Migrating to Token-based Authorization: Experiences & Lessons Learned

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Why?

- With the deprecation of GSI and proxy certificates, we have an opportunity to improve our authorization model
  - We don't want to simply reimplement GSI using JWTs
- Improve security using least privilege capabilities
- Improve usability and interoperability
  - Building on common JWT/OAuth technology
  - Coordinating across projects (LIGO, OSG, WLCG, etc.)
- Maintain the reliability and security of our cyberinfrastructure

- Our SciAuth project is focused on helping with this transition

https://sciauth.org/

How?

- Bi-weekly coordination meetings with WLCG, LIGO, Fermilab, etc.
- Hackathons & Interop Fests
- Phase in tokens while we phase out GSI proxy certificates
- Open Source SciTokens software
- Token issuers operated by CERN, CILogon, and OSG
- Using Hashicorp Vault for token management

How’s it going?

- In 2022, OSG successfully transitioned from proxy certificates to tokens via the OSG 3.6 release
- In February 2023, Fermilab began production with token-based authorization for their jobsub service. Now every payload job at Fermilab uses tokens.
- In May 2023, LIGO migrated core services to tokens for the start of the O4 observing run
- As of May 2023, both Virgo and LIGO have self hosted OSDF Origins providing SciTokens access to proprietary data via both OSDF and CVMFS
- WLCG token issuers in production at CERN for Alice, Atlas, CMS, and LHCb, on track to retire proxy certificates in WLCG by March 2026

Experiences & Lessons Learned

Balancing Scalability, Reliability, and Security

- Balance between shorter (security) and longer (scalability, reliability) token lifetimes
- Improvements to refresh token handling
  - Refresh token grace period at token issuers
  - Client acceptance of new refresh tokens (oidc-agent, vault, etc.)
- Timeouts and retries in token handling libraries (SciTokens)

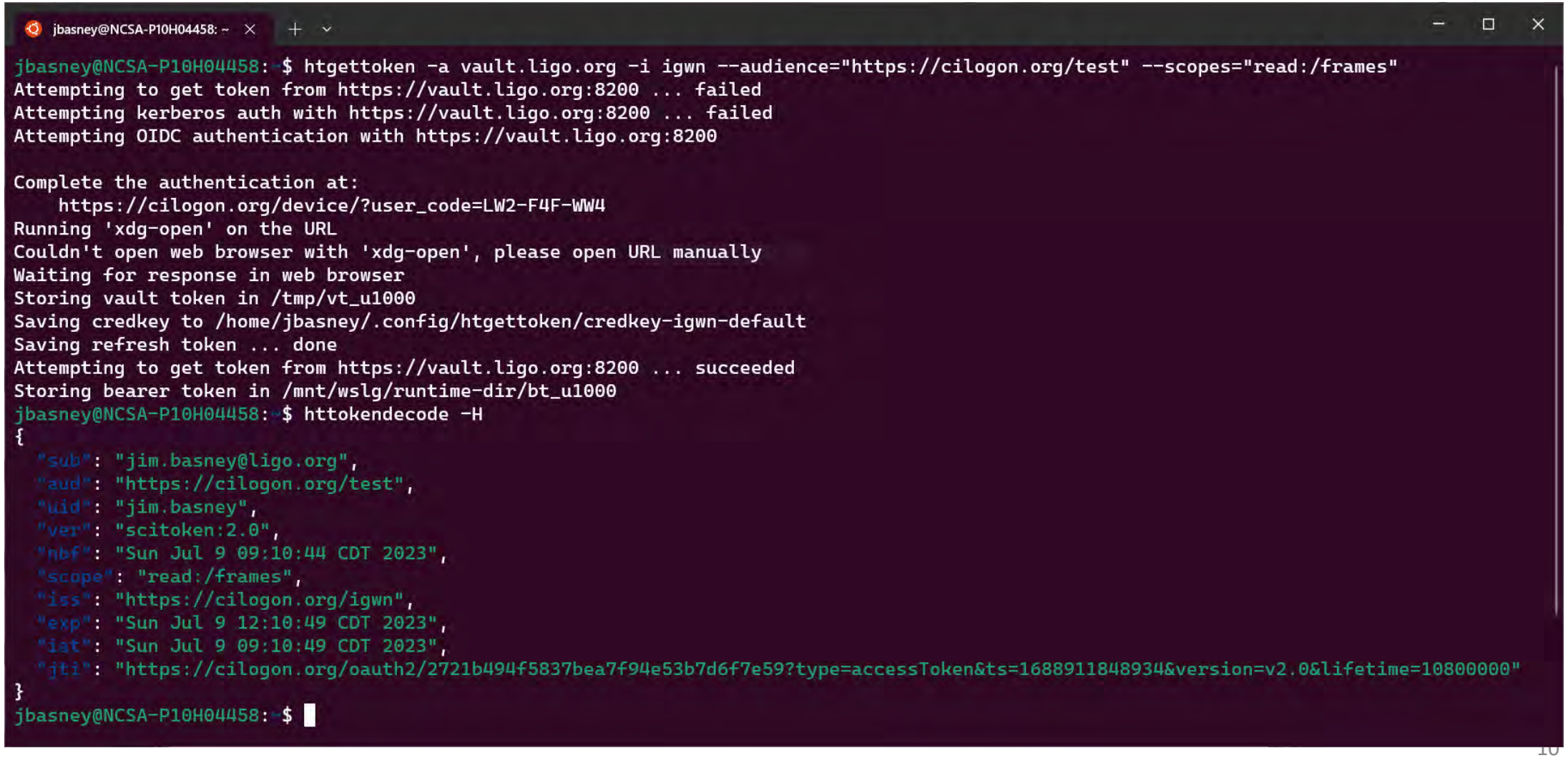
Authorization Policies

- Managing policies – revision control, LDAP
- Personal directories ("write:/staging/${uid}“)
- Robots
  - Access to “robot” tokens authorized via "Services:Robots:<robot-name>:SciTokens:authorized" groups

```
{
   "Issuers" : [
   {
      "IssuerName" : "IGWN",
      "Services" : [
         {
            "ServiceName" : "XRootD",
            "Scopes" : [
               {
                  "ScopeName" : "read:/frames",
                  "ScopeGroups": [
                     {
                        "EligibleGroup" : "cn=eligible_factor,ou=read-frames,ou=scopes,ou=SciTokens,ou=XRootD,ou=Services,ou=grouper,dc=ligo,dc=org",
                        "AuthorizedGroup" :"cn=authorized,ou=read-frames,ou=scopes,ou=SciTokens,ou=XRootD,ou=Services,ou=grouper,dc=ligo,dc=org",
                        "isMemberOf" : "Services:XRootD:SciTokens:scopes:read-frames:authorized",
                        "LDAP" : "ldaps://ldap.ligo.org"
                     },
                     {
                        "EligibleGroup" : "cn=CO:members:active,ou=groups,o=KAGRA-LIGO,o=CO,dc=gwastronomy-data,dc=cgca,dc=uwm,dc=edu",
                        "AuthorizedGroup" : "cn=CO:members:active,ou=groups,o=KAGRA-LIGO,o=CO,dc=gwastronomy-data,dc=cgca,dc=uwm,dc=edu",
                        "isMemberOf" : "gw-astronomy:KAGRA-LIGO:members",
                        "LDAP" : "ldaps://ldap.gw-astronomy.cilogon.org"
                     }
                  ]
               },
[…]
```

```
{
   "ScopeName" : "write:/staging/${uid}",
   "ScopeGroups" : [
      {
         "EligibleGroup" : "cn=LDGCITUsers,ou=CIT,ou=LDG,ou=LSC,ou=LVC,ou=Communities,ou=grouper,dc=ligo,dc=org",
         "AuthorizedGroup" :"cn=LDGCITUsers,ou=CIT,ou=LDG,ou=LSC,ou=LVC,ou=Communities,ou=grouper,dc=ligo,dc=org",
         "isMemberOf" : "Communities:LVC:LSC:LDG:CIT:LDGCITUsers",
         "LDAP" : "ldaps://ldap.ligo.org"
      },
      {
         "EligibleGroup" :
            "cn=CO:COU:LDG Grid Account Holders:members:active,ou=groups,o=KAGRA-LIGO,o=CO,dc=gwastronomy-data,dc=cgca,dc=uwm,dc=edu",
         "AuthorizedGroup" :
            "cn=CO:COU:LDG Grid Account Holders:members:active,ou=groups,o=KAGRA-LIGO,o=CO,dc=gwastronomy-data,dc=cgca,dc=uwm,dc=edu",
         "isMemberOf" : "CO:COU:LDG Grid Account Holders:members:active",
         "LDAP" : "ldaps://ldap.gw-astronomy.cilogon.org"
      }
   ]
}
```

Supporting Command-Line Interfaces



What’s next?

Migration Continues

- Completing phase-out of proxy certificates
  - CILogon plans to stop issuing X.509 certificates in 2025
  - WLCG on track to phase out certificates in 2026
- Further developing authorization policies
- Additional token integrations
  - CERN FTS – March 2024 WLCG data challenge
- Harmonizing SciTokens, WLCG, and EGI token profiles

What have we accomplished?

- Modernizing our authorization systems
- Improving our security posture
- A coordinated migration with minimal disruption

Thanks to the efforts of many people across many projects!

Thanks!

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