Microsoft Security

(~~Deep~~)dive to Entra ID Token Theft Protection

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Microsoft Threat Intelligence

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Who am I?

- Dr Nestori Syynimaa (DrAzureAD)
- Principal Identity Security Researcher
- Microsoft Threat Intelligence Center (MSTIC)

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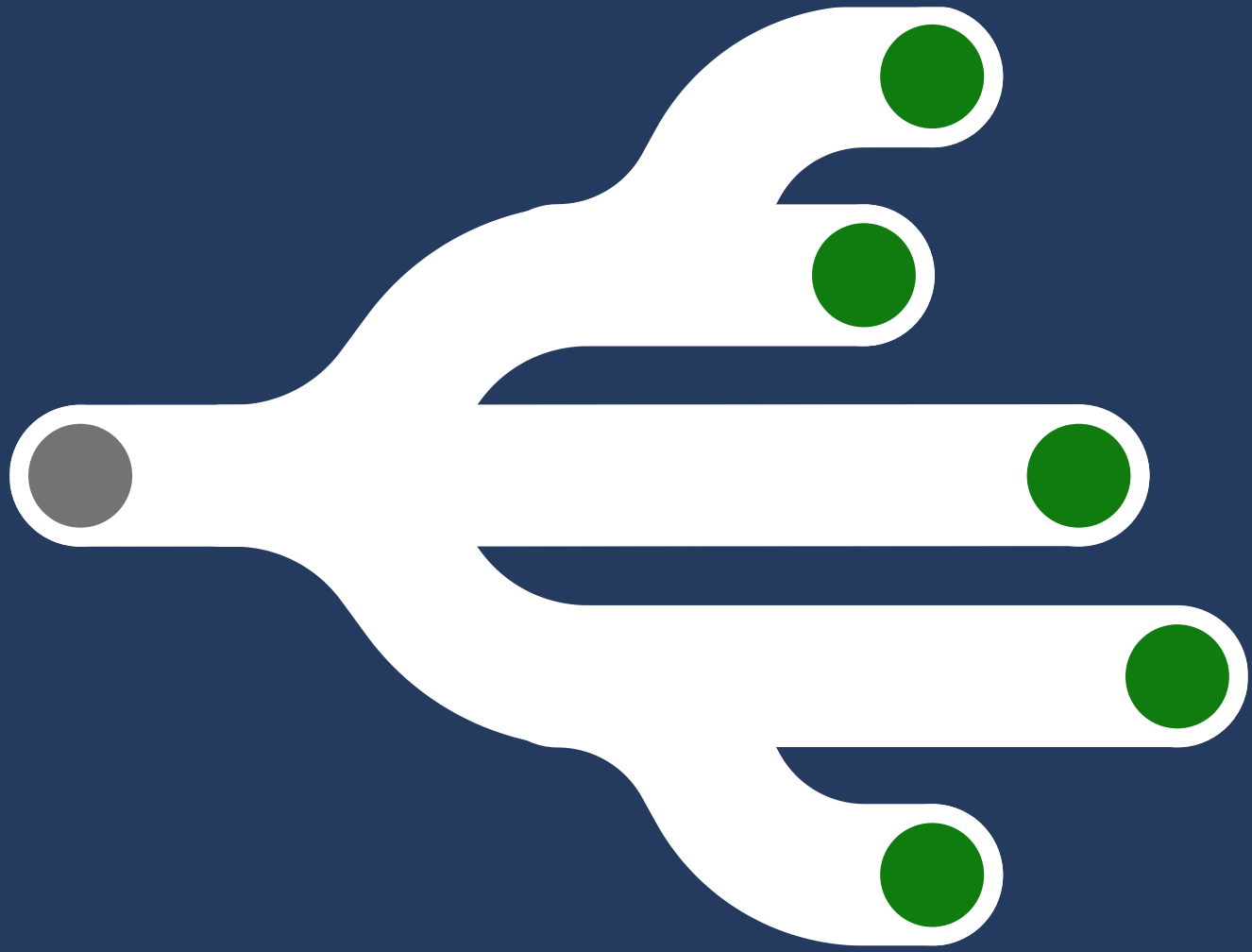
@DrAzureAD

Token based authentication attacks



Key concepts of token-based authentication

User

- Consumes services

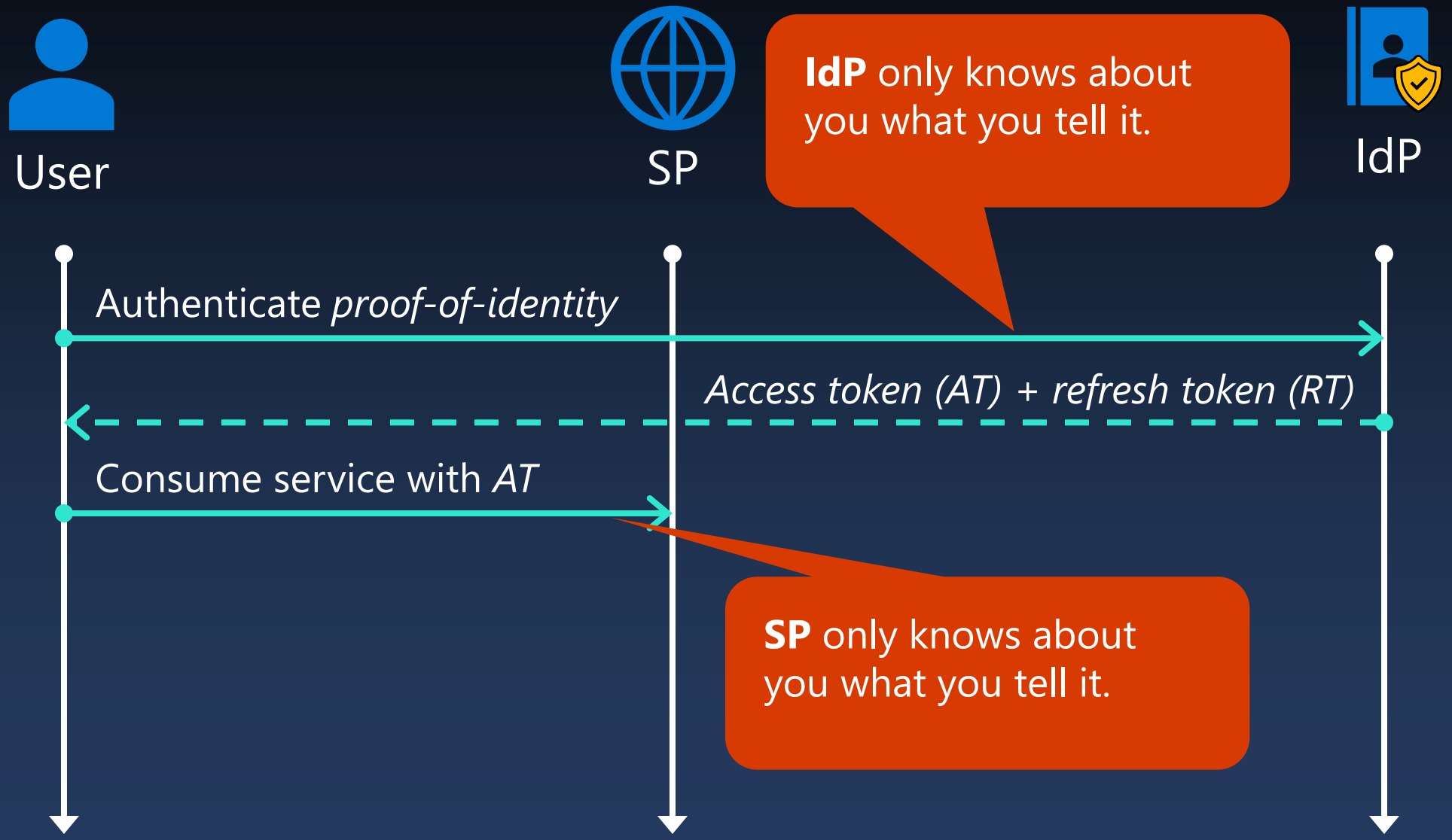
Service Provider (SP)

- Provides services

Identity Provider (IdP)

- Provides identity and access management

How the cloud works



Hackers don’t break in, they log in

Corey Nachreiner

CSO, WatchGuard

Identity attacks in perspective

Password-based attacks continue to dominate, but can be thwarted by using strong authentication methods.

More than 99% of identity attacks are password attacks

- Breach replay
- Password spray
- Phishing

Rely on predictable human behaviors such as selecting easy-to-guess passwords, reusing them on multiple websites, and falling prey to phishing attacks.

<1% of attacks

Less than 1% combined

MFA attacks

- SIM swapping
- MFA fatigue
- AitM

End-run MFA protection by intercepting security codes using stolen phone numbers, barraging users with MFA notifications until they approve, and capturing first and second factor credentials using fake replicas of legitimate websites.

Post-authentication attacks

- Token theft
- Consent phishing

Infiltrate a user's account after they authenticate by stealing a legitimate token created on their device and moving it to a device under the attacker's control, by searching source code repositories for Open Authorization (OAuth) tokens and other non-human credentials, or by tricking the authenticated user into granting permissions to malicious apps.

Infrastructure compromise

Often silently executed by professional groups or nation-state-backed threat actors with sophisticated operations, making them very hard to detect. Threat actors may compromise an on-premises federation server and copy its private signing key to forge tokens, compromise a privileged cloud user and add new federation contracts, or compromise a non-human workload identity and create new credentials with elevated privileges.

Source: Microsoft Threat Intelligence

https://www.microsoft.com/en-gb/security/security-insider/intelligence-reports/microsoft-digital-defense-report-2024

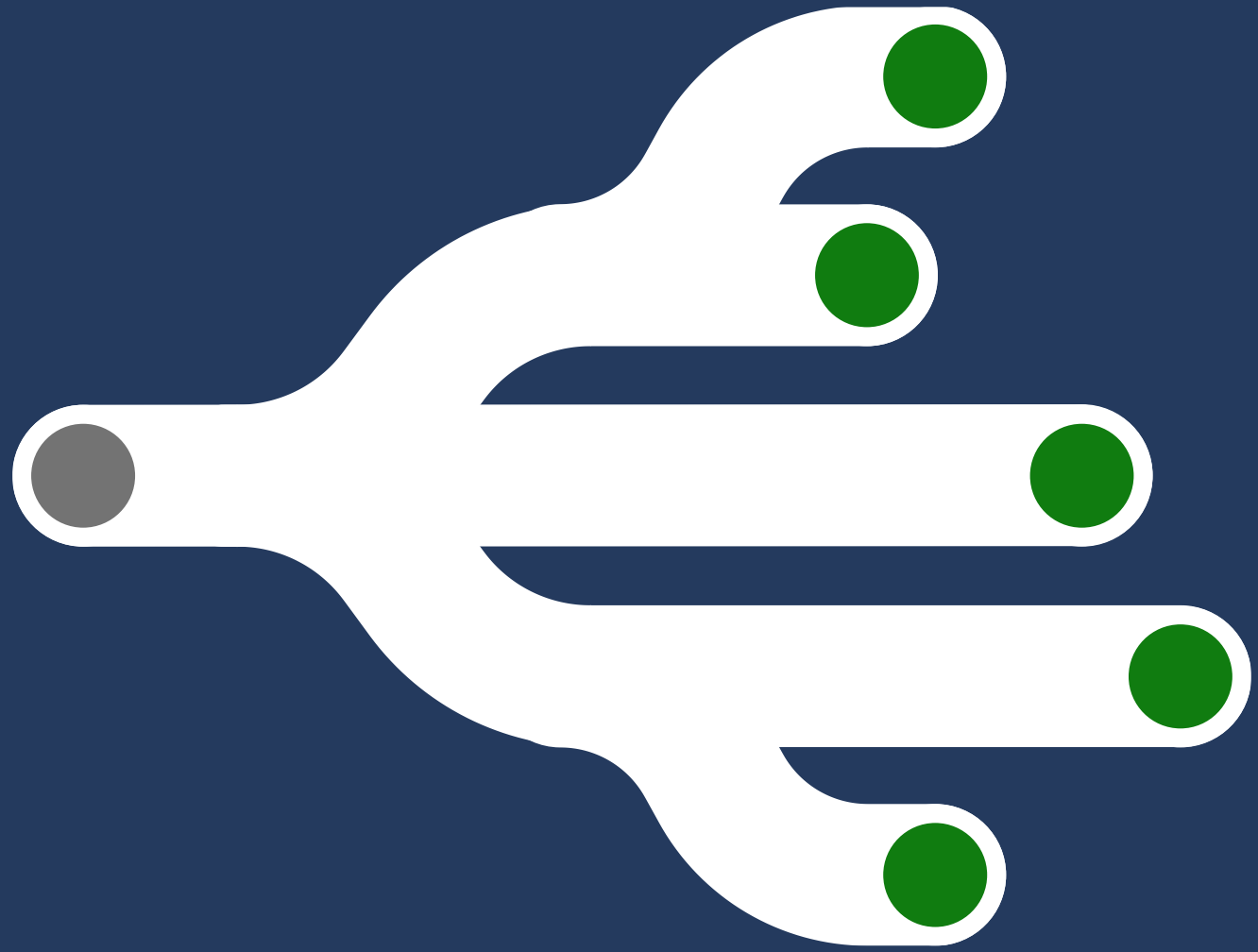
Biggest problem with network defense is that defenders think in lists. Attackers think in graphs.

As long as this is true, attackers win.

John Lambert

Corporate Vice President, Security Fellow, Microsoft

Token Theft

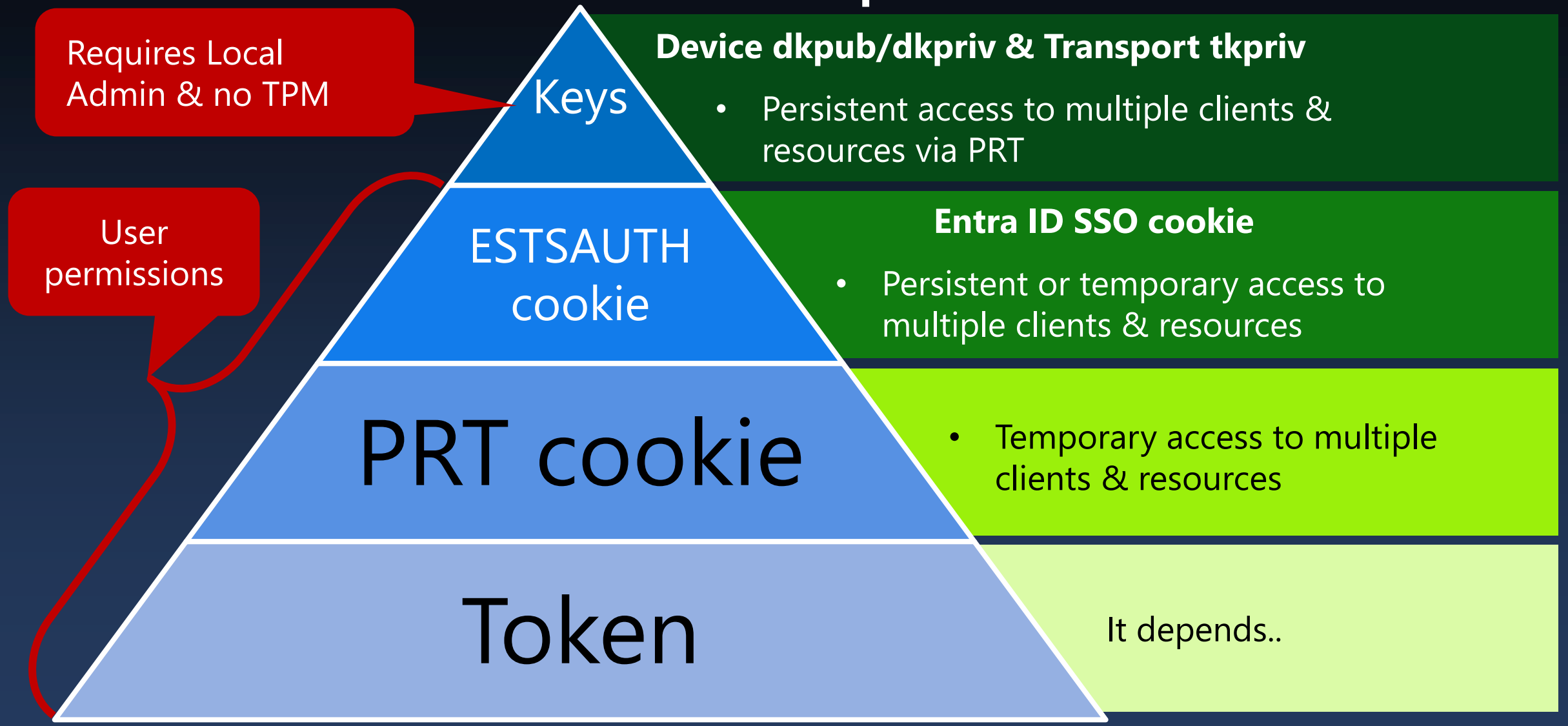


~~Man-in-the-Middle (MitM)~~
Adversary-in-the-Middle (AitM)

- *An attack where the **adversary positions** himself **in between** the **user and** the **system** so that he can intercept and alter data traveling between them.*[1]

1. NIST Glossary

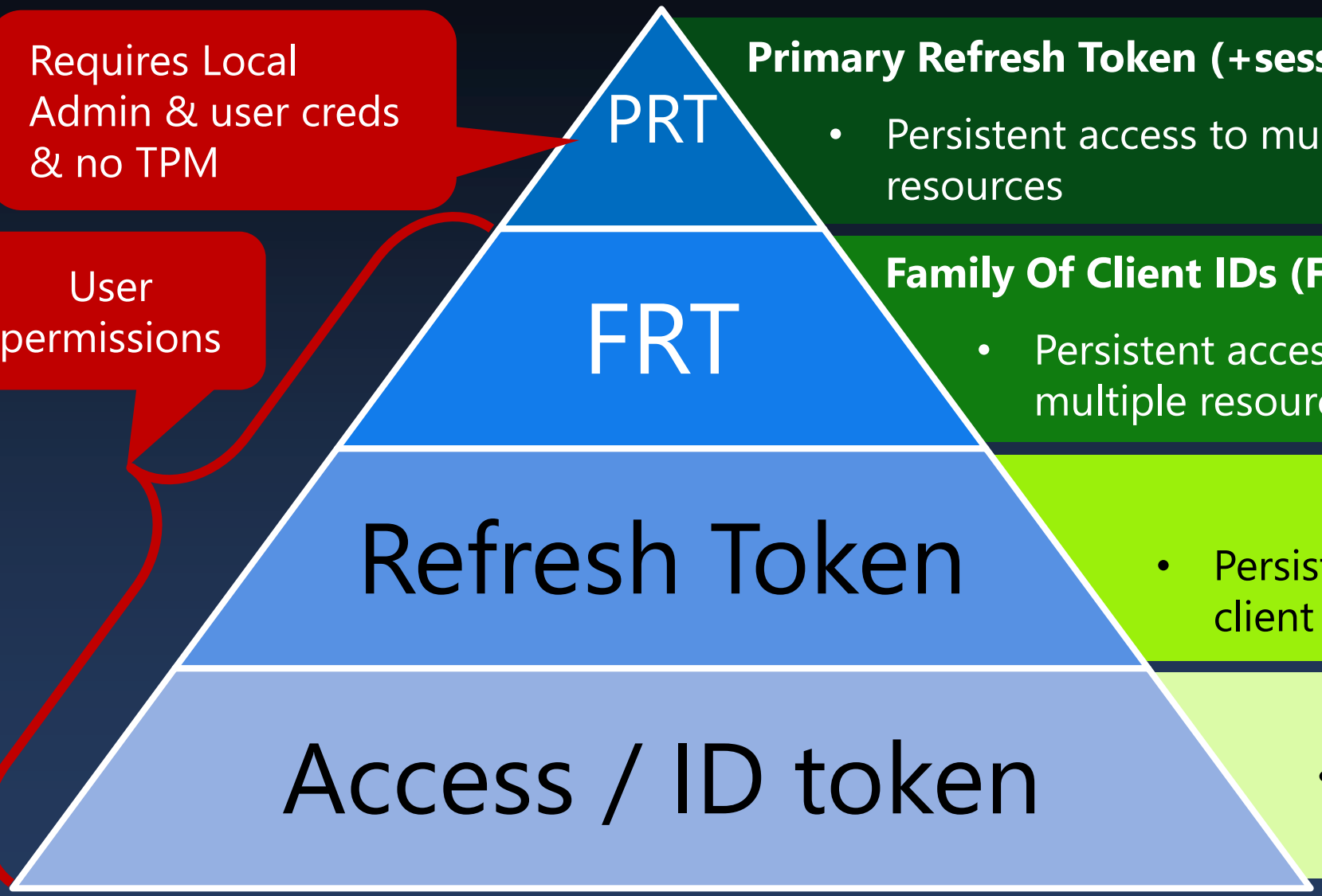
What to steal from user's endpoint?



Which token to steal?

Requires Local Admin & user creds & no TPM

User permissions



Primary Refresh Token (+session key) **90 d**

- Persistent access to multiple clients & resources

Family Of Client IDs (FOCI) Refresh Token **90 d**

- Persistent access to FOCI clients & multiple resources

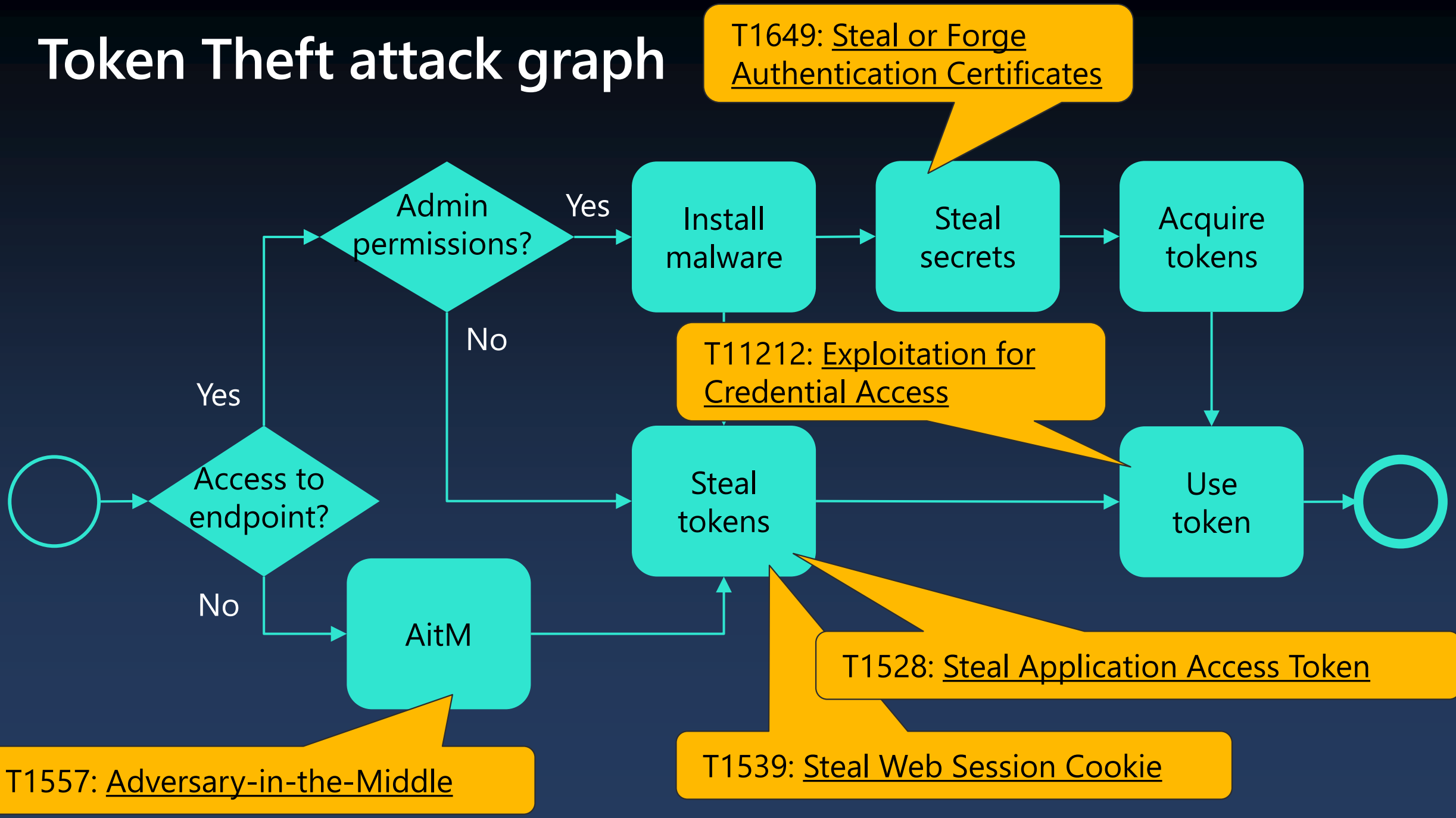
90 d

- Persistent access to single client & multiple resources

1-28 h

- Temporary access to single client & resource

Token Theft attack graph

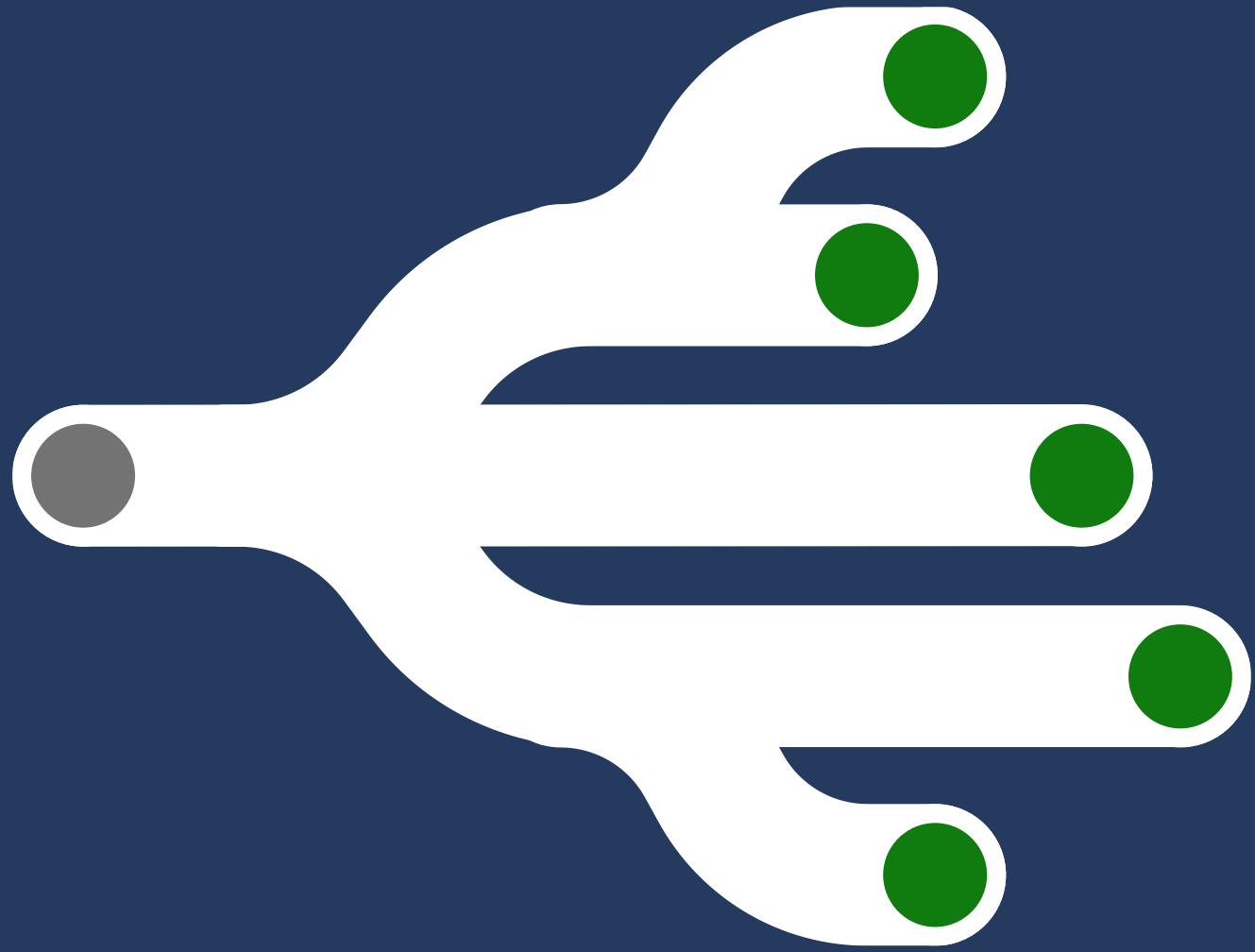


Token security best practices

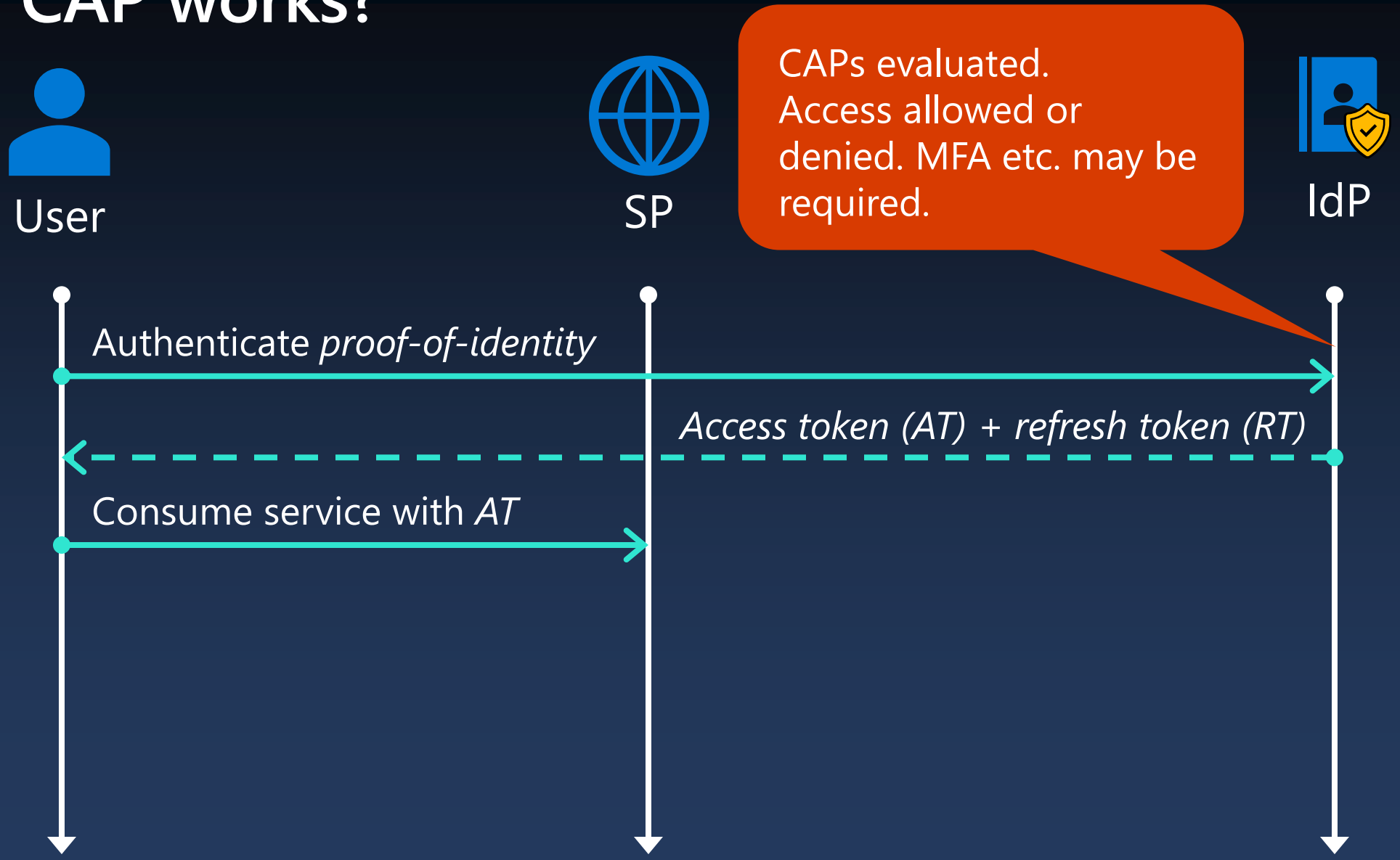
- **Conditional Access Policies:** Use Conditional Access policies to enforce compliant network checks. This ensures that tokens are only used from trusted networks and devices.
- **Token Binding:** Implement Token Protection (formerly known as token binding) to cryptographically tie tokens to client secrets. This prevents token replay attacks from different devices.
- **Continuous Access Evaluation (CAE):** Implement CAE to continuously evaluate the security state of the session. This helps in detecting and revoking tokens if there are changes in the user's security posture, such as network location changes.

https://techcommunity.microsoft.com/blog/coreinfrastructureandsecurityblog/token-protection-by-using-microsoft-entra-id-/4302207

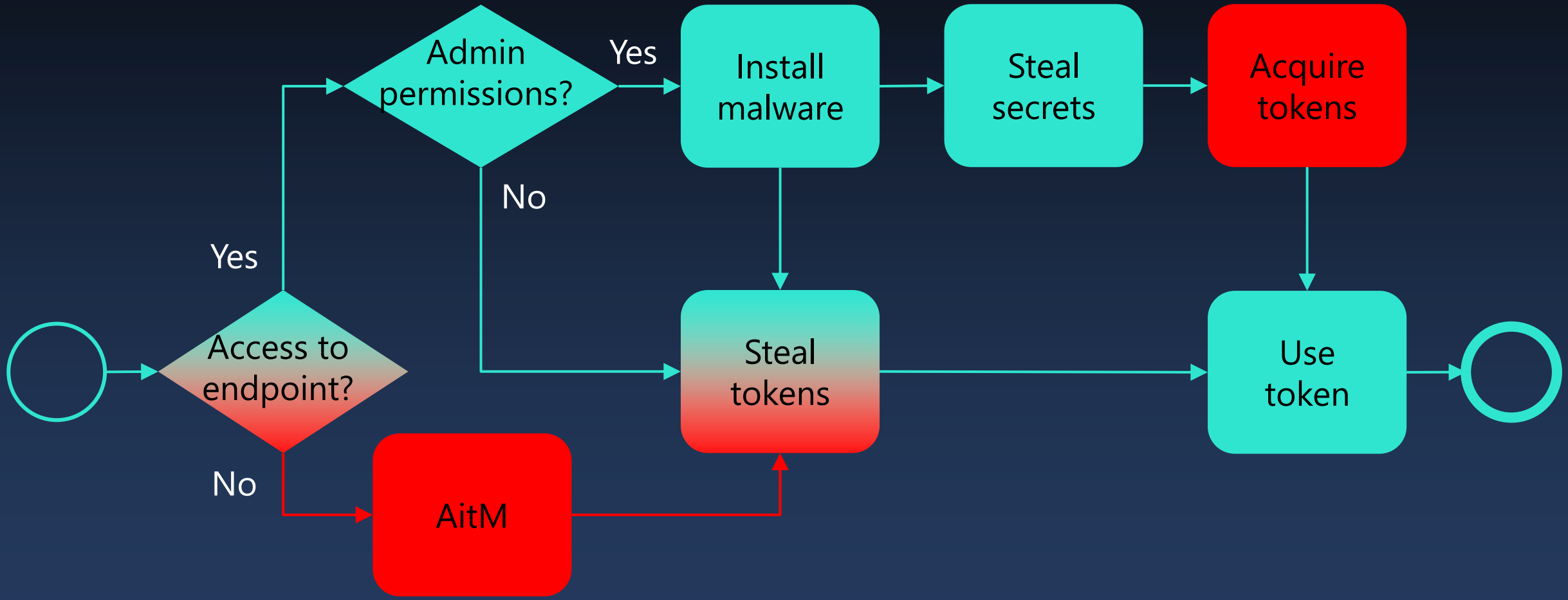
Conditional Access Policies (CAP)



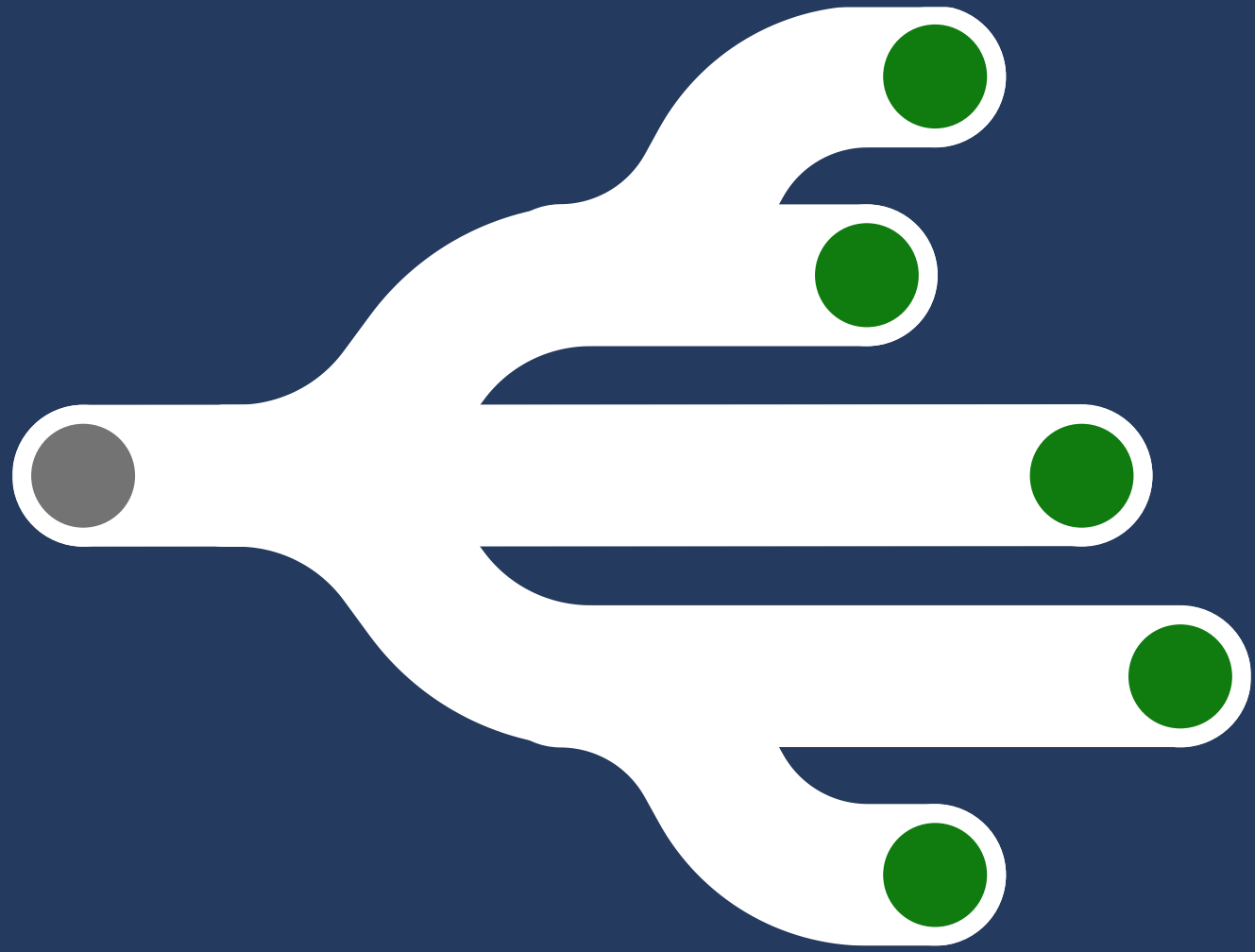
How CAP works?



CAP *may* protect against AitM and Acquire token



Token Protection



Token protection 1/4

- Supports:
  - Office 365 Exchange Online, SharePoint Online, Teams
  - Azure Virtual Desktop
  - Windows 365
- Requirements:
  - Microsoft Entra registered, joined, or hybrid joined Windows 10+ (or hybrid joined WSE 2019+), *preview for MacOS & iOS*
  - Supported native client (OneDrive, Teams, etc.)
  - Entra ID ~~P2~~ P1
- Deployment:
  - Conditional access policy

https://learn.microsoft.com/en-us/entra/identity/conditional-access/concept-token-protection

Token protection 2/4

“Token Protection ensures that tokens can only be used on the intended device. When enforced through Conditional Access policies, tokens authorizing access to resources must come from the device where the user originally signed in. This provides the best available protection for your high-value users and data against breaches involving token theft.”

“We’re targeting **Refresh Tokens** for protection first as they tend to be longer-lived and more broadly scoped than other types of tokens and are therefore more valuable for an attacker to steal. “

https://techcommunity.microsoft.com/blog/microsoft-entra-blog/public-preview-token-protection-for-sign-in-sessions/3815756

Token Protection 3/4

"A key part of Microsoft's protections against token theft is the use of tokens that are cryptographically tied to the device they own. This is often called **token binding**, but may also be called sender constrained tokens, or token proof of possession. Token protection makes it harder to execute the main types of attacks designed to steal tokens, including network-based attacks and those using malware on the device by restricting use of the stolen token from devices they weren't issued to."

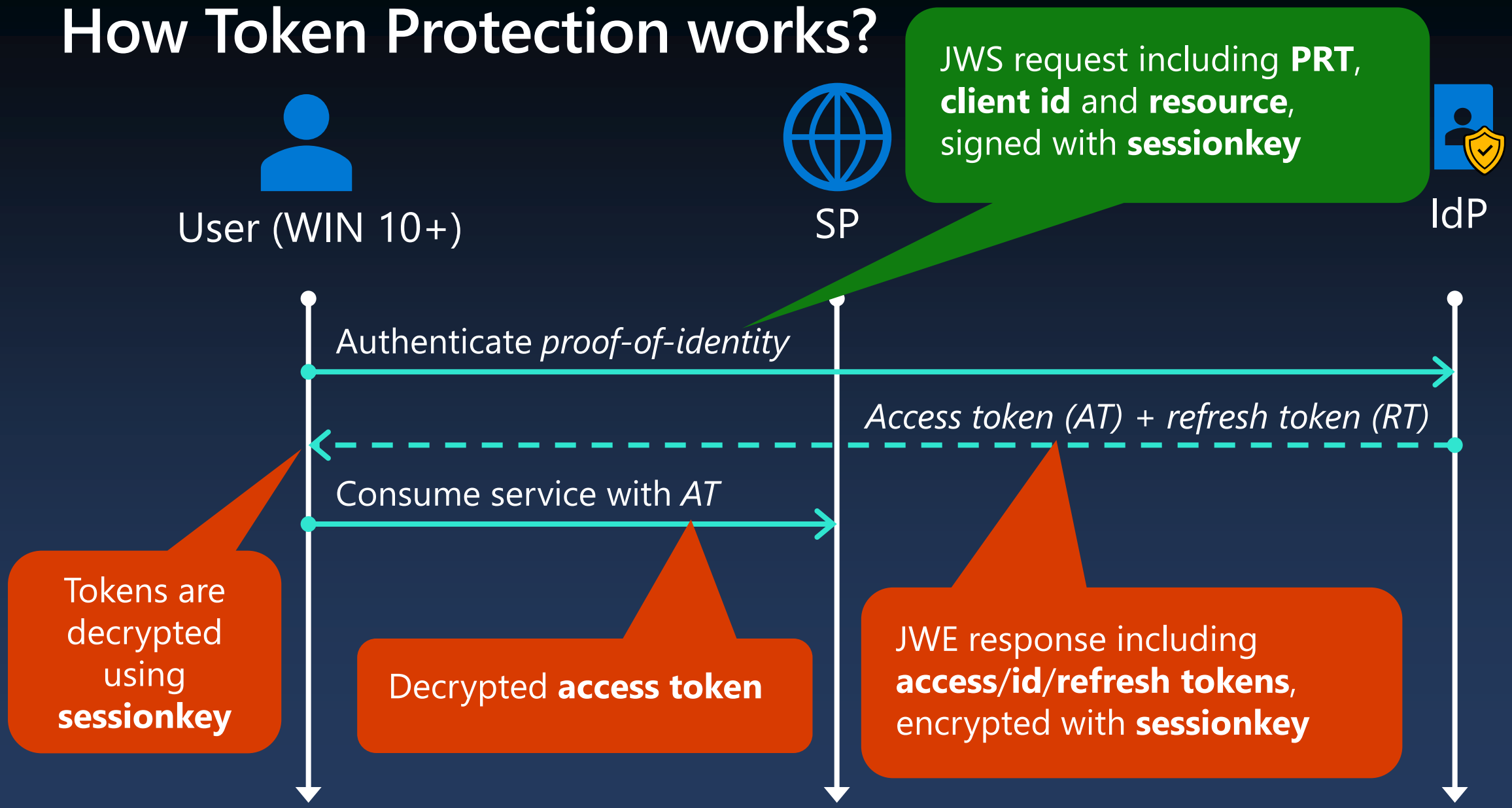
https://techcommunity.microsoft.com/blog/microsoft-entra-blog/how-to-break-the-token-theft-cyber-attack-chain/4062700

Token Protection 4/4

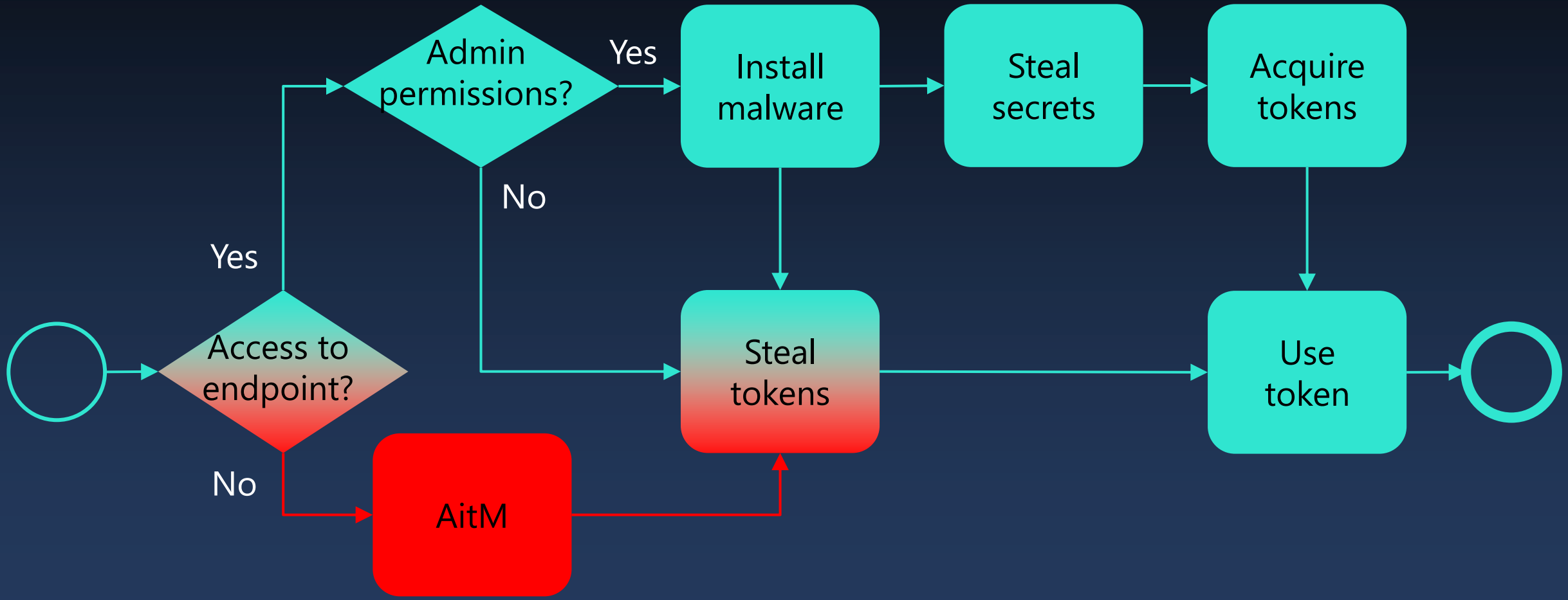
“Token protection creates a cryptographically secure tie between the token and the device (client secret) it's issued to. Without the client secret, the bound token is useless. When a user registers a Windows 10 or newer device in Microsoft Entra ID, their primary identity is bound to the device. What this means: A policy can ensure that only bound sign-in session (or refresh) tokens, otherwise known as Primary Refresh Tokens (PRTs) are used by applications when requesting access to a resource.”

https://techcommunity.microsoft.com/blog/coreinfrastructureandsecurityblog/token-protection-by-using-microsoft-entra-id-/4302207

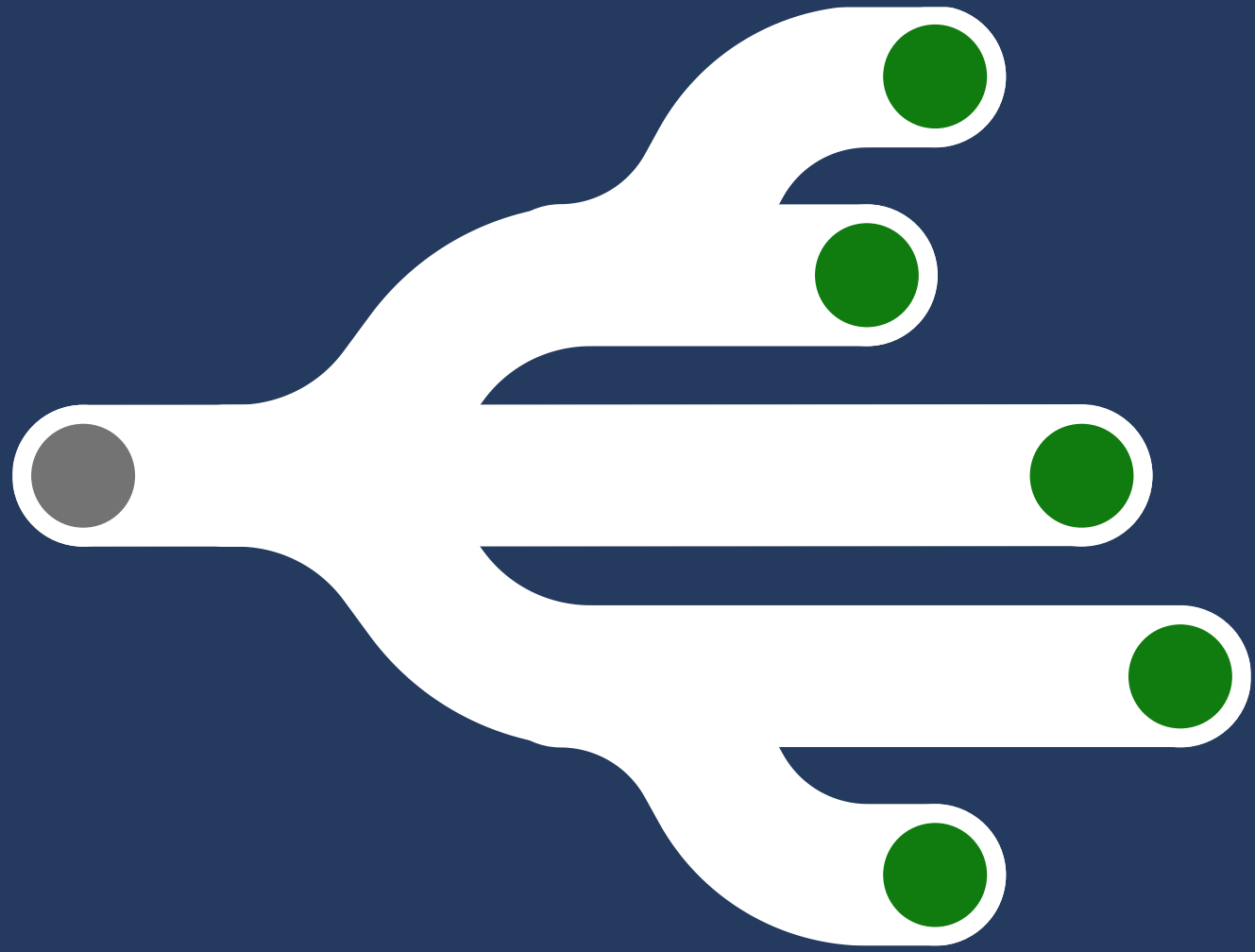
How Token Protection works?



Token Protection prevents AitM attacks



Continuous Access Evaluation (CAE)

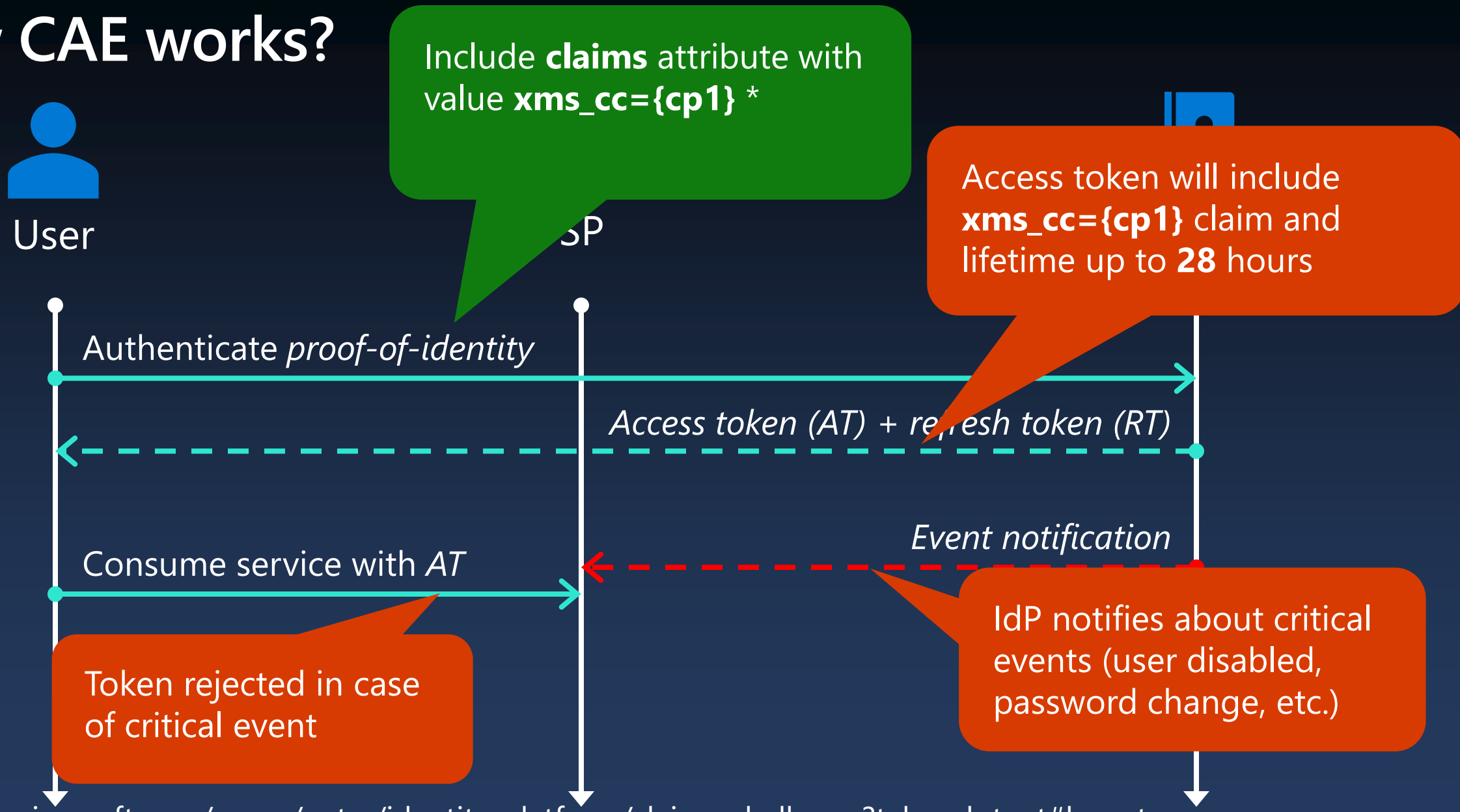


Continuous Access Evaluation

- Supports:
  - Office 365 Exchange Online, SharePoint Online, Teams
- Requirements:
  - Supported client (OneDrive, Teams, custom app etc.)
  - Entra ID P1
- ~~Deployment~~ Customisation:
  - Conditional access policy

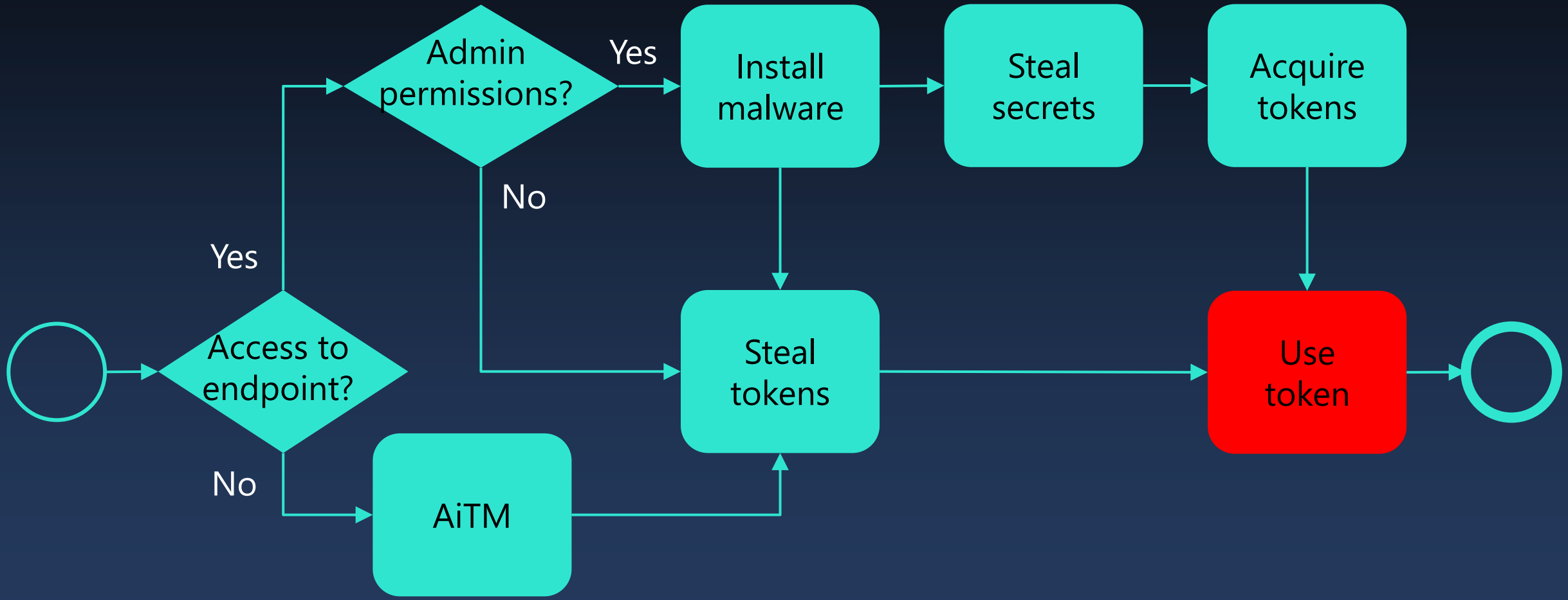
https://learn.microsoft.com/en-us/entra/identity/conditional-access/concept-continuous-access-evaluation

How CAE works?



* https://learn.microsoft.com/en-us/entra/identity-platform/claims-challenge?tabs=dotnet#how-to-communicate-client-capabilities-to-microsoft-entra-id

CAE *may* prevent token replay



* https://learn.microsoft.com/en-us/entra/identity/conditional-access/concept-continuous-access-evaluation#conditional-access-policy-evaluation

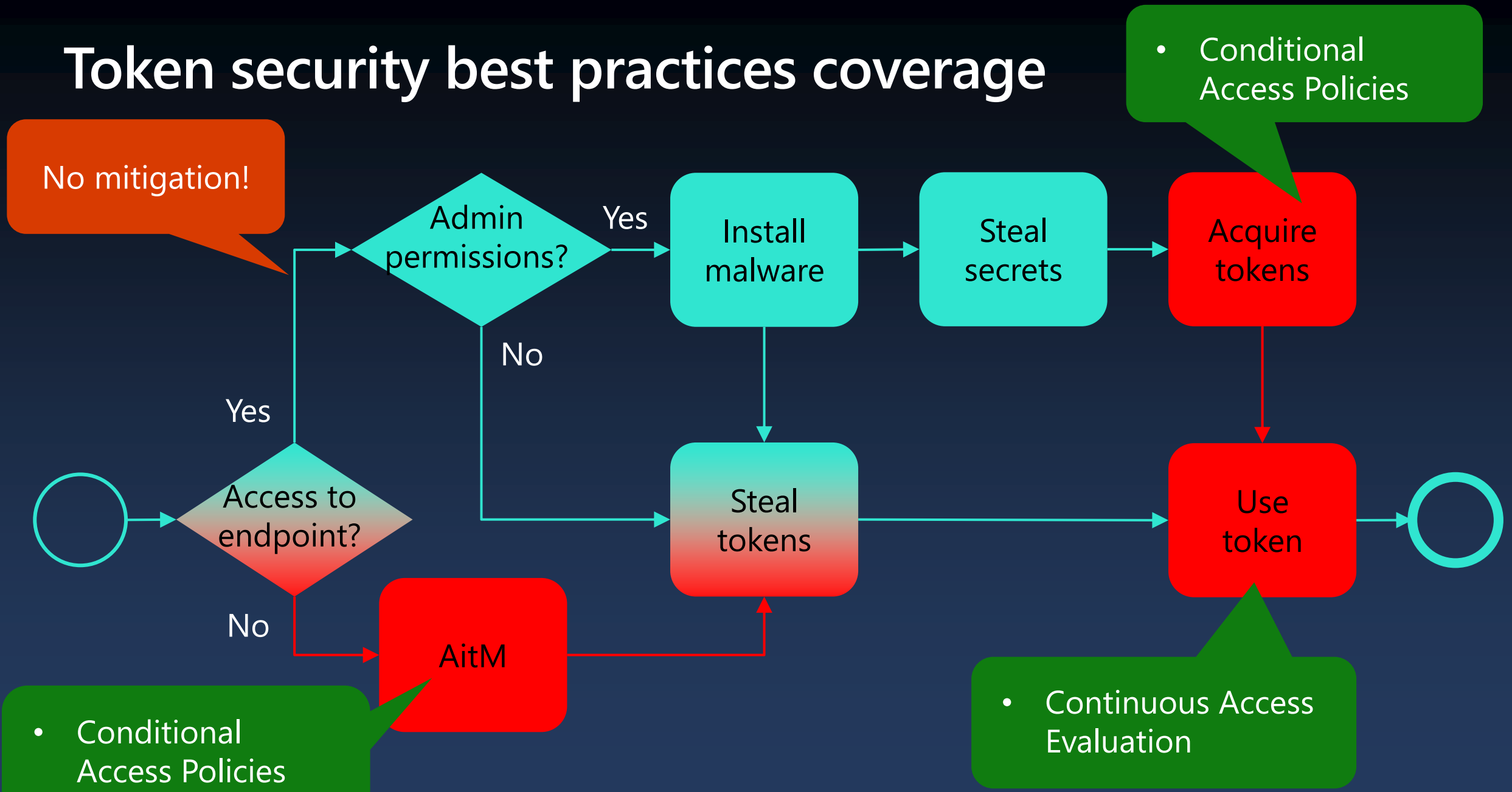
Exploiting CAE

- CAP requires Entra ID P1 license
  - Token Protection is enforced by CAP
  - CAE can be customized using CAP
- You can *request* CAE tokens without P1 license
  - Allows threat actors to get tokens with much longer lifetime (up to 28 hours vs 1 hour)

Detecting CAE abuse

```
union isfuzzy=true SigninLogs, AADNonInteractiveUserSignInLogs
| mv-expand todynamic(AuthenticationProcessingDetails)
| where AuthenticationProcessingDetails.key has "Is CAE Token"
| where AuthenticationProcessingDetails.value has "true"
| project TimeGenerated, AppId, ResourceIdentity, UserPrincipalName
```

Token security best practices coverage



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THANK YOU!

Questions?