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Architecting Passwordless Authentication with FIDO2

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Agenda

- Passwords are a problem
- Going passwordless
- FIDO2 under the hood
- FIDO2 and Windows 10 Azure sign-in

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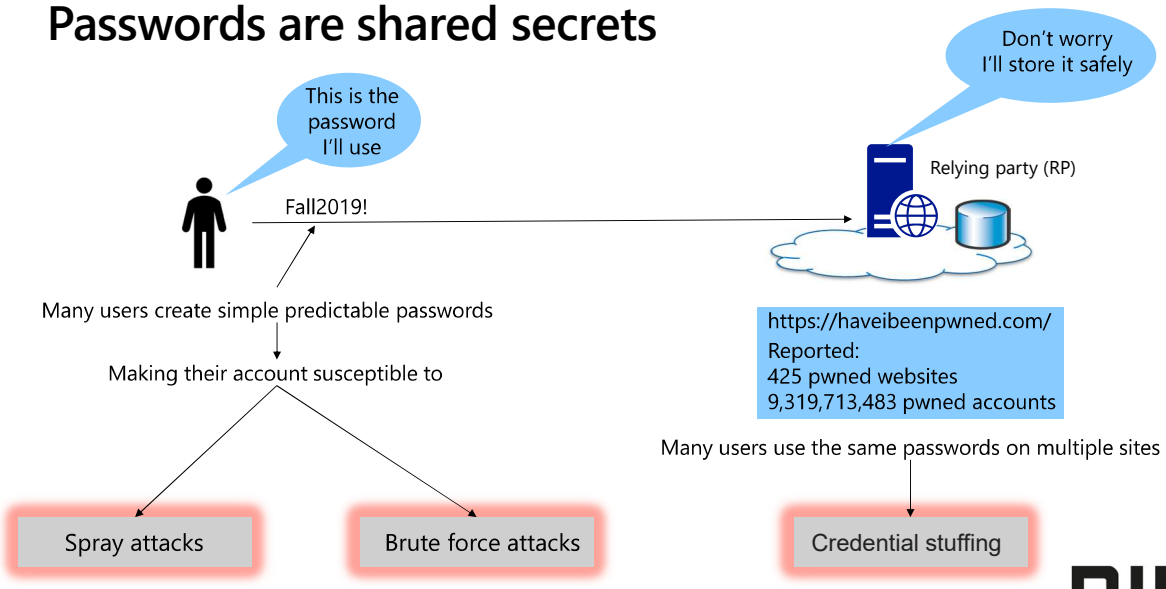
Passwords are shared secrets



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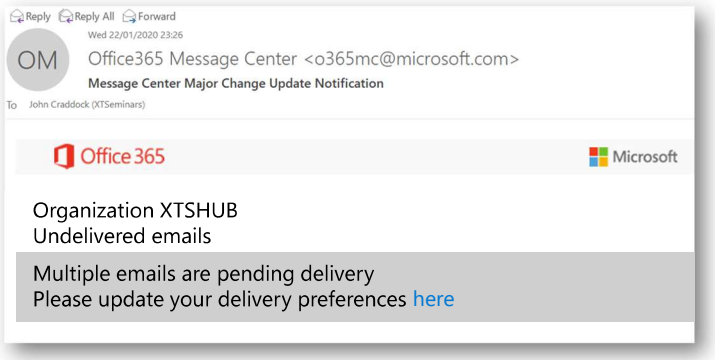
I'm not getting emails…



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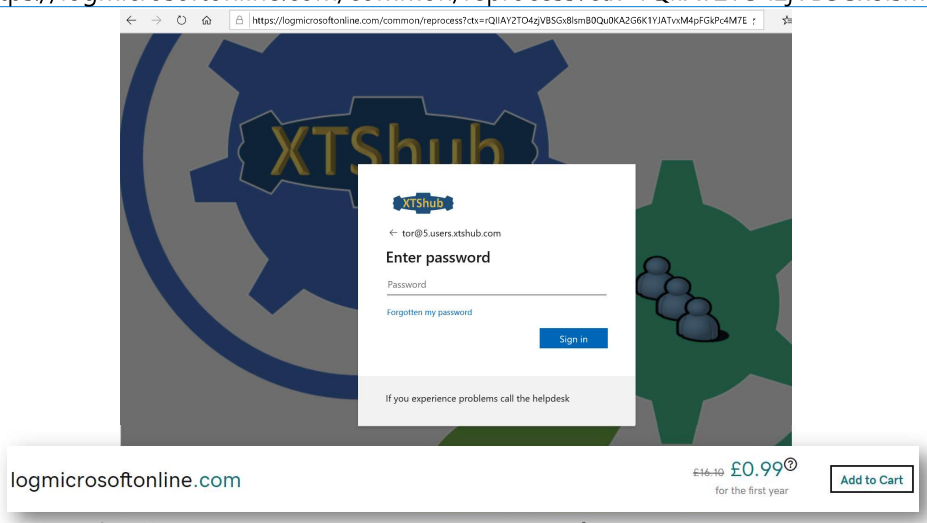
Is there a problem?

https://logmicrosoftonline.com/common/reprocess?ctx=rQIIAY2TO4zjVBSGx8lsm



- Oops you just gave away your password

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Password resets

Question 1: what was the name of you first pet?

- Resets send to an already compromised email alias
- Resets via Knowledge-Based Authentication (KBA) security questions and answers
  - Answers already known from pwned website or social media disclose

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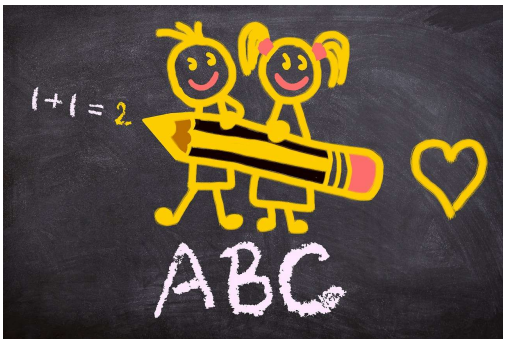
Challenges



- Educating users about password security is difficult
- MFA is a must it will eliminate 99.9% of sign ins with *compromised* passwords succeeding
  - In most cases simple SMS MFA will be sufficient
  - For convenience or high value accounts go for alternatives
- Don't over prompt for MFA
  - With an authenticator app users get complacent and just approve

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How do we eliminate passwords being compromised?

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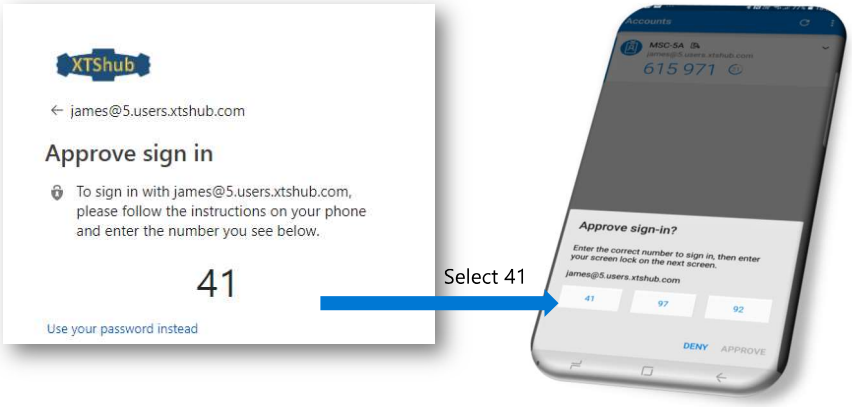
Azure AD passwordless sign-in



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To be Internet scalable there must be standards

- Fast IDentity Online (FIDO) Alliance founded in July 2012
  - Mission to work on creating a passwordless authentication protocol
- December 2014 the Alliance published
  - The passwordless protocol FIDO Universal Authentication Framework (FIDO UAF)
  - The second-factor protocol FIDO Universal 2nd Factor (FIDO U2F)
- 2019 - FIDO2 core Web Authentication protocol (WebAuthN) adopted by the World Wide Web Consortium (W3C) as an Internet standard
- 2019 - Microsoft Hello certified as FIDO2 compliant
- Many vendors released FIDO2 security keys

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Proliferation of FIDO2 security keys

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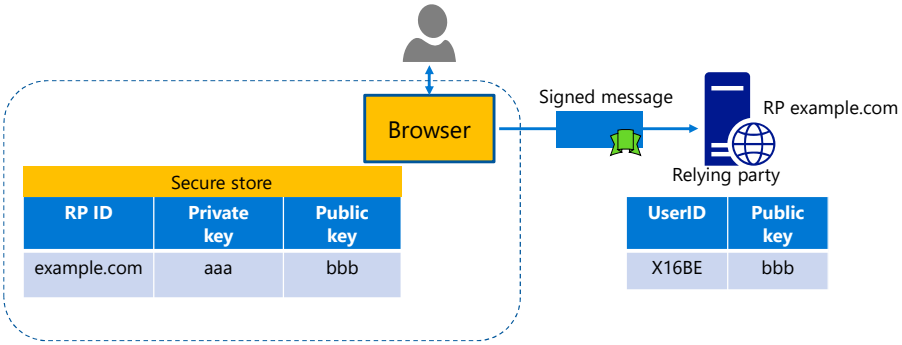
Replaces shared secrets with asymmetric cryptography



- The user signs a message with their private key
  - The private key never leaves the user's possession
- The RP can validate the signature with the user's public key
  - This proves the message has not been altered and the sender is the owner of the private key

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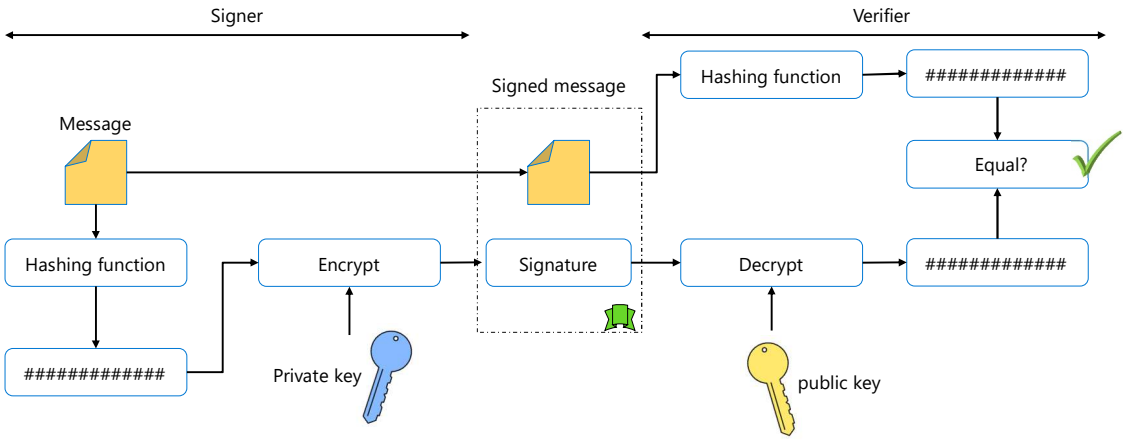
Crypto signing and verification



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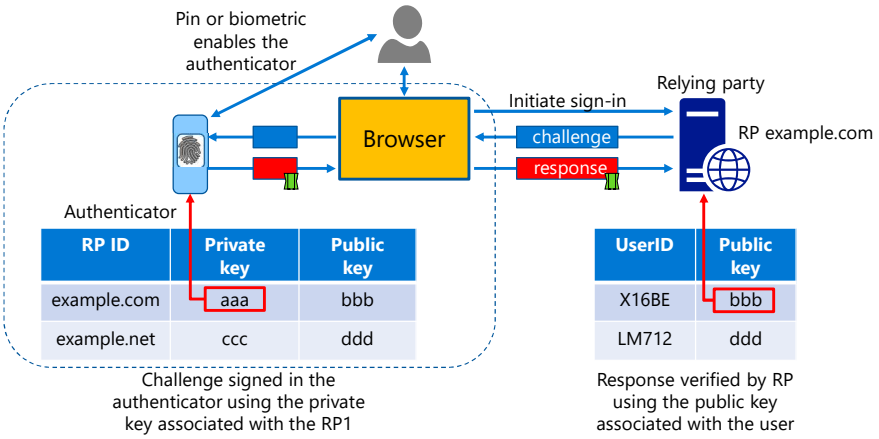
FIDO2 Authentication



- The signed response is called an assertion

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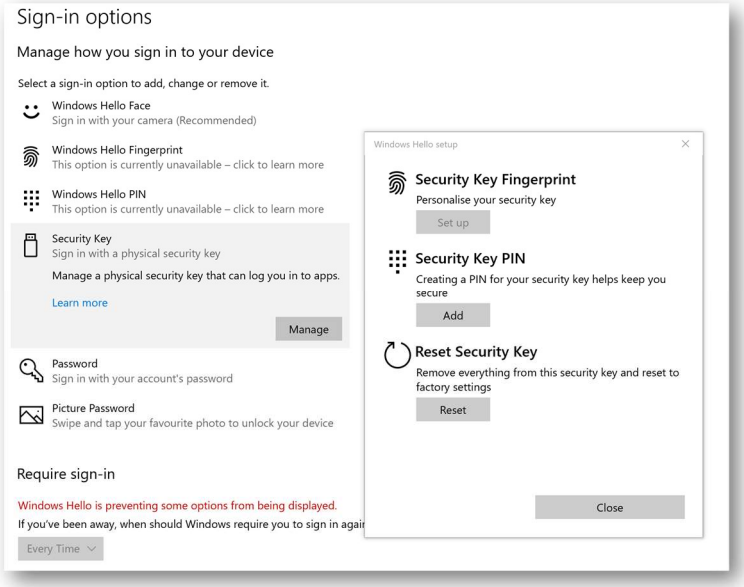
Setting up a FIDO2 security key with Windows 10



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Top tip

- Windows 10 allows you to reset a key and clear all the credentials
- Go to "Sign-in options | Security Key | Manage | Reset“
- If you receive a message that the key cannot be reset
  - Perform the reset within 10 seconds of powering up the key

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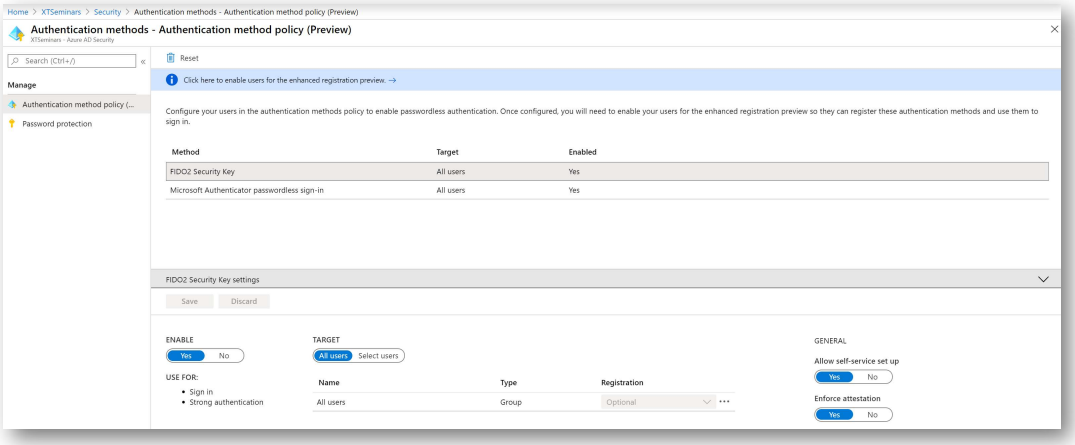
Enabling FIDO 2 security keys in Azure AD



- In the future policies will be added
  - MFA
  - SSPR
  - Password

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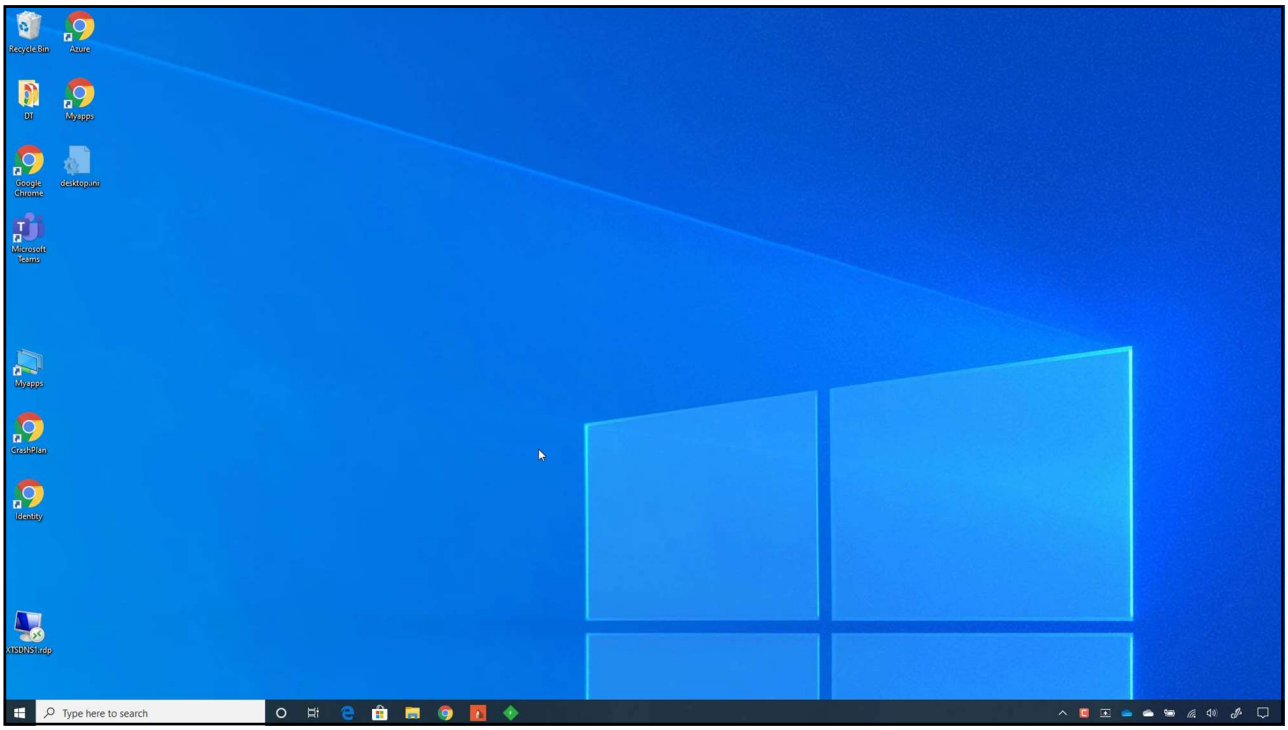

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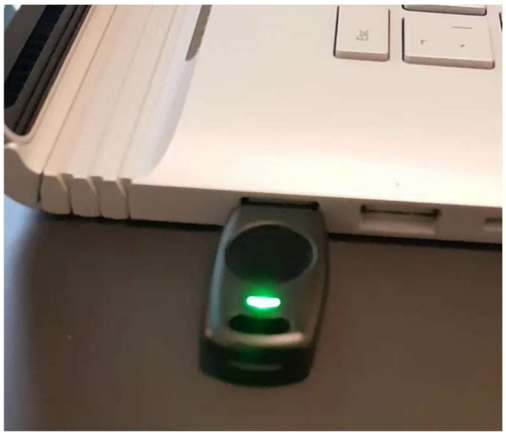
eWBM Goldengate G310



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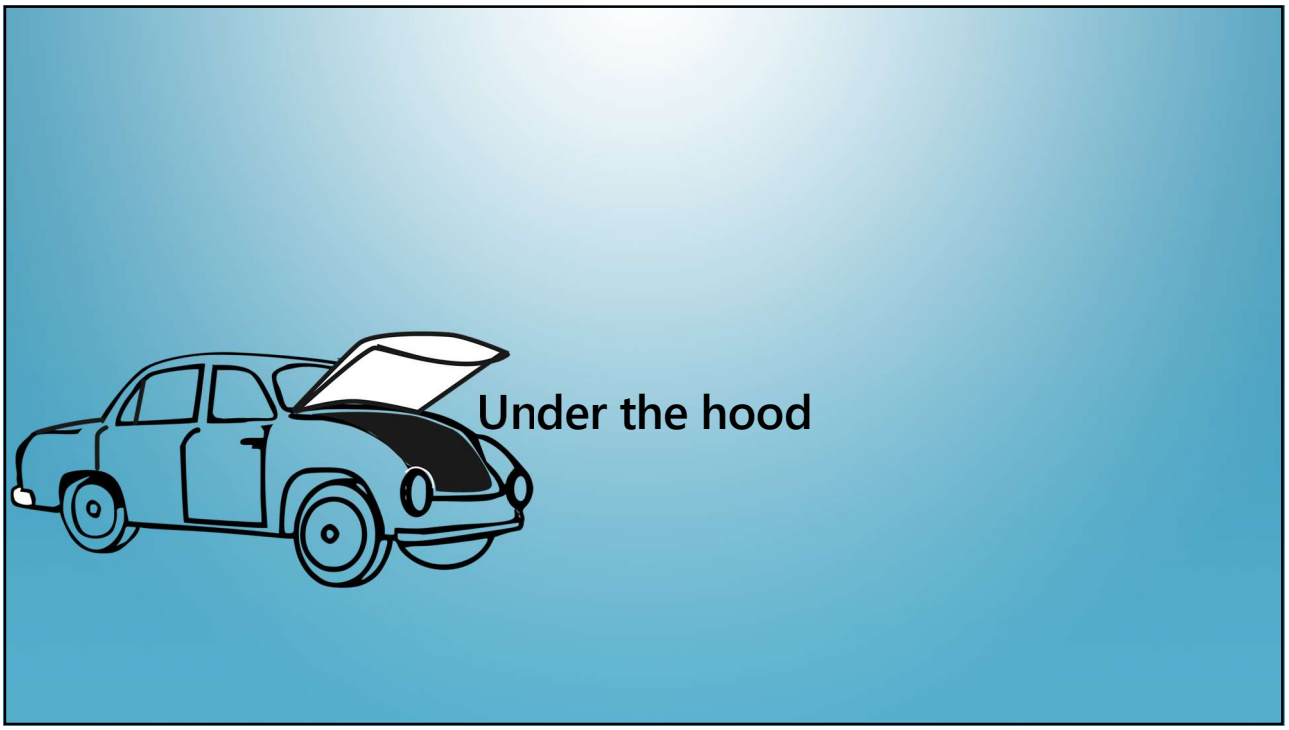

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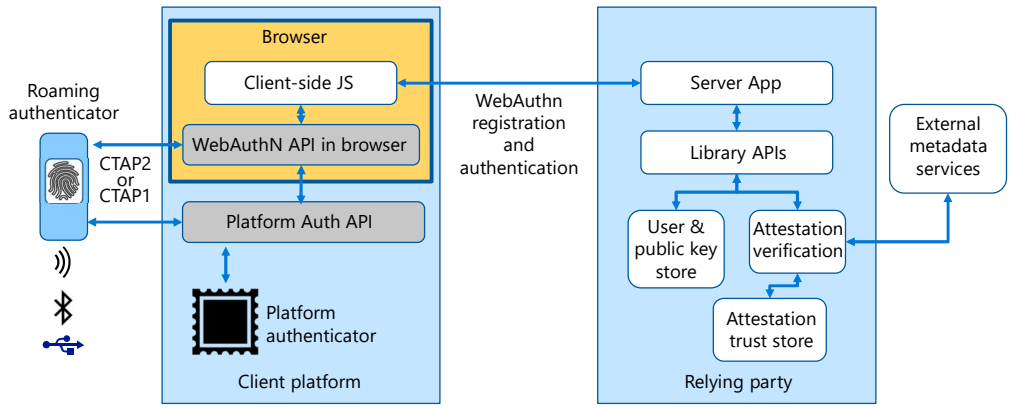
FIDO2 components and protocols



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Two Ceremonies

Registration

Authentication

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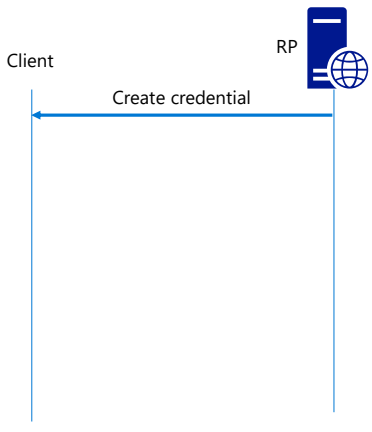
Registration ceremony



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Create Credential parameters include

Challenge: Random string of bytes, used to prevent replay attacks

RPId: Identifies the RP's domain

User: Randomly generated id that is used to associate a credential with a user

pubKeyCredParams: Specifies the cryptographic types of public keys that are acceptable to the RP

authenticatorSelection:

- The type of authenticator - cross-platform (roaming) or platform (bound)
- If the authenticator private key should be residential
  - Required for passwordless authentication
- If user verification to the authenticator is required, preferred or discouraged

timeout: The user is required to respond within this time; otherwise, an error occurs.

attestation: Allows the RP to specify if attestation data is required. Attestation data allows the RP to verify the veracity and the security of authenticator being used

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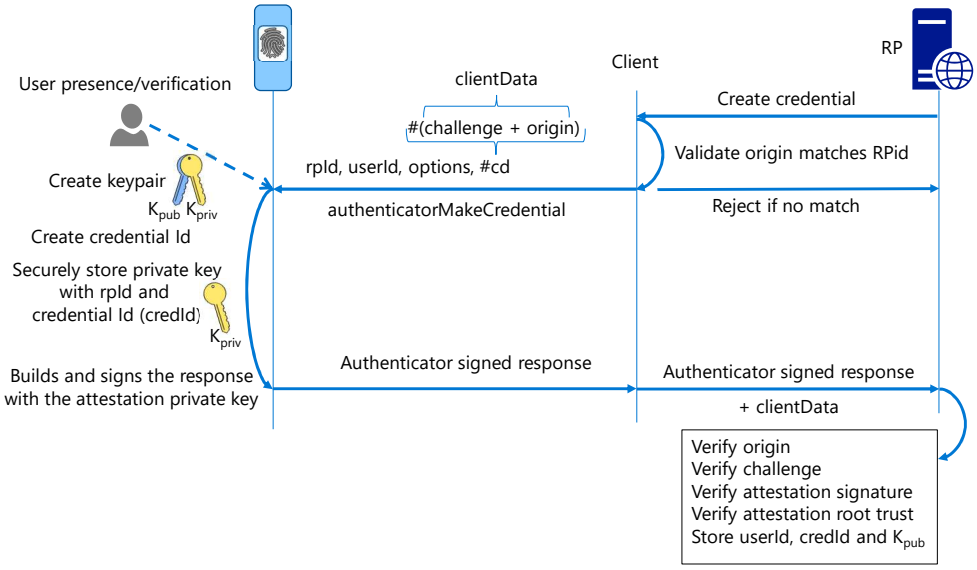
Registration ceremony



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Attestation metadata

- FIDO Alliance Metadata Service (MDS)
  - Authenticator vendors can publish Metadata Statements
    - Trusted source of information about authenticators
  - Provides characteristics and capabilities of a particular authenticator
  - Allows risk-based decisions to be made about a particular authenticator
- Authenticators are identified by an Authenticator Attestation GUID (AAGUID)
- During registration the authenticator signs the response with an attestation private key that is burnt into the device

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Verifying the attestation signature

- The attestation signature signs the attestation data and the users public key
- Verification of the signature confirms that the public key has not been substituted by a man-in-the-middle attack
  - The signing certificate's public key is used to verify the signature,
    - The certificate chain is verified as well as the certificate revocation list
  - Some RPs will rely on the veracity of the TLS channel and allow self-attestations (surrogate-attestations)
    - Self-attestations use a self-signed certificate
  - Microsoft Azure AD has a "Force Attestation" option which can be switched to No to allow self-signed certs

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AAGUIDS & Metadata

Product Name or Laser Marking	Firmware	FIDO2 AAGUID
YubiKey 4 (Series)	All	N/A
YubiKey 5 (USB-A, No NFC)	5.1.X	cb69481e-8ff7-4039-93ec-0a2729a154a8
YubiKey 5 (USB-A, No NFC)	5.2.X	ee882879-721c-4913-9775-3dfcce97072a
YubiKey 5 NFC	5.1.X	fa2b99dc-9e39-4257-8f92-4a30d23c4118
YubiKey 5 NFC	5.2.X	2fc0579f-8113-47ea-b116-bb5a8db9202a
YubiKey 5 Nano	5.1.X	cb69481e-8ff7-4039-93ec-0a2729a154a8
YubiKey 5 Nano	5.2.X	ee882879-721c-4913-9775-3dfcce97072a


```
{
    deviceId: "1.3.6.1.4.1.41482.1.7",
    displayName: "YubiKey 5 Series security key",
    transports: 4,
    deviceUrl: "https://support.yubico.com/support/solutions/articles/15000014180-yubikey-5c",
    imageUrl: "https://developers.yubico.com/U2F/Images/YK5-series.png",
  - selectors: [
      - {
            type: "x509Extension",
          - parameters: {
                key: "1.3.6.1.4.1.45724.1.1.4",
              - value: {
                    type: "hex",
                    value: "cb69481e8ff7403993ec0a2729a154a8"
                }
            }
        }
    ]
},
```


Section from Yubico metadata

Product	VID	PID	AAGUID
Goldengate 310	0x311F	0x4A1A	95442b2e-f15e-4def-b270-efb106facb4e
Goldengate 320	0x311F	0x4C2A	87dbc5a1-4c94-4dc8-8a47-97d800fd1f3c

eWBM

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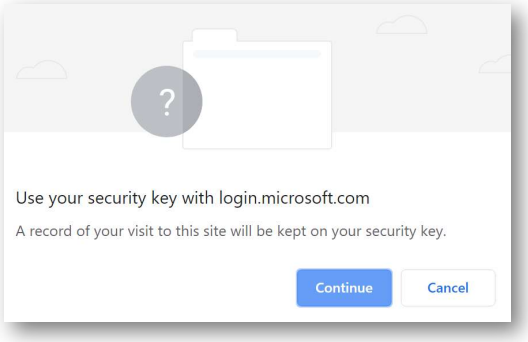
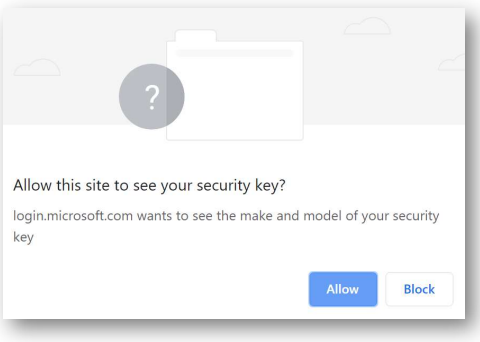
FIDO2 via a browser



Resident keys



Attestation

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Identifying the user

- Registration includes binding a FIDO credential on an given authenticator to a specific user
  - Trust on First Use (TOFU)
    - Only assures that the user registering the credential can authenticate to the RP
  - Invitation
    - Invitation sent to user in advance of registration
  - Identity Proofing
    - User documents/presence may be required
  - Binding to an existing credential
    - Sign-in, possibly with MFA, before registering credential and authenticator
- Multiple authenticators can be registered on an account for recovery

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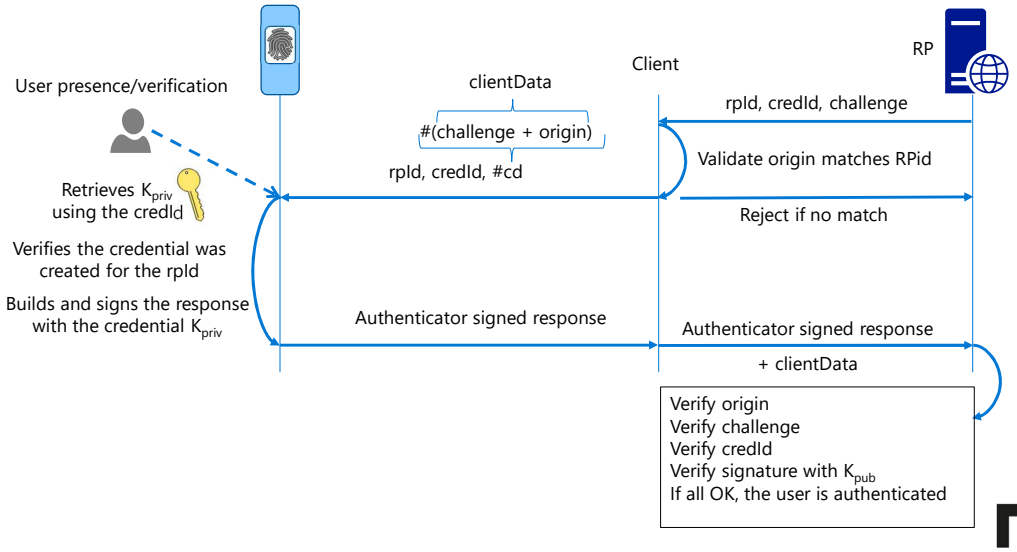
Authentication ceremony



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Demo…

Registration and authentication

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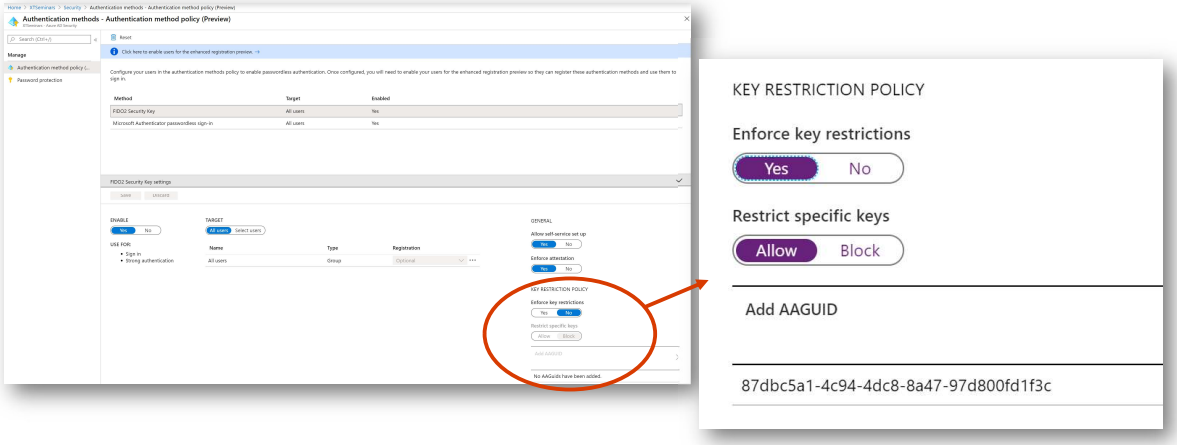
White and black listing authenticators



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Demo…

Blocked authenticator

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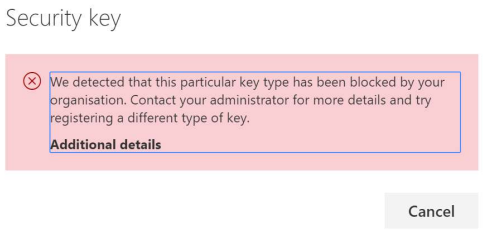
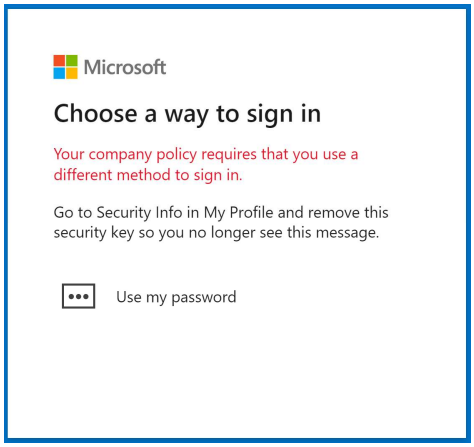
Blocked security keys



During registration



During authentication if the policy has changed between registration and authentication

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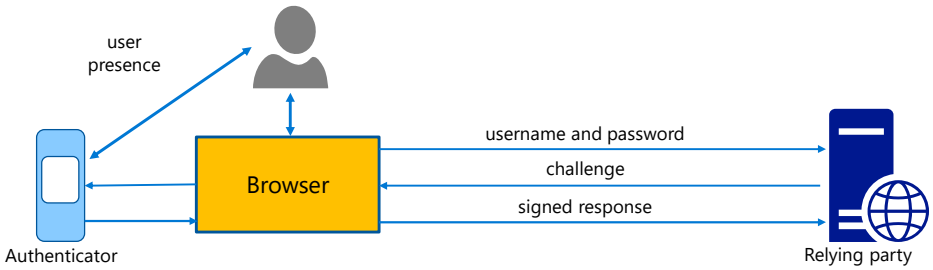
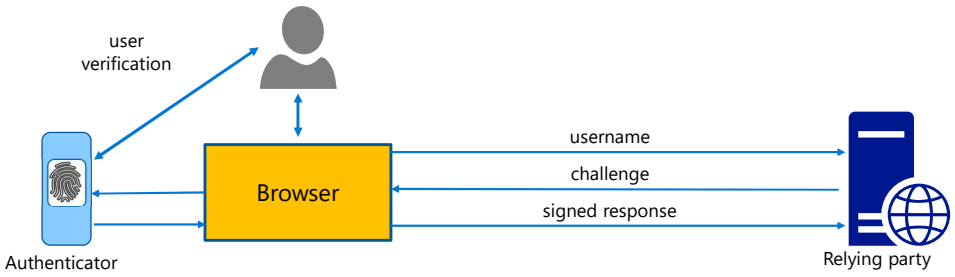
Usage scenarios

Second factor authentication



Passwordless



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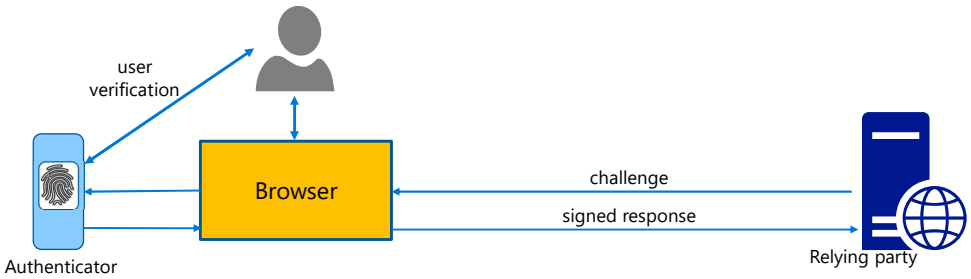
Nameless and Passwordless



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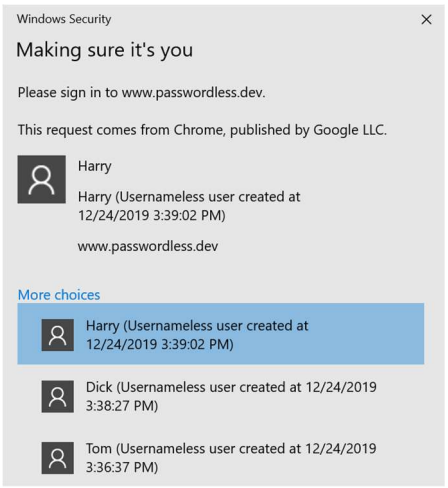
Multiple names registered for the same resource



- The user chooses

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Windows 10 sign in with a FIDO2 security key

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AAD Joined and hybrid AAD joined devices

One to one
Windows Hello for Business

One to many
FIDO2 security key

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Windows 10 FIDO2 sign-in

- Microsoft security key requirements
  - Resident keys
  - Client PIN for keys that don't have a biometric interface
  - HMAC-secret for offline sign-in
  - Multiple accounts per RP
- Sign-in with a security key is enabled via
  - Intune
  - Group policy
  - Creating a provisioning package using the Windows Configuration Designer app

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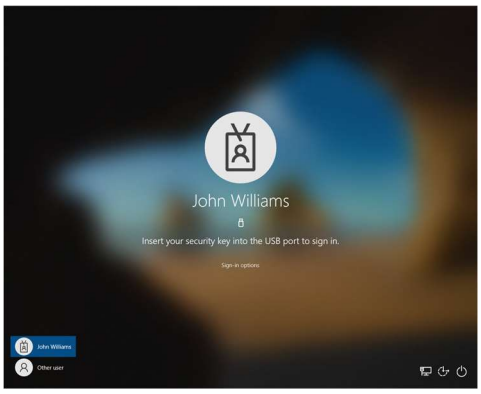
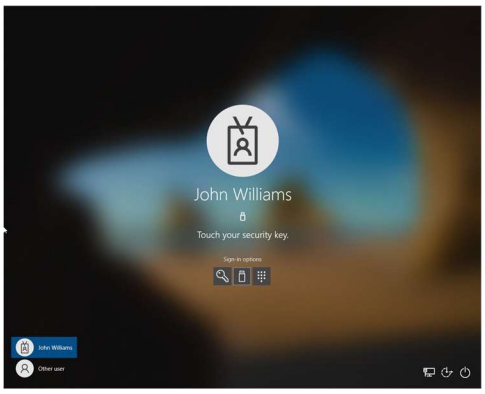
Sign in





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SSO to on-premises

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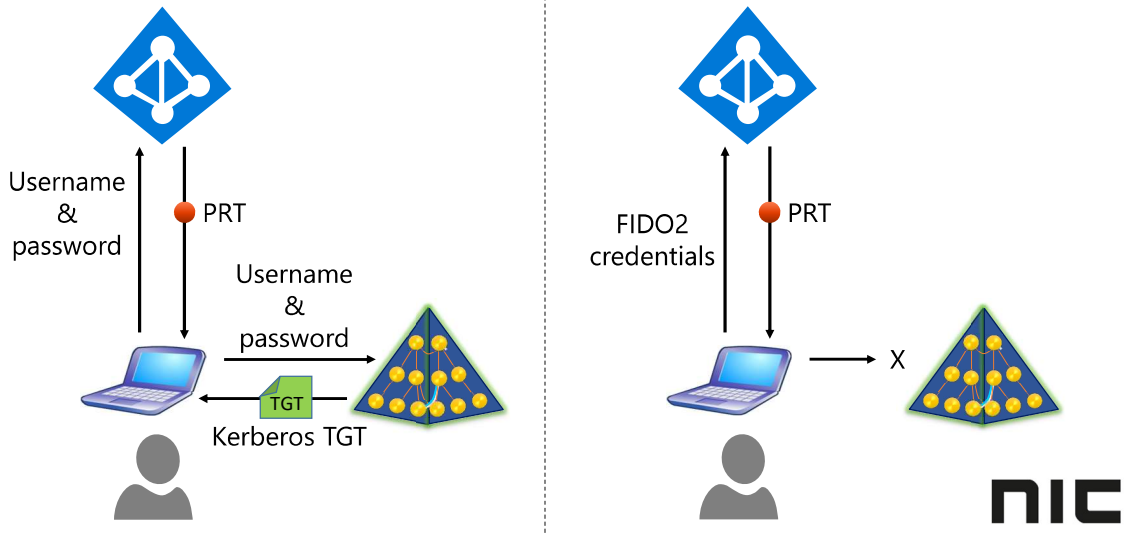
Windows sign-in to Azure AD and on-premises



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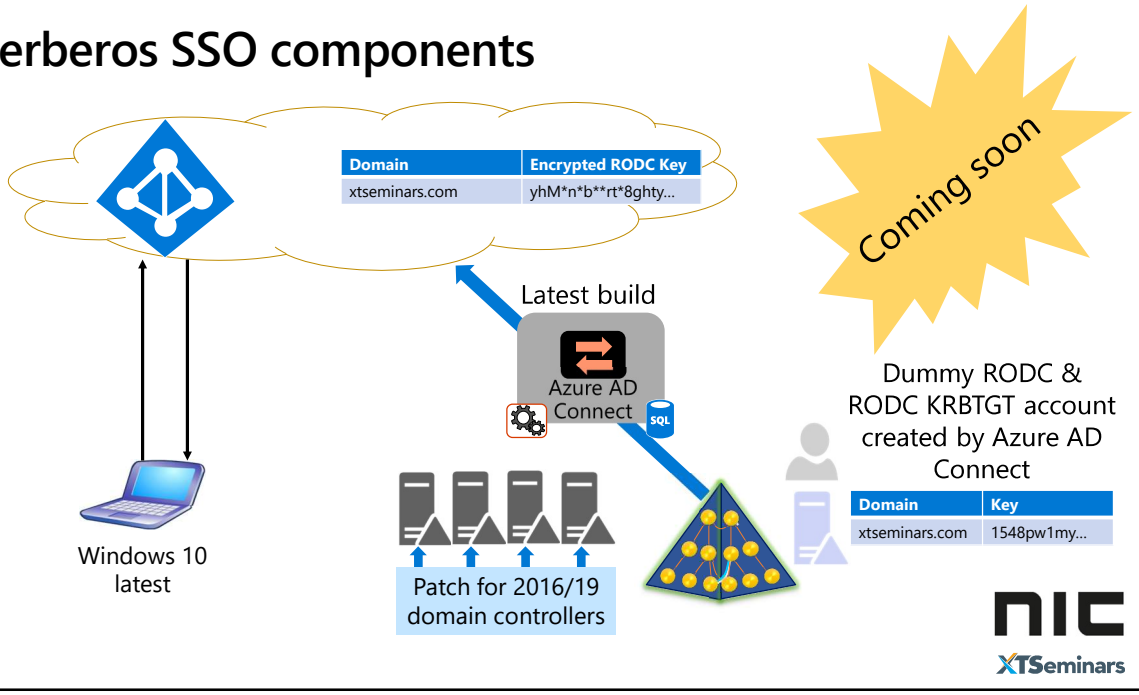
Kerberos SSO components



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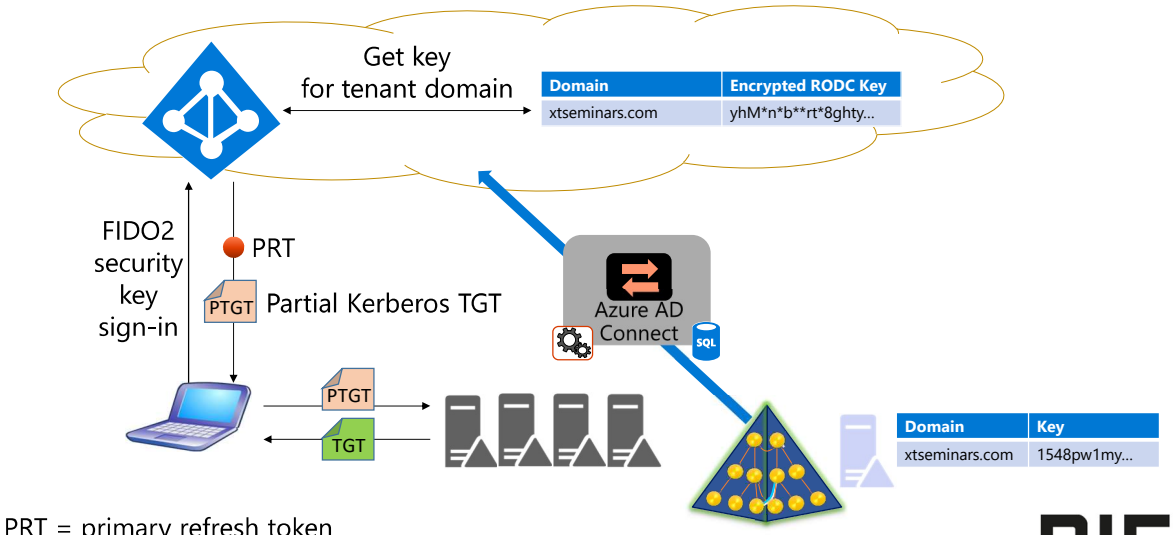
Sign-in with FIDO2



PRT = primary refresh token
TGT = ticket granting ticket

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Now we can live in a world without passwords

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In summary

- A user is required to create the password
  - Not any longer a unique cryptographic key pair is created for each site
- Users reveal their passwords via phishing attacks
  - Even if a user gave away their PIN via social engineering, an attack is not going to succeed without the authenticator
  - All credentials are scoped for a particular relying party, eliminating phishing attacks via fake websites
- The target system holds a database of usernames, passwords and possibly KBA questions and answers
  - Gaining access to the user's public keys has no benefit to a hacker

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If you want to play…

- https://webauthn.me/
- https://webauthn.io
- https://webauthnsample.azurewebsites.net/
- https://www.passwordless.dev/overview

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