Token Authentication Background

Mine Altunay, Dave Dykstra
October 6, 2021
FIFE Token Task Force Meeting

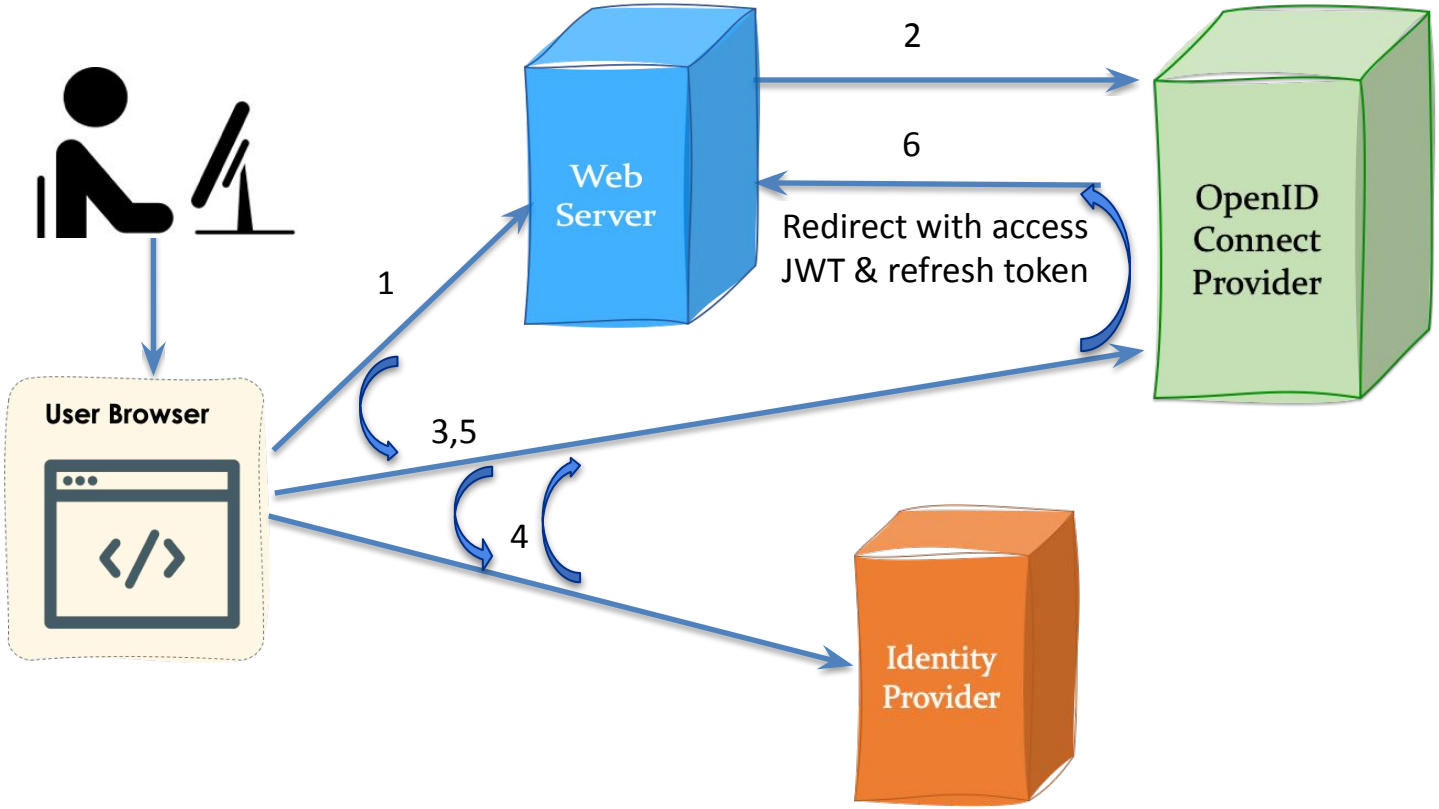
Why Switch to Tokens?

- The primary reason to switch to tokens is that X.509 proxies were never used outside of the grid community
  - They were invented by Globus, and Globus has abandoned support for the libraries. OSG and a few others have taken up support in the “Grid Community Toolkit” but OSG is dropping their support too
  - X.509 user certificates depended on support at the SSL/TLS layer that is only rarely used
- Oauth2/OpenID Connect (OIDC) JSON Web Tokens (JWTs) are in very wide-spread use, and they are more secure because they enable much more fine grained control
  - There are a lot of existing tools that we can use with them, although we also often need some customization
  - They’re much easier to use because they are sent at a higher layer, e.g. http Bearer header
  - Fine grained control does make them more complicated to use
- Note: X.509 host certificates are not going away, and they are an essential component to securely verifying JWTs over https

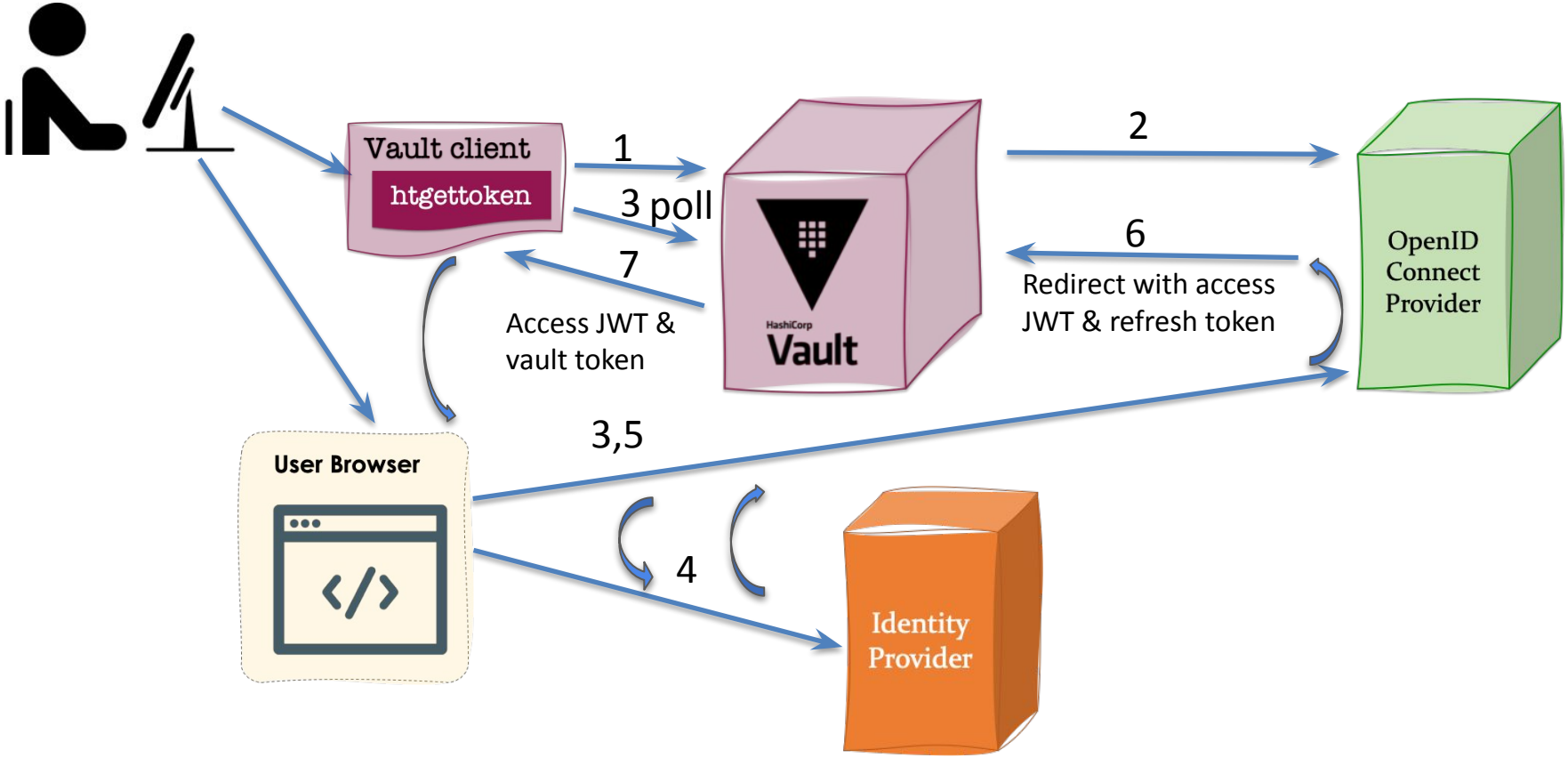
Why use Vault?

- Oauth2/OIDC is designed for use in web browsers & web servers, but many of our tools are based on command line
- After initial web browser approval, Oauth2 usually uses a “refresh token” that can be indefinitely renewed, so it is has high security value and needs protection
- The available command line tool oidc-agent (from the science research community, at KIT) is not user friendly enough at protecting refresh token
- We needed a server-based solution, analogous to MyProxy in our old architecture
- Hashicorp Vault is a very popular open source generic secret store server, that already supports OIDC and Kerberos
    - Needed some slight additions, submitted as PRs
    - Very flexible plugin architecture, REST/JSON API, and flexible access policies
    - Issues its own tokens for very flexible access to particular paths in its filesystem-like space
    - Needed configurator (htvault-config), and a new command line client (htgettoken) to control the flows

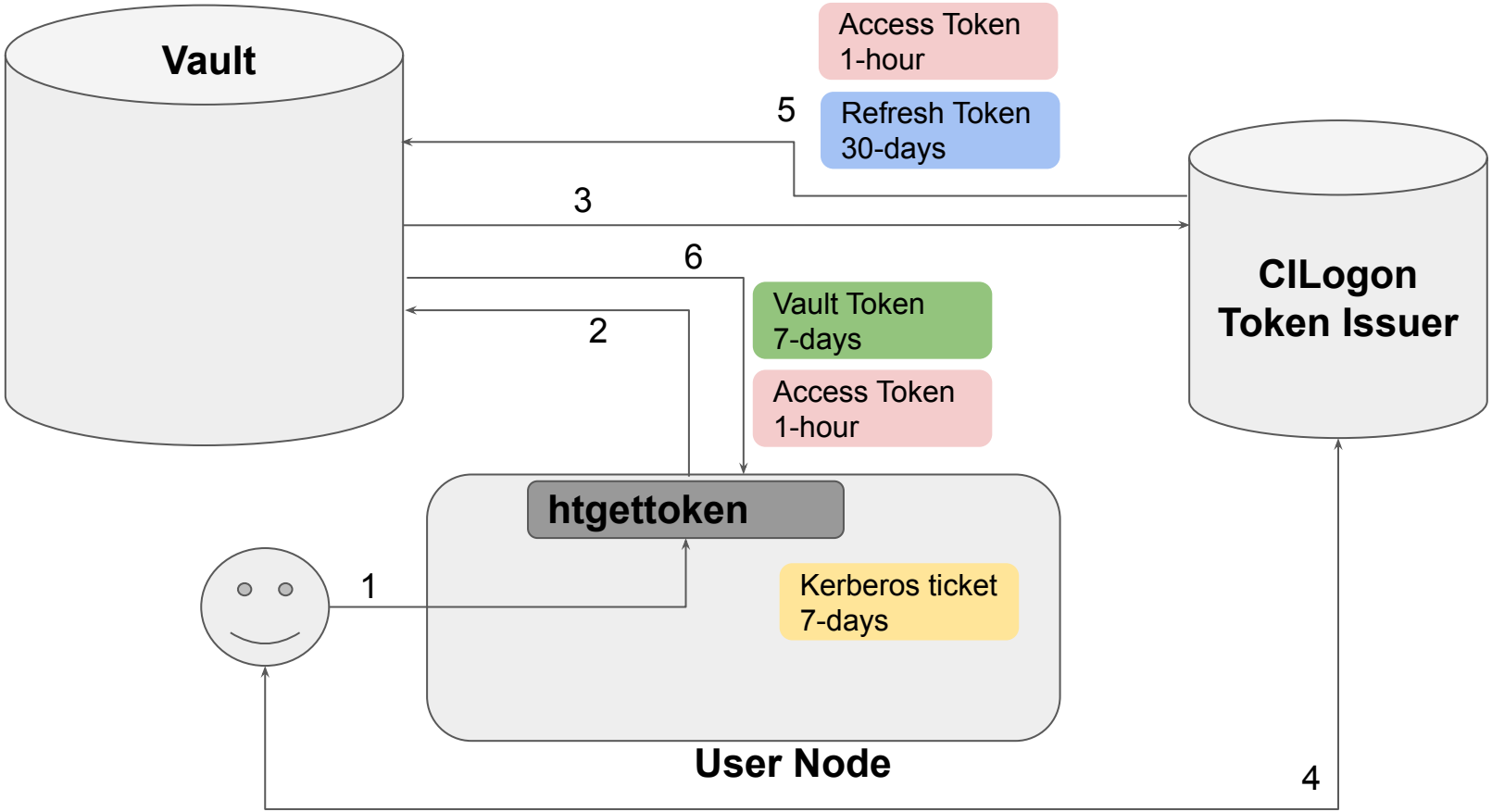
Normal federated OIDC flow



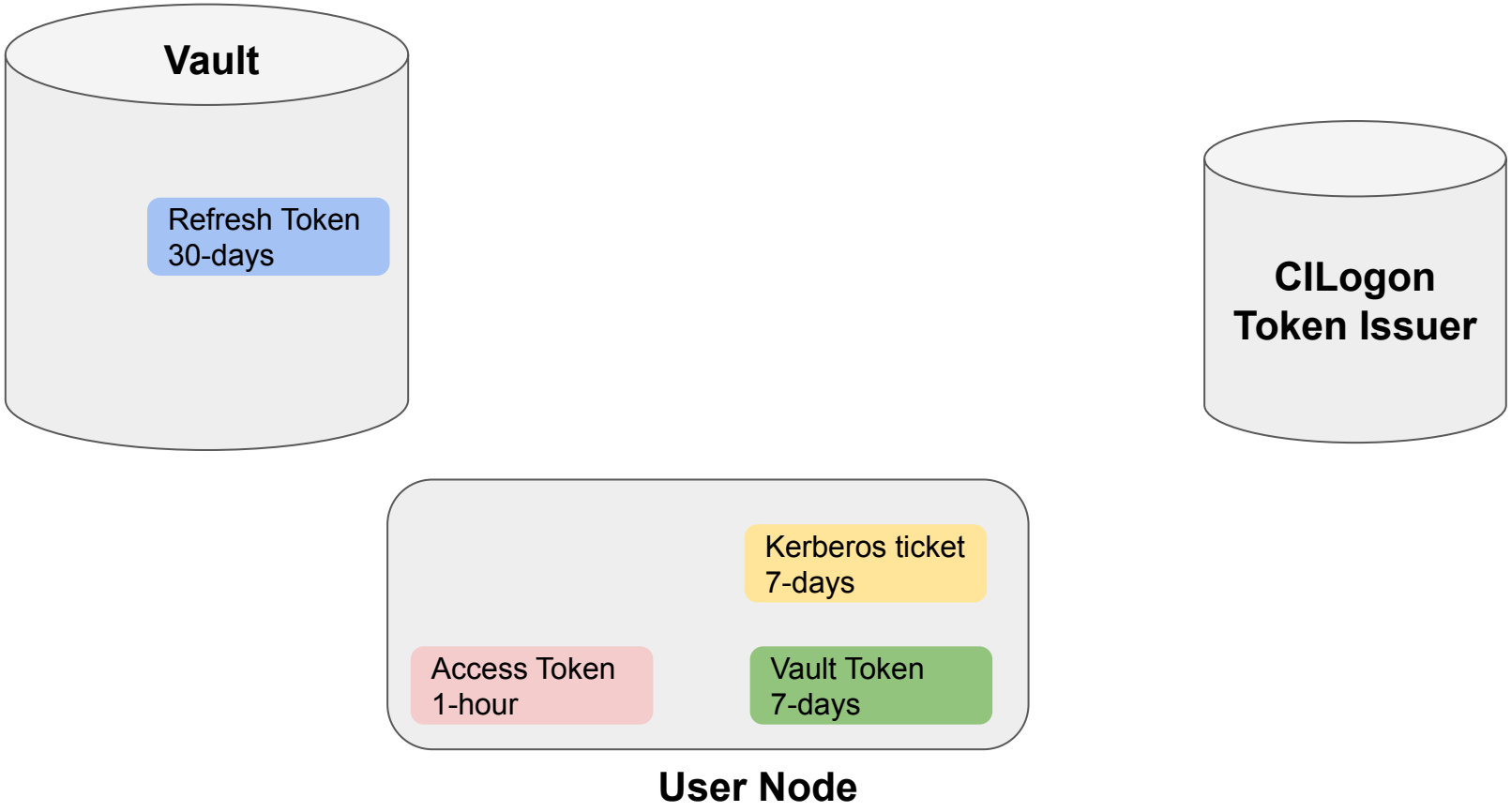
htgettoken with Vault initial OIDC flow



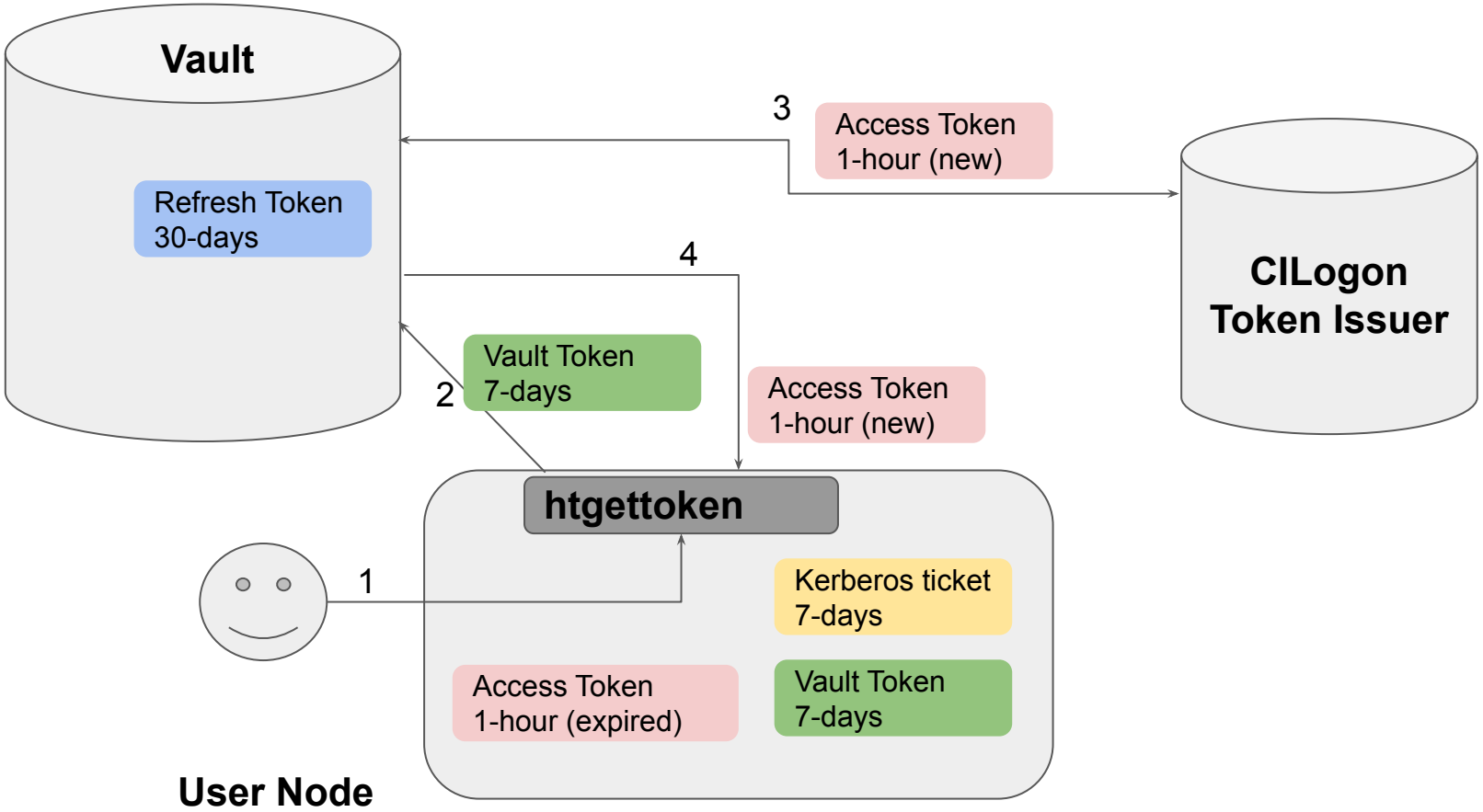
Initial Authentication (Case 0)



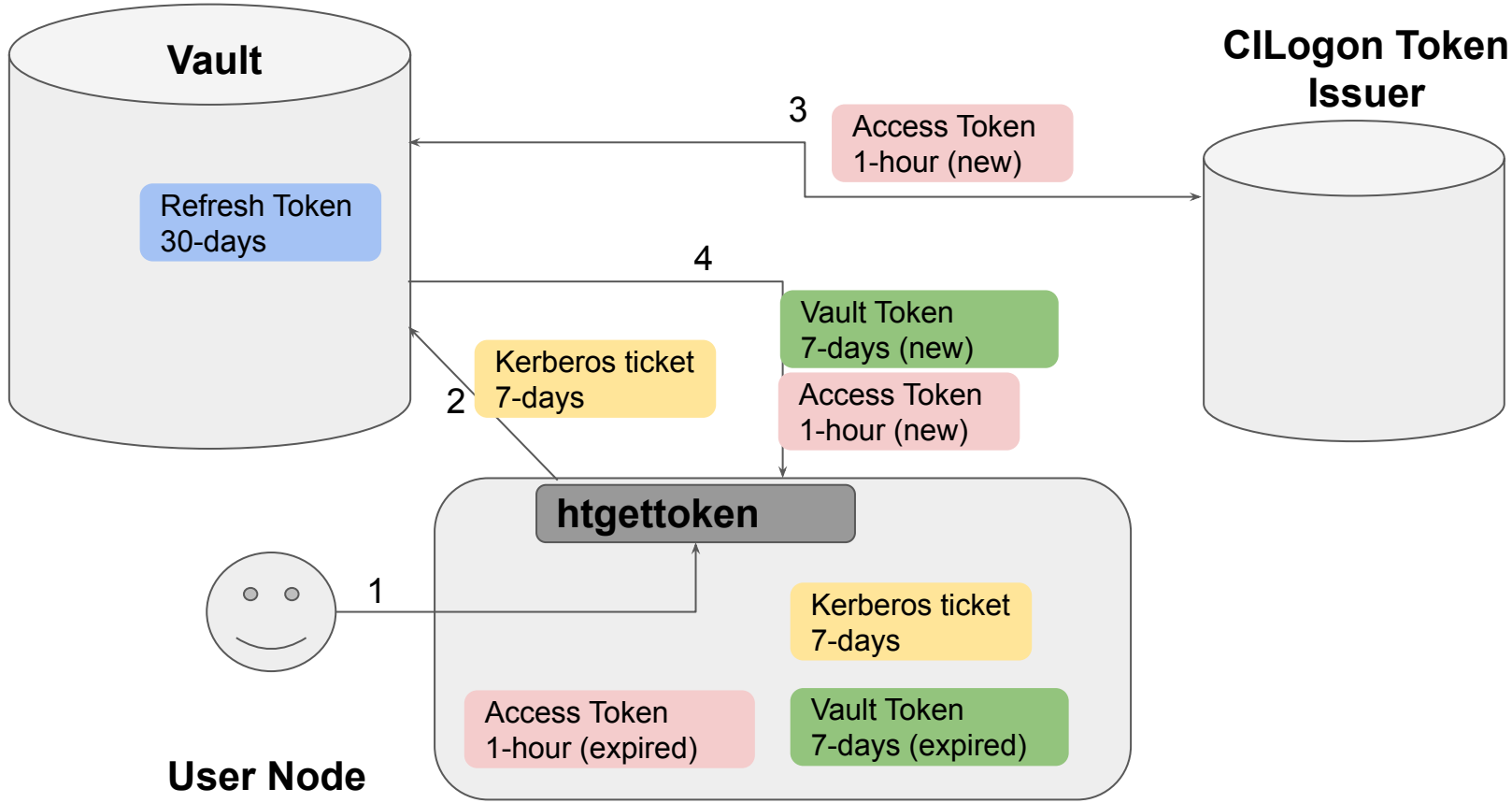
Credential Lifetimes and Storage Overview



Authentication with Vault Token (within 7 days, Access Token Expired, Case 1)



Authentication with Kerberos (Vault token and Access token both expired, Case 2)



Authentication after Refresh Token Expires (A month of No Activity, Case 3)

- As long as a user keeps using htgettoken, it will keep renewing its Access Token, Vault Token and the Refresh Token before expiring.
- If a user has no activity for a month, the Refresh Token expires.
- After the Refresh Token expires, the user must authenticate just like the initial authentication Case 0.

htgettoken files

- htgettoken normally uses 3 files:
  1. A “credkey” which is an index for the credential, a portion of the path in the vault “filesystem” where the refresh token is stored.
     - Comes from the token issuer
     - Normally for fermilab it simply matches your user id
     - Stored in home directory when a new refresh token is issued, can be shared across client machines, per issuer and per role
  2. A vault token, stored in /tmp/vt_u$(id -u) by default
     - Not in home directory because it is sensitive for security, but not in per-session space so it can be reused across login sessions
  3. A bearer, or access token, stored in ${XDG_RUNTIME_DIR:-/tmp}/bt_u$(id -u) by default
     - Specified by WLCG Bearer Token Discovery standard
     - Defaults to $XDG_RUNTIME_DIR, managed by systemd, which goes away after user completely logs out of a machine (but shared between multiple logins at once)

Example with htgettoken -v

```
$ env|grep HTG
HTGETTOKENOPTS=--web-open-command=xdg-open
$ htgettoken -v -a fermicloud543.fnal.gov -i dune
Attempting OIDC authentication with https://fermicloud543.fnal.gov:8200

Complete the authentication via web browser at:
    https://cilogon.org/device/?user_code=ZJL-CP9-KZG
Running 'xdg-open' on the URL
Waiting for response in web browser
Storing vault token in /tmp/vt_u3382
Saving credkey to /nashome/d/dwd/.config/htgettoken/credkey-dune-default: dwd
Saving refresh token to https://fermicloud543.fnal.gov:8200
  at path secret/oauth-dune/creds/dwd:default
Getting bearer token from https://fermicloud543.fnal.gov:8200
  at path secret/oauth-dune/creds/dwd:default
Storing bearer token in /run/user/3382/bt_u3382
```

Example decode

```
$ httokendecode
{
  "wlcg.ver": "1.0",
  "aud": "https://wlcg.cern.ch/jwt/v1/any",
  "sub": "dwd@fnal.gov",
  "nbf": 1633465577,
  "scope": "storage.create:/dune/scratch/users/dwd compute.create compute.read
compute.cancel compute.modify storage.read:/dune",
  "iss": "https://cilogon.org/dune",
  "exp": 1633469182,
  "iat": 1633465582,
  "wlcg.groups": [
    "/dune"
  ],
  "jti":
"https://cilogon.org/oauth2/4a5c03b2a93e4e118b27cb23c1e68a17?type=accessToken&
ts=1633465582430&version=v2.0&lifetime=3600000"
}
```

CILogon as our token issuer

- We have arranged with CILogon to be our token issuer
- FERRY has been updated to store data about our users in an LDAP server that CILogon hosts, and CILogon uses that information to issue tokens
  - Lists which users are allowed with which VOs and Roles
  - FERRY defines “capabilitysets” to indicate which scopes to include for each VO and Role
  - Vault is configured with corresponding VOs and Roles and just asks for the right capabilityset, and CILogon issues the token
- JWTs are verified by looking up well-known url under the “iss” claim, e.g.
  - https://cilogon.org/fermilab/.well-known/openid-configuration
- Under there is a lot of information about the issuer including public signing keys

Support for “robot” (unattended) operation

- htgettoken supports use of robot kerberos credentials to get new vault tokens
  - Robot kerberos credentials are long lived
  - Principals are in the form “user/purpose/machine.name”
    - “user” can also be a group login, for example “dunepro”
    - In fact, we have configured all our shared roles by default to store refresh tokens in vault under the group name, but that can be overridden by FERRY
  - User (or authorized user for a group) does OIDC authentication once but specifies htgettoken `--credkey` option matching Kerberos principal to store refresh token in subpath under the user’s Vault secrets path
    - The same htgettoken command can be used with robot Kerberos credentials
    - This gets used instead of the credkey file

Managed Token Service

- Working with long-lived kerberos keytabs can be tricky, and they are high value from a security perspective since they don’t expire
- For that reason, we are planning a FIFE Managed Token Service analogous to the FIFE managed proxy service
- Will push access tokens to experiment machines, and possibly vault tokens, and will push vault tokens to HTCondor

HTCondor configuration

- System admin:
  - Install condor-credmon-vault rpm and set for example:
    `SEC_CREDENTIAL_GETTOKEN_OPTS = -a fermicloud543.fnal.gov`
- User submit file for example:

```
use_oauth_services = dune
dune_oauth_permissions = storage.read:/ #optional
dune_oauth_resource = https://eos.cern.ch #optional
```

- Service names may include role, such as `cms_production`
- Handles may appended to store multiple variations for each service:

```
dune_oauth_permissions_readonly = storage.read:/
dune_oauth_permissions_write = storage.write:/
```

- All tokens end up in `$_CONDOR_CREDS`

Links

- WLCG Authorization Working Group client tools investigation report
  - https://github.com/WLCG-AuthZ-WG/client-tools
- Bearer token discovery:
  - https://github.com/WLCG-AuthZ-WG/bearer-token-discovery
- WLCG JWT profile
  - https://github.com/WLCG-AuthZ-WG/common-jwt-profile
- Vault & plugins
  - https://www.vaultproject.io/
  - https://github.com/hashicorp/vault-plugin-auth-jwt
  - https://github.com/puppetlabs/vault-plugin-secrets-oauthapp
- htvault-config: https://github.com/fermitools/htvault-config
- htgettoken: https://github.com/fermitools/htgettoken
- Htcondor with vault docs: https://htcondor-vault.readthedocs.io
- oidc-agent: https://indigo-dc.gitbook.io/oidc-agent/

More Detailed Backup Slides

HTCondor integration

- htgettoken and Vault have been integrated into HTCondor
  - condor_submit can be configured to automatically invoke htgettoken as needed and store a vault token in credd
    - Vault token used by condor_credmon_vault to get new short-lived access tokens pushed to jobs
    - Vault token is extra long, 4 weeks, in order to work with jobs that are queued for a long time
      - Corresponds to time of proxies stored in MyProxy
  - Submit file specifies issuer, optional role, and optionally can choose reduced audience and/or scopes
    - May obtain more than one token for a job
    - Based on previous implementation of Oauth2 credential support
  - Vault token is stored with an extension indicating the VO & role, so can keep a variety on same machine
  - Will be in HTCondor's distro in 9.0.6, 9.1.5, now in release candidate
    - Also available in all OSG builds of htcondor-9.0+

Token flow with HTCondor and Vault