.0:attrname-format:basic">
      <saml:AttributeValue xsi:type="xs:string">bcampbell@pongidentity.com</saml:AttributeValue></saml:Attribute>
  </saml:AttributeStatement></saml:Assertion>
```

From

Signature

Who

Constraints

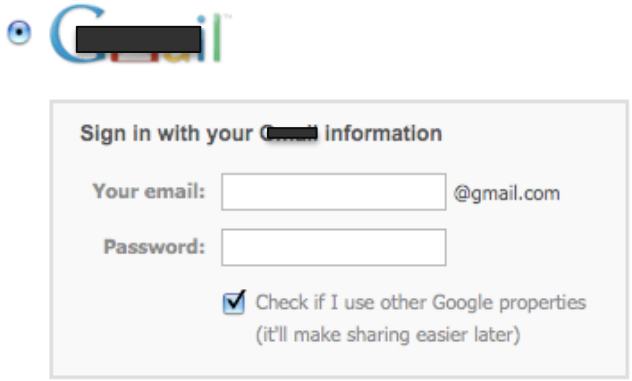
More Constraints

To (also a constraint)

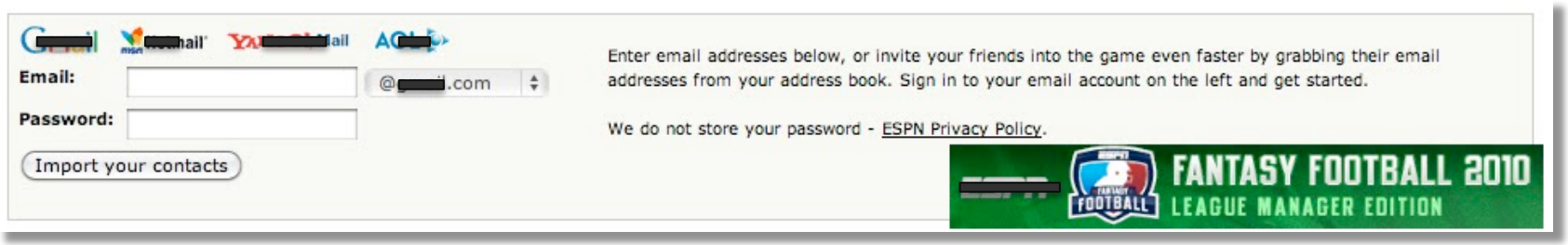
Authentication info

More user info

OAuth Drivers: Password Sharing is Bad



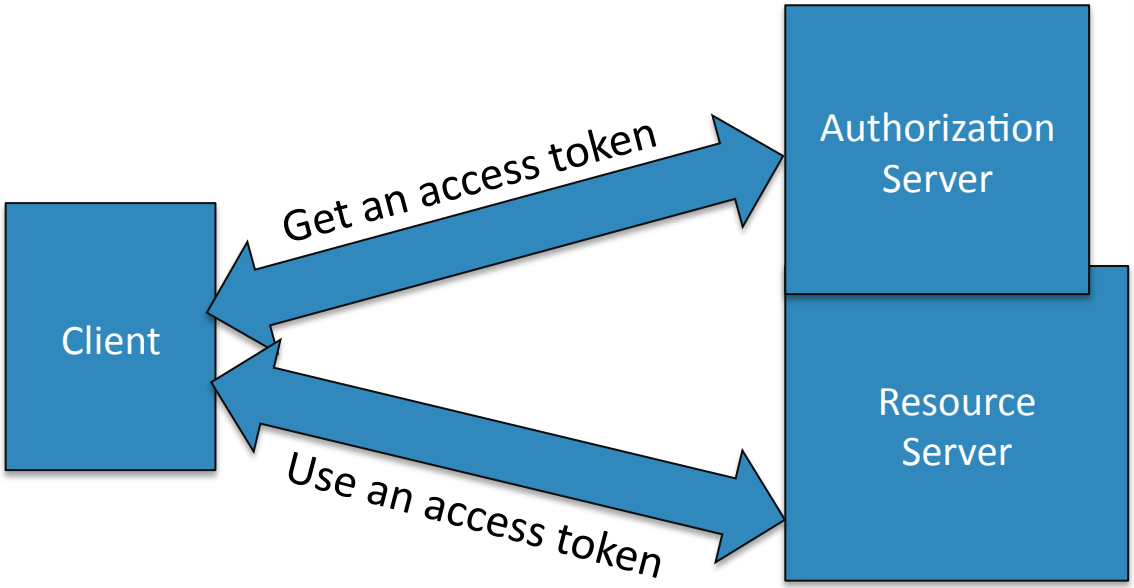
Other sites asks YOU for your <redacted> password so it can access your <redacted> stuff.

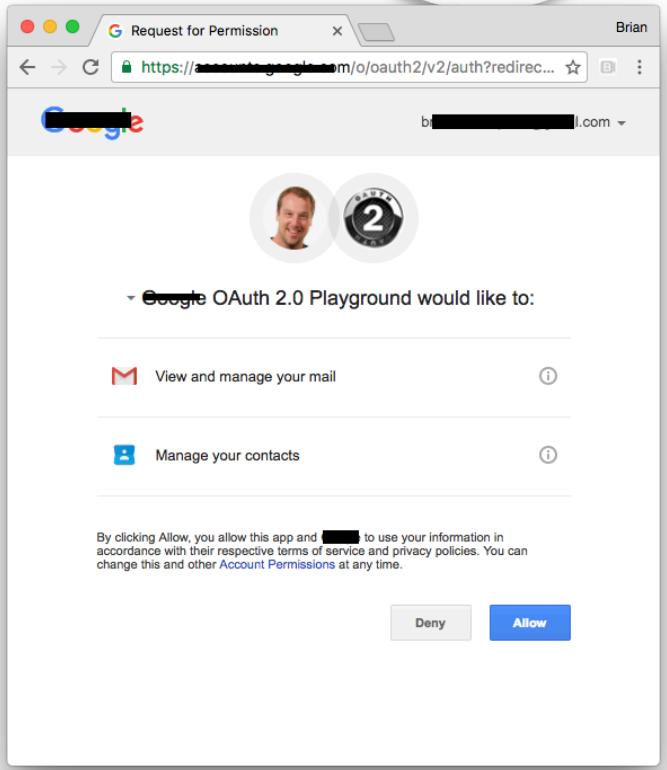


OAuth Drivers: SOAP -> REST & JSON

but there were no comparable authentication & authorization standards to WS-*

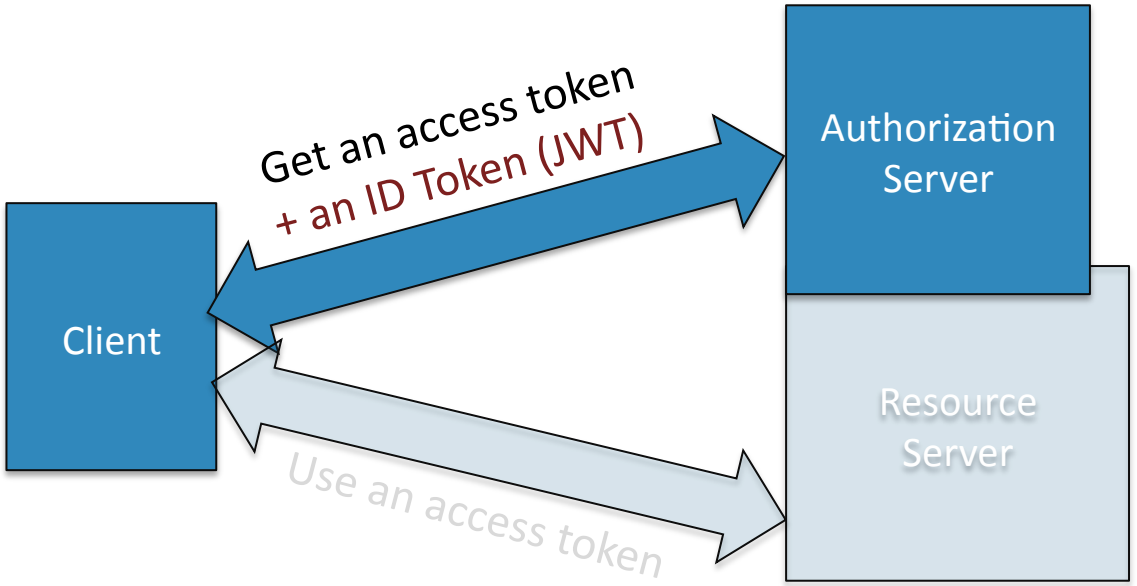
OAuth 2.0 In A Nutshell





OpenID Connect: SSO built on OAuth 2.0

- "OpenID Connect is a simple identity layer on top of the OAuth 2.0 protocol."
- Simple is in the eye of the beholder
  - But complexity burden largely shifted to the identity provider
- Adoption in both employee and consumer use-cases
- Adds a lot to OAuth
  - But the main thing is the JSON Web Token (JWT) based ID Token



jot or not?

The Header

```
{"kid":"5","alg":"ES256"}
```

The Payload

```
{"iss":"https:\/\/idp.example.com",
"exp":1357255788,
"aud":"https:\/\/sp.example.org",
"jti":"tmYvYVU2x8LvN72B5Q_EacH._5A",
"acr":"2",
"sub":"Brian"}
```

The JWT

```
eyJraWQiOiI1IiwiYWxnIjoiRVMyNTYifQ.eyJpc3MiOiJodHRwczpcL1wvaWRwLmV4YW1wbGUuY29tIiwKImV
4cCI6MTM1NzI1NTc4OCwKImF1ZCI6Imh0dHBzOlwvXC9zcC5leGFtcGxlLm9yZyIsCiJqdGkiOiJ0bVl2WVZVM
ng4THZONzJCNVFfRWFjSC5fNUEiLAoiYWNyIjoiMiIsCiJzdWIiOiJCcmlhbiJ9.SbPJIx_JSRM1wluioY0Svf
ykKWK_yK4LO0BKBiESHu0GUGwikgC8iPrv8qnVkIK1aljVMXcbgYnZixZJ5UOArg
```

The Signature

it's not the size of your token…

eyJraWQiOiI1IiwiYWxnIjoiRVMyNTYifQ.eyJpc3MiOiJodHRwczpcL1wvaWRwLmV4YW1wbGUuY29tIiwKImV4cCI6MTM1NzI1NTc4OCwKImF1ZCI6Imh0dHBzOlwvXC9zcC5leGFtcGxlLm9yZyIsCiJqdGkiOiJ0bVl2WVZVMng4THZONzJCNVFfRWFjSC5fNUEiLAoiYWNyIjoiMiIsCiJzdWIiOiJCcmlhbiJ9.SbPJIx_JSRM1wluioY0SvfykKWK_yK4LO0BKBiESHu0GUGwikgC8iPrv8qnVkIK1aljVMXcbgYnZixZJ5UOArg


```
<Assertion Version="2.0" IssueInstant="2013-01-03T23:34:38.546Z" ID="oPm.DxOqT3ZZi83IwuVr3x83xlr"
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  <Issuer>https://idp.example.com</Issuer>
  <ds:Signature><ds:SignedInfo>
      <ds:CanonicalizationMethod Algorithm="http://www.w3.org/2001/10/xml-exc-c14n#"/>
      <ds:SignatureMethod Algorithm="http://www.w3.org/2001/04/xmldsig-more#ecdsa-sha256"/>
      <ds:Reference URI="#oPm.DxOqT3ZZi83IwuVr3x83xlr">
        <ds:Transforms><ds:Transform Algorithm="http://www.w3.org/2000/09/xmldsig#enveloped-signature"/>
          <ds:Transform Algorithm="http://www.w3.org/2001/10/xml-exc-c14n#"/></ds:Transforms>
        <ds:DigestMethod Algorithm="http://www.w3.org/2001/04/xmlenc#sha256"/>
        <ds:DigestValue>8JT03jjlsqBgXhStxmDhs2zlCPsgMkMTC1lIK9g7e0o=</ds:DigestValue>
      </ds:Reference></ds:SignedInfo>
    <ds:SignatureValue>SAXf8eCmTjuhV742blyvLvVumZJ+TqiG3eMsRDUQU8RnNSspZzNJ8MOUwffkT6kvAR3BXeVzob5p08jsb99UJQ==</ds:SignatureValue>
  </ds:Signature>
  <Subject>
    <NameID Format="urn:oasis:names:tc:SAML:1.1:nameid-format:unspecified">Brian</NameID>
    <SubjectConfirmation Method="urn:oasis:names:tc:SAML:2.0:cm:bearer">
      <SubjectConfirmationData NotOnOrAfter="2013-01-03T23:39:38.552Z" Recipient="https://sp.example.org"/>
    </SubjectConfirmation>
  </Subject>
  <Conditions NotOnOrAfter="2013-01-03T23:39:38.552Z" NotBefore="2013-01-03T23:29:38.552Z">
    <AudienceRestriction><Audience>https://sp.example.org</Audience></AudienceRestriction>
  </Conditions>
  <AuthnStatement AuthnInstant="2013-01-03T23:34:38.483Z" SessionIndex="oPm.DxOqT3ZZi83IwuVr3x83xlr">
    <AuthnContext><AuthnContextClassRef>2</AuthnContextClassRef></AuthnContext>
  </AuthnStatement>
</Assertion>
```


JWT

SAML ASSERTION

…it's how you use it

- Simpler = Better
- Web safe encoding w/ no canonicalization (Because canonicalization is a four letter word*)
- Improved Interoperability & Security
  - Mostly been true but has its critics…
- Eliminates entire classes of attacks (vs. XML DSIG)
  - XSLT Transform DOS, Remote Code Execution, and Bypass
  - C14N Hash Truncation
  - Entity Expansion Attacks
  - XPath Transform DOS and Bypass
  - External Reference DOS
  - Signature Wrapping Attacks
  - Bypass from inconsistent treatment of XML comments in c14n and XML APIs [new!]

Brad Hill, pictured here speaking in 2011, published some of these attacks on XML signatures

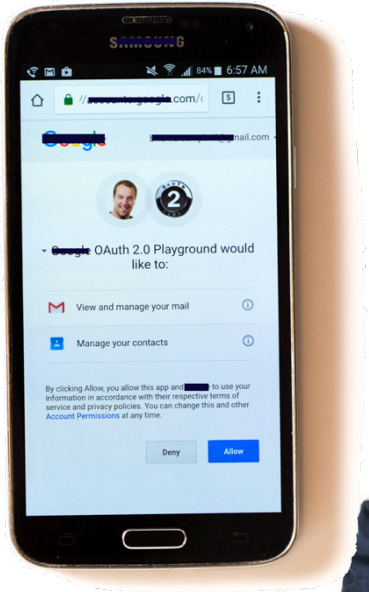
* especially when you spell it c14n

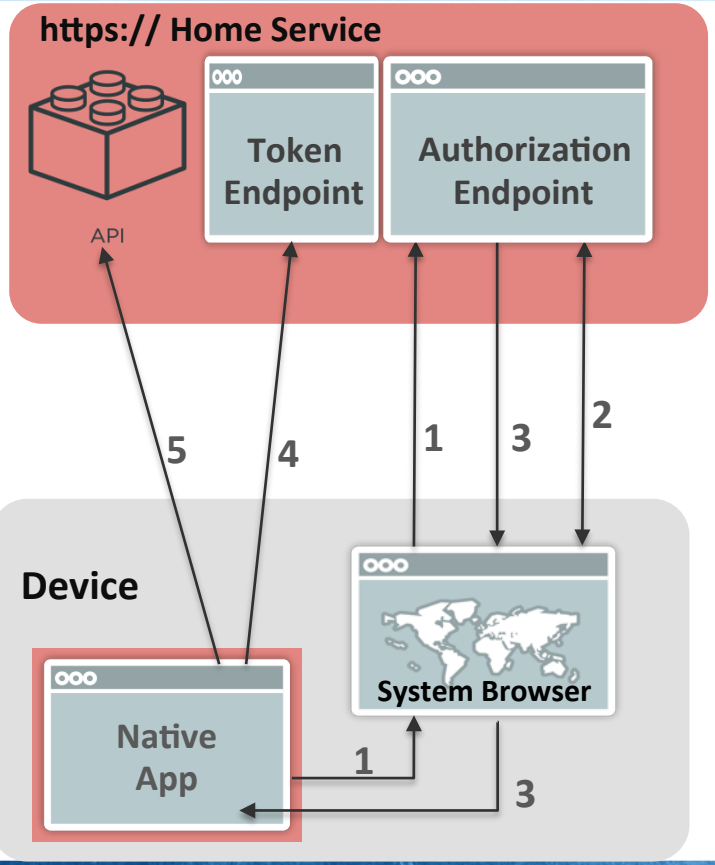
Analysts* Predict 5.43 Zillion Mobile Devices by 2021

* Might have been me


BEST CURRENT PRACTICE
RFC 8252
OAuth 2.0 used for sign-on with native mobile applications
TECHNICAL SPORTWEAR
SILVINI

OAuth 2.0 for Native Apps

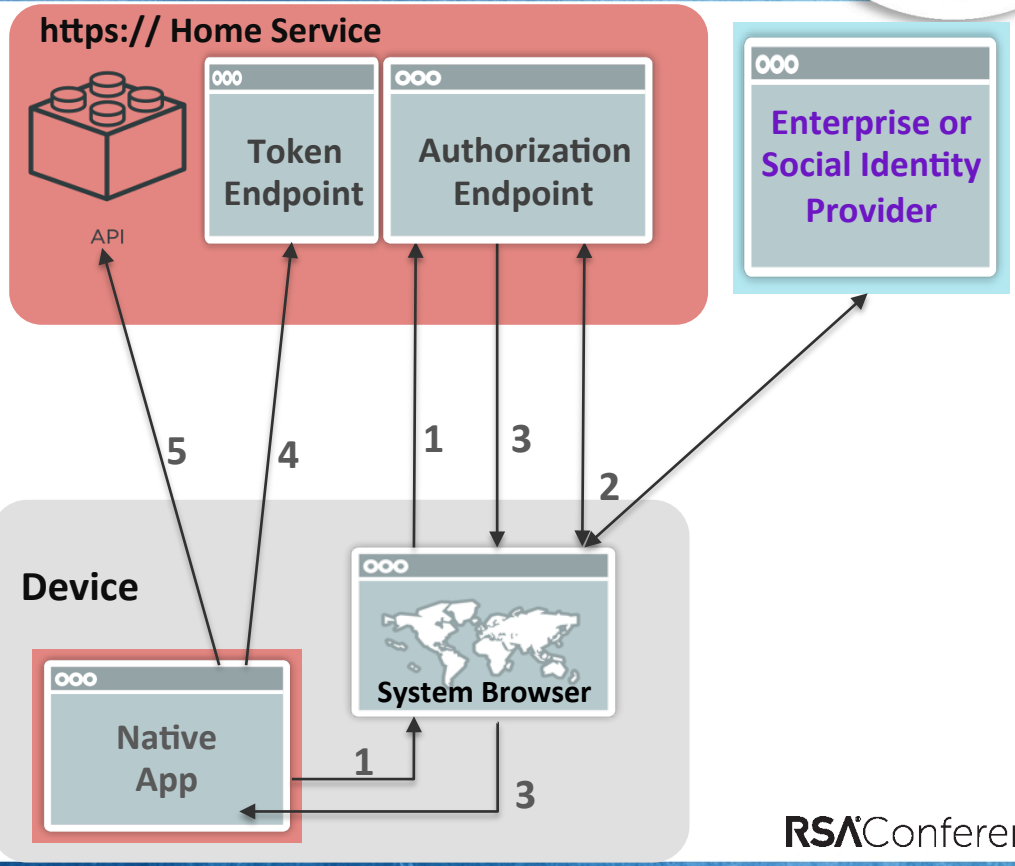




1. Request authorization + PKCE
2. User authentication & approval
3. Callback to custom scheme URI
4. Exchange code + PKCE for tokens
5. Access protected APIs with token

Enables Federated and Multi-factor Sign-on

Leveraging existing and future investment in web based authentication



The Internet of Things & IAM

ID for IoT

- Standardized Online Authentication Using Public Key Cryptography
- PKI without the I
- UAF & U2F

Fast IDentity Online U2F

- Strong cryptographic 2nd factor option for end user security
- U2F device: USB, NFC, Bluetooth LE, on-board machine/mobile

- Registration of client generated site-specific public key
- Authentication by signing a challenge

A New Home for FIDO

- From the FIDO Alliance to the Web Authentication Working Group in the W3C
  - Defining a client-side API providing strong authentication functionality to web applications
  - With the FIDO 2.0 APIs as input

What’s In Your Pocket?

Phone becoming a nearly ubiquitous “something you have”

While standards make having fewer hard token(s) feasible

Biometrics

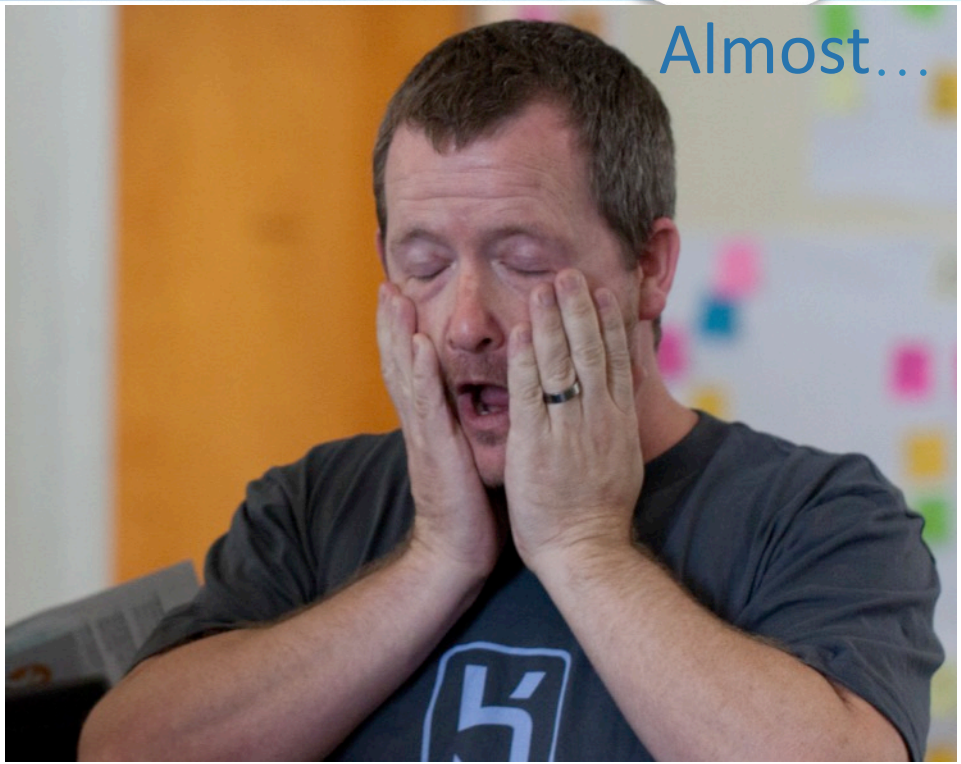
Used as device local authentication to unlock a key used in remote authentication

Token Binding

- Enables a long-lived binding to browser generated public-private key pair used to sign TLS exported keying material and sent as an HTTP header
- Bind to cookies, SSO tokens, OAuth tokens

Are we done yet?

- IAM: Seamlessly enabling the right people to have access to the right resources at the right time
  - Federated single sign-on to SaaS & organizational applications deployed wherever (or “social” login to consumer apps)
  - Stronger user authentication with less frequent direct user interaction
  - Stronger session and SSO tokens bound to keys on the device



RSAConference2018

San Francisco | April 16 – 20 | Moscone Center

Thanks!

SESSION ID: SEM-M04

You've been watching:

IDENTITY AND ACCESS MANAGEMENT:

Past/present/future, SAML, OAuth, FIDO, OIDC, other acronyms, and emerging trends

Brian Campbell

Distinguished Engineer
Ping Identity
@__b_c