(WIP) Reducing the Efficacy of Phishing due to Poor User Behavior

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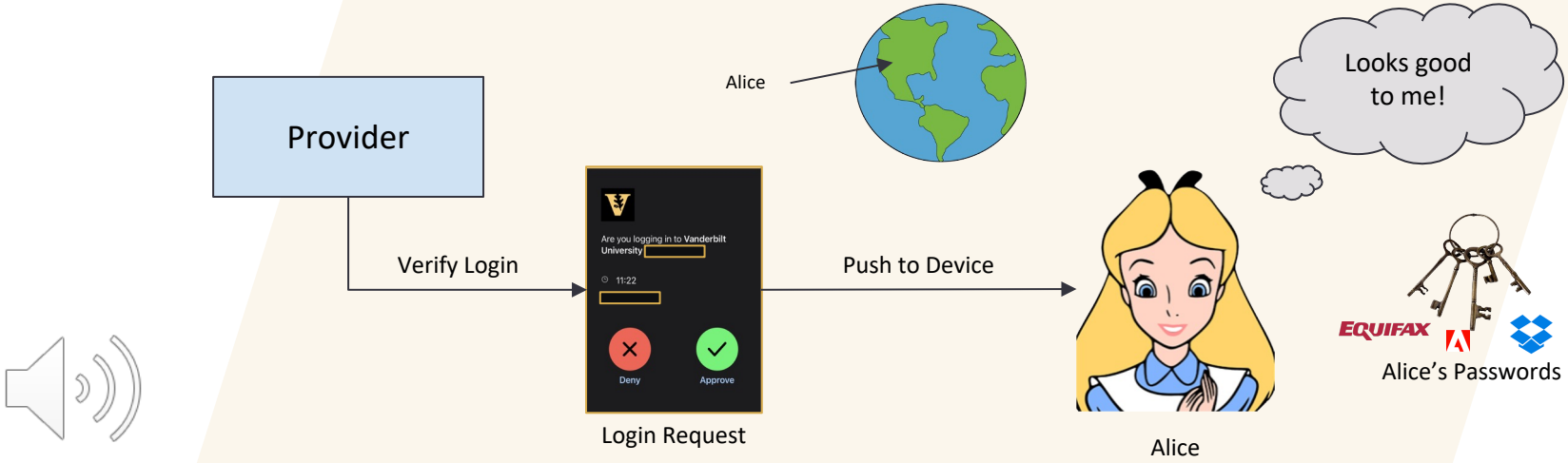
Introduction

What happens when a user approves a login request regardless of the timing or reality of whether the true user is logging in?



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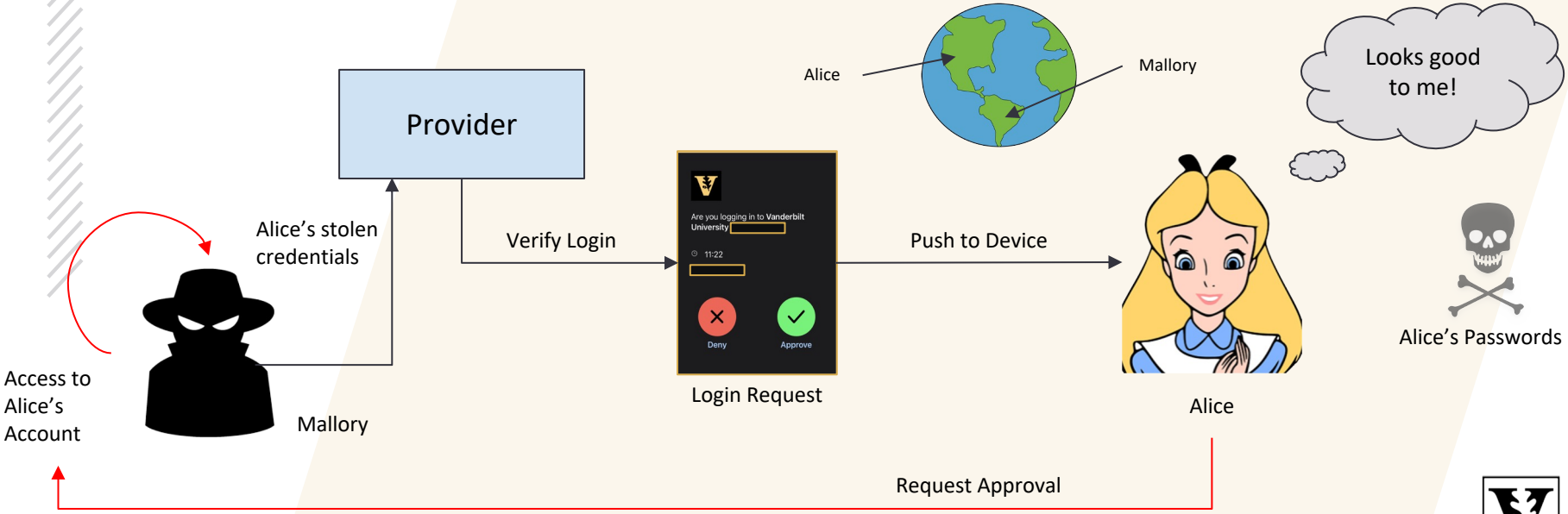


Problem

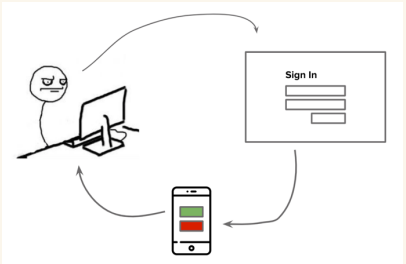
Phishing Alert Update: Do Not Approve Duo Push Alerts If You Did Not Initiate a Login [1]

Top 3 types of data compromised in phishing attacks: credentials, PII, Medical[2]

A Google study of **12.4M phishing victims** and **1.9B stolen credentials** from March 2016-2017 concludes "**7–25% of stolen passwords** in our dataset would enable an attacker to **log in to a victim's Google account** through password reuse"[3]

- MFA = security + risk of fatigue
- Fatigue + unsuspecting user = careless login request approval
- Careless approval + (phished/reused/stolen) credentials = **compromised user account(s)**

Key Question: How to prevent a successful breach assuming **adversary possesses phished or stolen credentials** and a **step-up fatigued end user**?



1 https://news.unchealthcare.org/2022/02/phishing-alert-update-do-not-approve-duo-push-alerts-if-you-did-not-initiate-a-login/
2 https://www.tessian.com/blog/phishing-statistics-2020/
3 https://research.google/pubs/pub46437/

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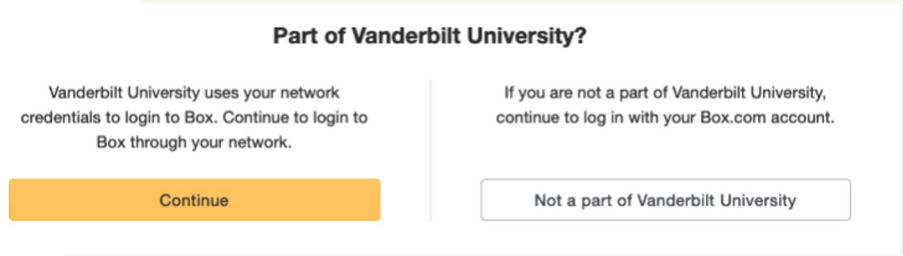
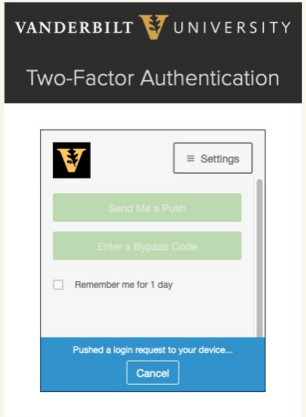
Background

- SAML 2.0 common in corporate environments (others e.g. Google OpenID Connect)
  - We focus on SAML but our solution is protocol-agnostic
- Single Sign-On (SSO) paradigm provides multi-service access using one set of credentials
- SAML 2.0 terms (analogs exist in other protocols)
  - Identity Provider (IdP): System that authenticates the user (e.g. Duo)
  - Service Provider (SP): Application of interest to user (e.g. Box)
  - Assertions: Indicate to the SP that the principal (user) is logged in
- Authentication (user **identity**) vs. Authorization (user **privilege**)



Service Provider



Identity Provider

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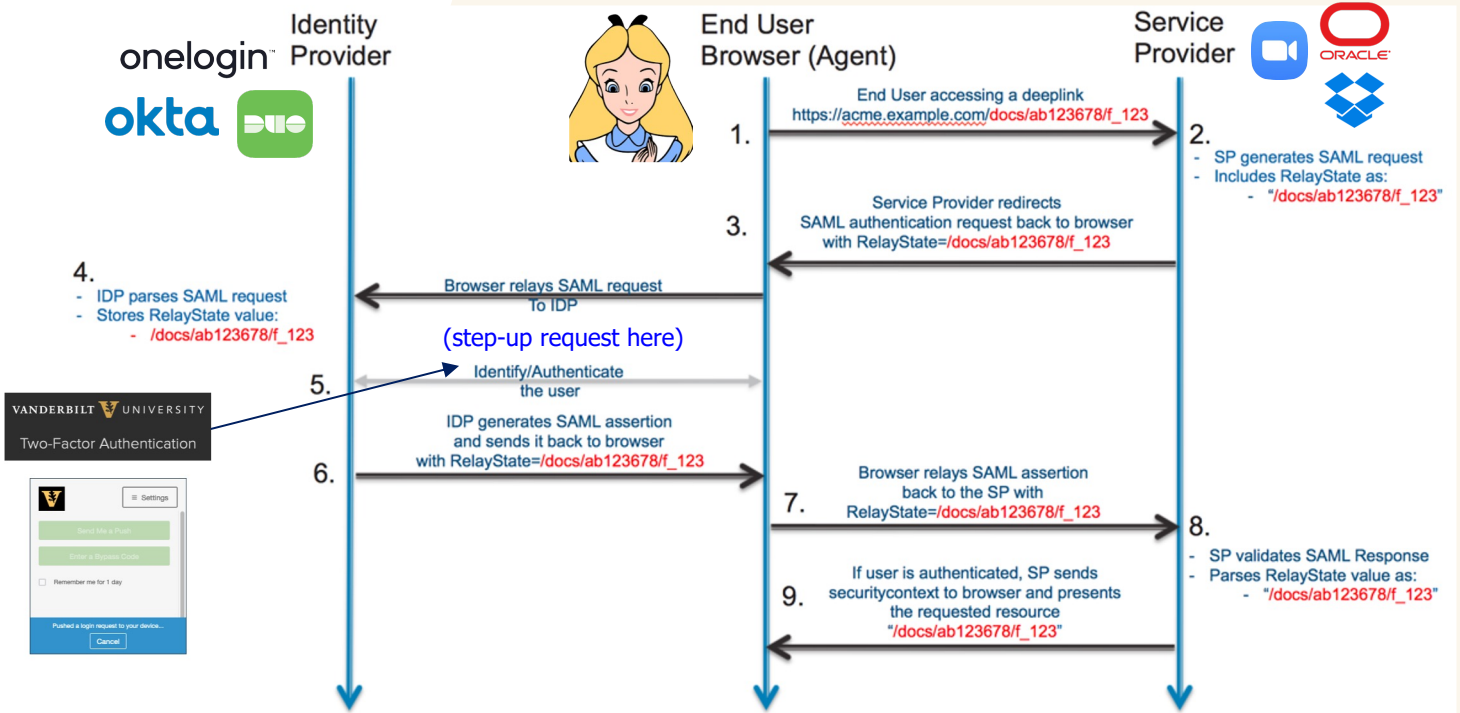
Background



https://developer.okta.com/img/saml_guidance_deeplink.png

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Proposed Approach

- **Goal:** Prevent successful phishing from mishandled login requests
- **Insight**: Keep signed JSON Web Tokens (JWTs, “jots”) in localStorage to manage enrolled devices and users requesting login
  - Problem: localStorage is NOT safe out of the box!
    - Solution: store jwt-count and jwt-version attributes to verify token integrity
- **Implementation**: Provide enrollment (uses jwt-count, prescribed to user) and login (uses jwt-version, opaque to user) endpoints managed by security policy
  - (WIP) require hashed nonce as additional layer

- aka The Unavailable LogIn Page

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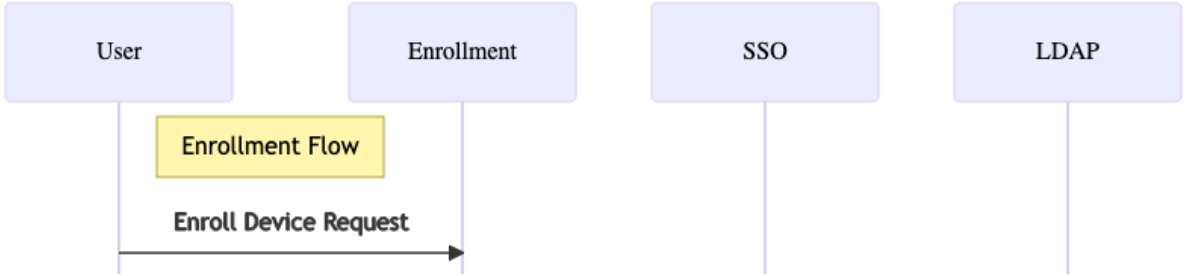

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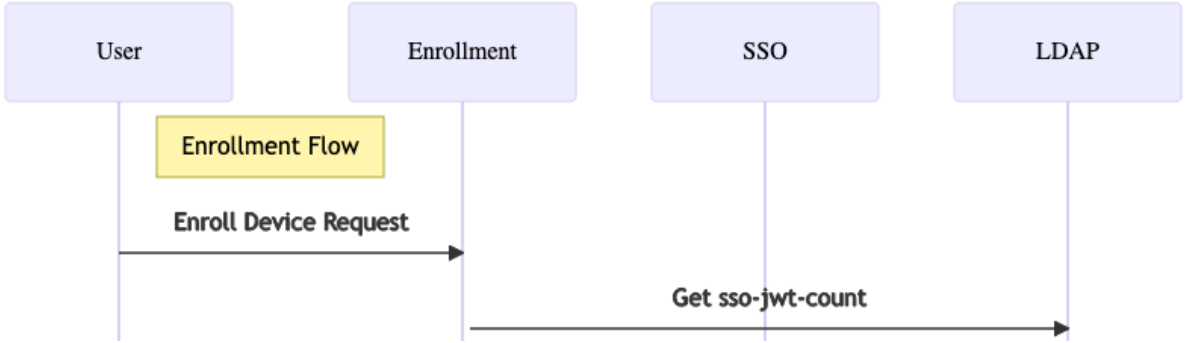
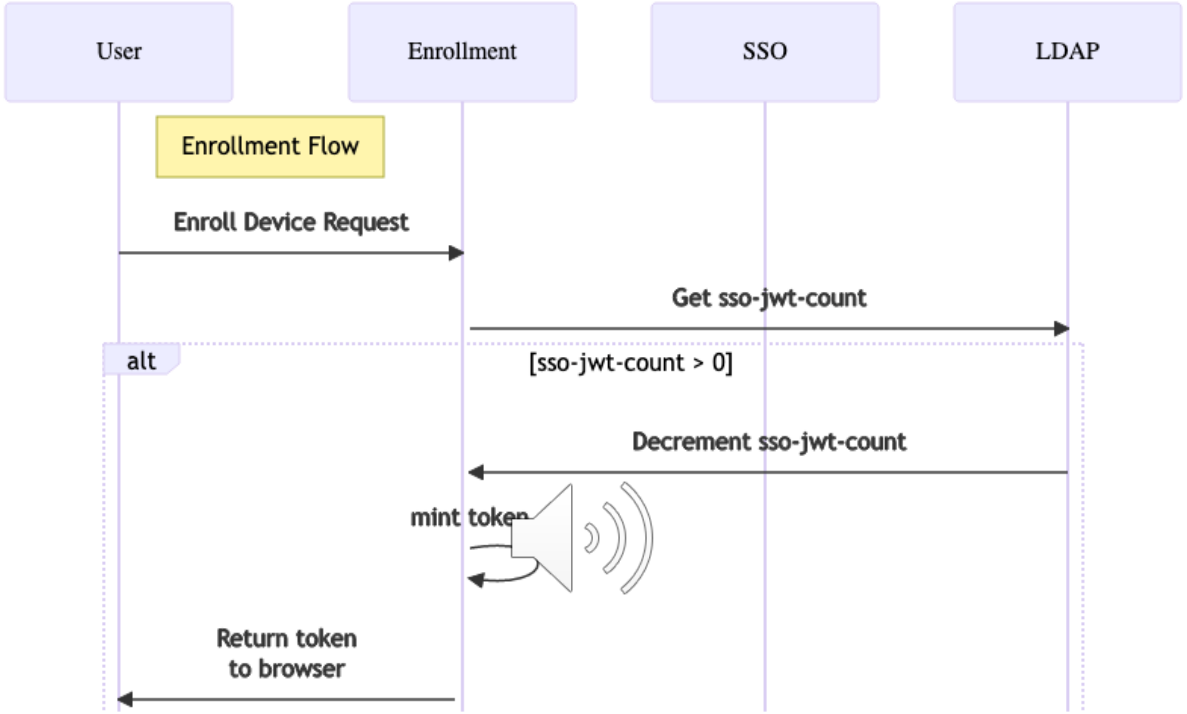
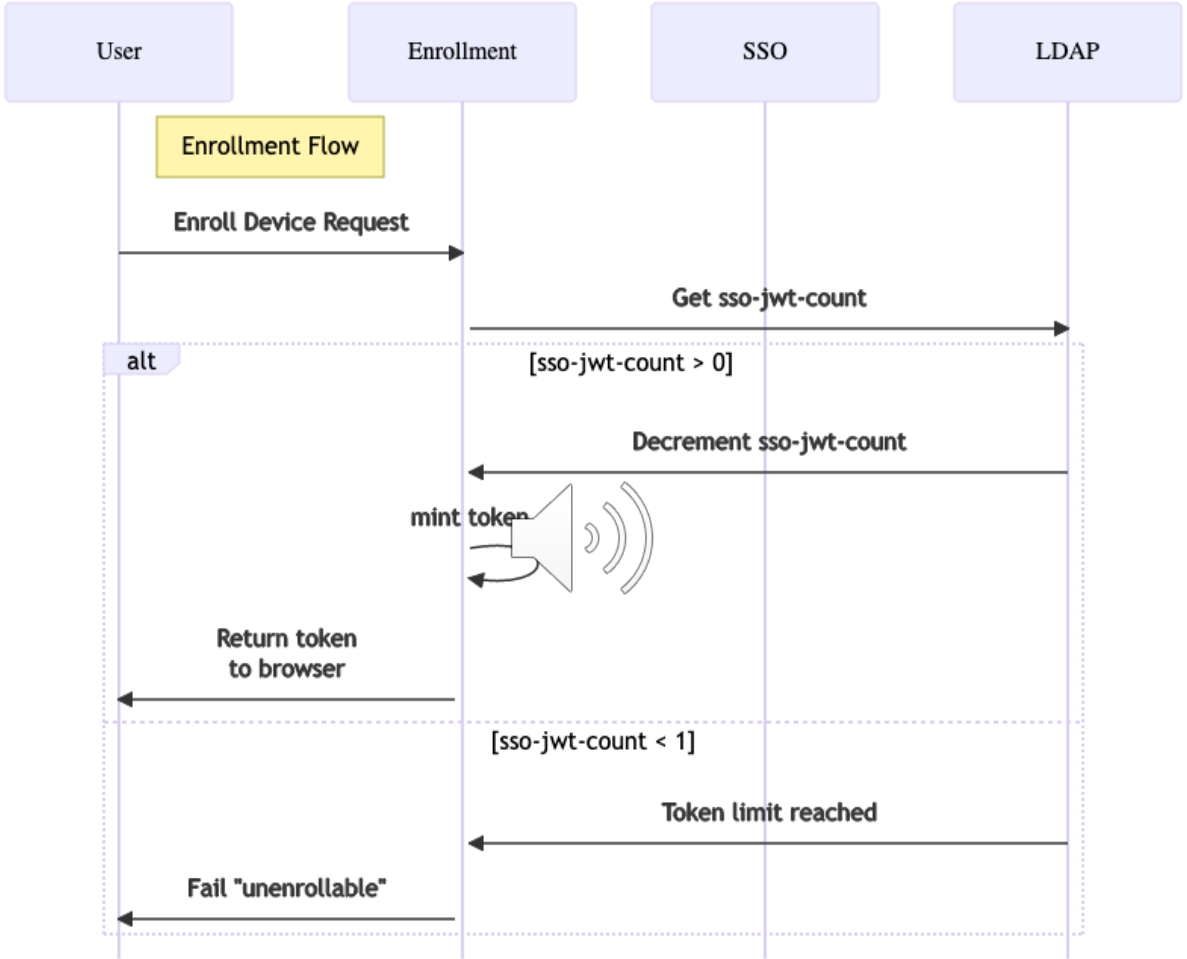

User
Enrollment
SSO
LDAP
Enrollment Flow
Enroll Device Request
Get sso-jwt-count


User
Enrollment
SSO
LDAP
Enrollment Flow
Enroll Device Request
Get sso-jwt-count
alt
[sso-jwt-count > 0]
Decrement sso-jwt-count
mint token
Return token
to browser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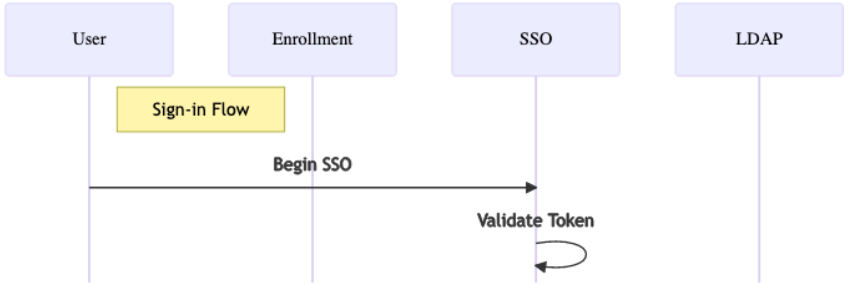
Get sso-jwt-count
alt
[sso-jwt-count > 0]
Decrement sso-jwt-count
mint token
Return token
to browser
[sso-jwt-count < 1]
Token limit reached
Fail "unenrollable"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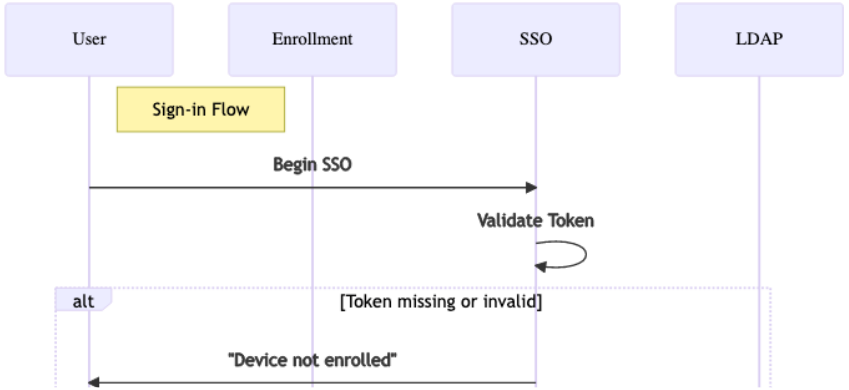
SSO
LDAP
Sign-in Flow
Begin SSO
Validate Token



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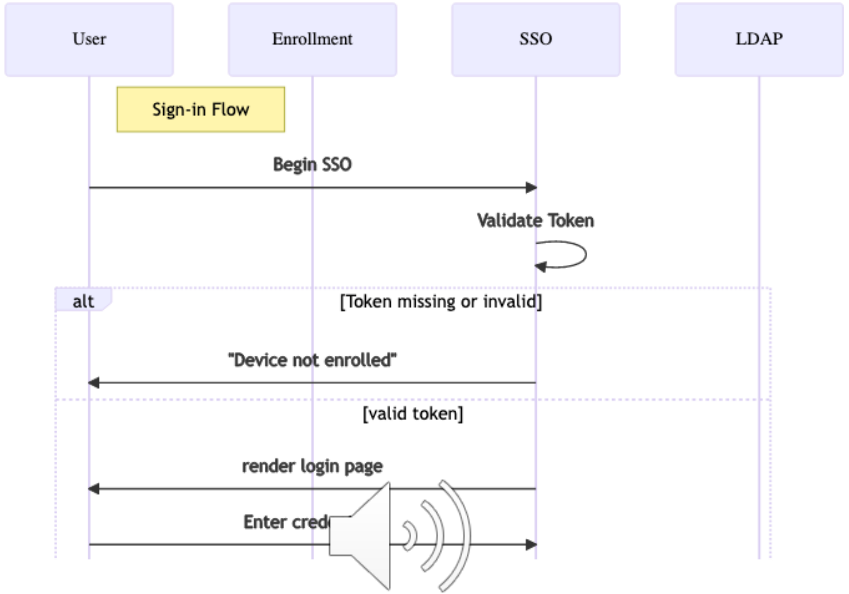
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alt
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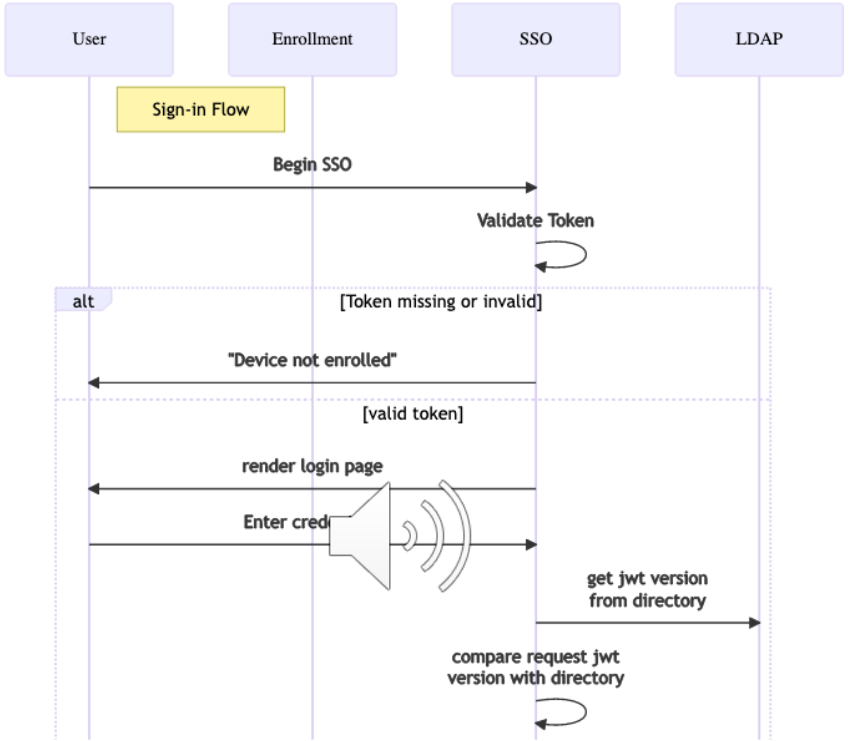
[valid token]
render login page
Enter cred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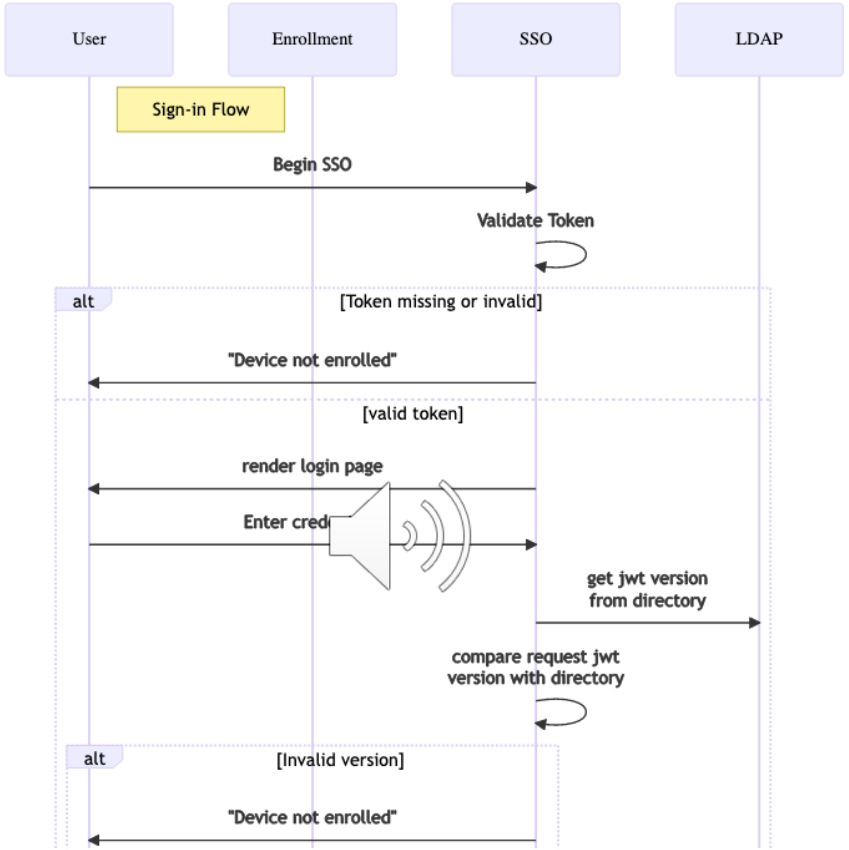
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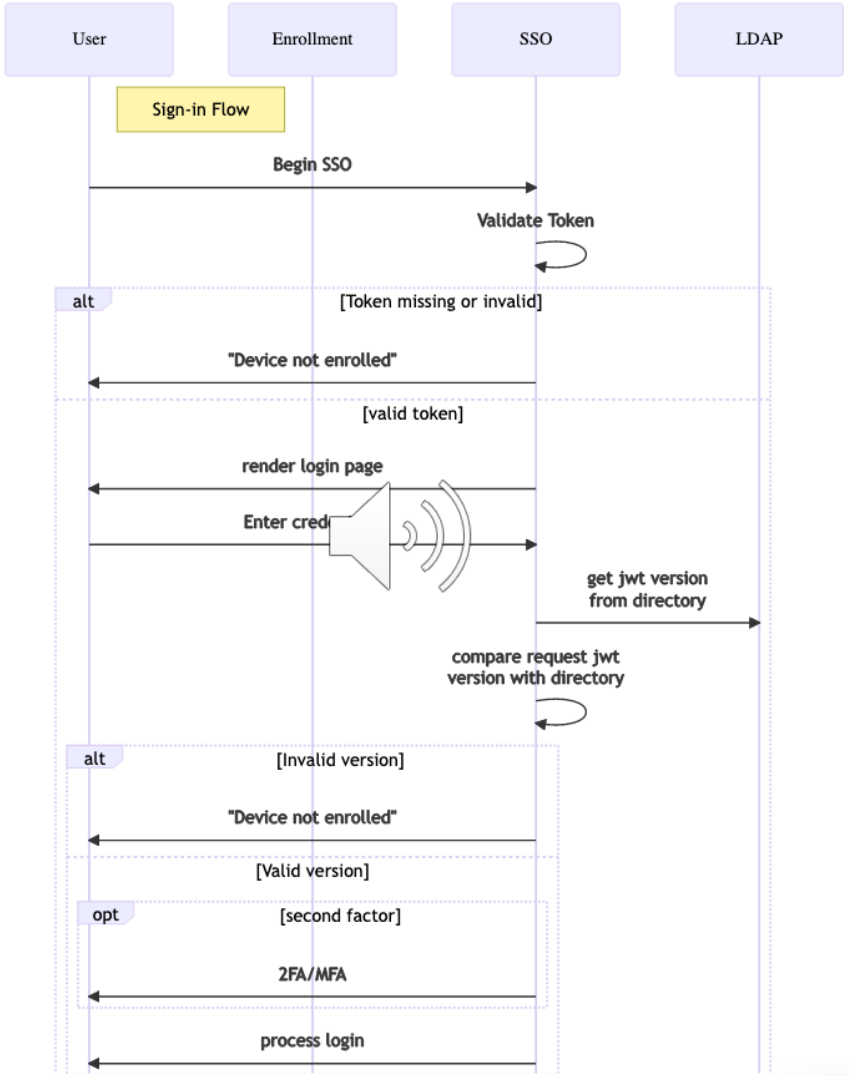
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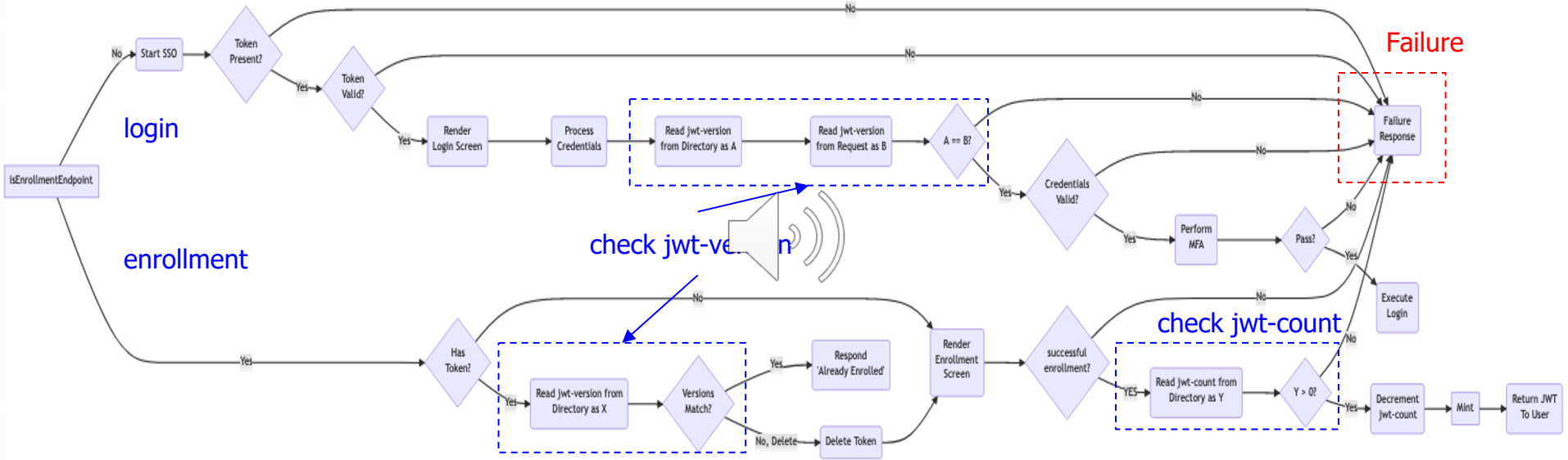
Enter cred
get jwt version
from directory
compare request jwt
version with directory
alt
[Invalid version]
"Device not enrolled"
[Valid version]
opt
[second factor]
2FA/MFA
process login

Failure Paths



Thank You

Please contact michael . sandborn @ vanderbilt . edu with questions

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