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/${uid}"")
• Robots
  • Access to “robot” tokens authorized via
    "Services:Robots:<robot-name>:SciTokens:authorized" groups
{
  "Issuers": [
    {
      "IssuerName": "IGWN",
      "Services": [
        {
          "ServiceName": "XRootD",
          "Scopes": [
            {
              "ScopeName": "read:/frames",
              "ScopeGroups": [
                {
                  "EligibleGroup": "cn=eligible_factor,ou=read-frames,ou=scopes,ou=SciTokens,ou=XRootD,ou=Services,ou=grouper,dc=ligo,dc=org",
                  "AuthorizedGroup": "cn=authorized,ou=read-frames,ou=scopes,ou=SciTokens,ou=XRootD,ou=Services,ou=grouper,dc=ligo,dc=org",
                  "isMemberOf": "Services:XRootD:SciTokens:scopes:read-frames:authorized",
                  "LDAP": "ldaps://ldap.ligo.org"
                },
                {
                  "EligibleGroup": "cn=CO:members:active,ou=groups,o=KAGRA-LIGO,o=CO,dc=gwastronomy-data,dc=cgca,dc=uwm,dc=edu",
                  "AuthorizedGroup": "cn=CO:members:active,ou=groups,o=KAGRA-LIGO,o=CO,dc=gwastronomy-data,dc=cgca,dc=uwm,dc=edu",
                  "isMemberOf": "gw-astronomy:KAGRA-LIGO:members",
                  "LDAP": "ldaps://ldap.gw-astronomy.cilogon.org"
                }
              ],
              "LDAP": "ldaps://ldap.ligo.org"
            }
          ],
          "LDAP": "ldaps://ldap.ligo.org"
        }
      ],
      "LDAP": "ldaps://ldap.ligo.org"
    }
  ],
  "LDAP": "ldaps://ldap.ligo.org"
}
"ScopeName": "write:/staging/${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=gwastonomy-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=gwastonomy-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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