

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 July 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

```
jbasney@NCSA-P10H04458: ~$ htgettoken -a vault.ligo.org -i igwn --audience="https://cilogon.org/test" --scopes="read:/frames"
Attempting to get token from https://vault.ligo.org:8200 ... failed
Attempting kerberos auth with https://vault.ligo.org:8200 ... failed
Attempting OIDC authentication with https://vault.ligo.org:8200

Complete the authentication at:
  https://cilogon.org/device/?user_code=LW2-F4F-WW4
Running 'xdg-open' on the URL
Couldn't open web browser with 'xdg-open', please open URL manually
Waiting for response in web browser
Storing vault token in /tmp/vt_u1000
Saving credkey to /home/jbasney/.config/htgettoken/credkey-igwn-default
Saving refresh token ... done
Attempting to get token from https://vault.ligo.org:8200 ... succeeded
Storing bearer token in /mnt/wslg/runtime-dir/bt_u1000
jbasney@NCSA-P10H04458:~$ httokencode -H
{
  "sub": "jim.basney@ligo.org",
  "aud": "https://cilogon.org/test",
  "uid": "jim.basney",
  "ver": "scitoken:2.0",
  "nbf": "Sun Jul 9 09:10:44 CDT 2023",
  "scope": "read:/frames",
  "iss": "https://cilogon.org/igwn",
  "exp": "Sun Jul 9 12:10:49 CDT 2023",
  "iat": "Sun Jul 9 09:10:49 CDT 2023",
  "jti": "https://cilogon.org/oauth2/2721b494f5837bea7f94e53b7d6f7e59?type=accessToken&ts=1688911848934&version=v2.0&lifetime=10800000"
}
jbasney@NCSA-P10H04458:~$
```

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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