CENTER FOR HIGH THROUGHPUT COMPUTING

PATh PARTNERSHIP to ADVANCE THROUGHPUT COMPUTING

(Sci)Tokens Authentication in HTCondor-CE

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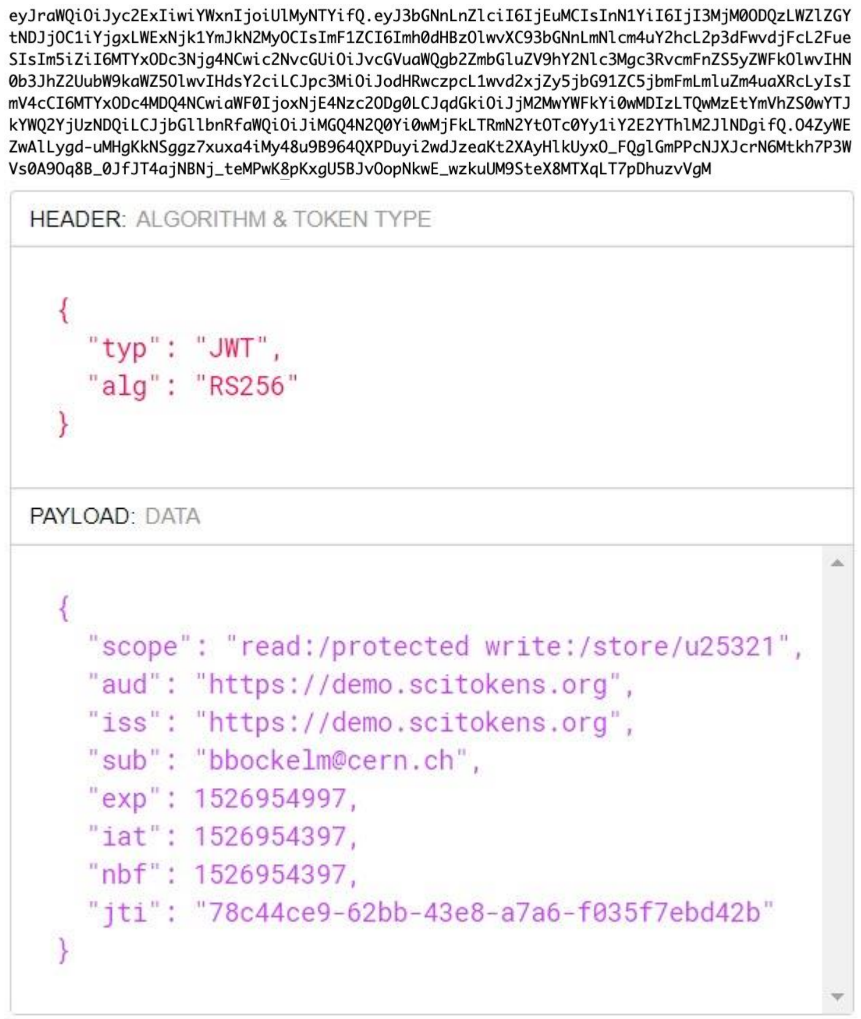
HTCondor Software Suite

Why Move to Tokens?

- HTC has used X.509 credentials for user authentication
  - Proposed by grid community with extensions
- Tokens are more widely supported
  - Proxies never embraced by industry
- Tokens allow a better security model
  - Authorization via capability instead of identity

JSON Web Tokens (JWT)

- A set of key-value pairs…
- Signed by an issuer
- Some keys are standardized
  - iss: Token Issuer
  - exp: Expiration time
  - scope: List of authorizations
  - aud: Service token can be used at



```
eyJraWQiOiJyc2ExIiwiYWxnIjoiUlMyNTYifQ.eyJ3bGNnLnZlciI6IjEuMCIsInN1YiI6IjI3MjM0ODQzLWZlZGY
tNDJjOC1iYjgxLWExNjk1YmJkN2MyOCIsImF1ZCI6Imh0dHBzOlwvXC93bGNnLmNlcm4uY2hcL2p3dFwvdjFcL2Fue
SIsIm5iZiI6MTYxODc3Njg4NCwic2NvcGUiOiJvcGVuaWQgb2ZmbGluZV9hY2Nlc3Mgc3RvcmFnZS5yZWFkOlwvIHN
0b3JhZ2UubW9kaWZ5OlwvIHdsY2ciLCJpc3MiOiJodHRwczpcL1wvd2xjZy5jbG91ZC5jbmFmLmluZm4uaXRcLyIsI
mV4cCI6MTYxODc4MDQ4NCwiaWF0IjoxNjE4Nzc2ODg0LCJqdGkiOiJjM2MwYWFkYi0wMDIzLTQwMzEtYmVhZS0wYTJ
kYWQ2YjUzNDQiLCJjbGllbnRfaWQiOiJiMGQ4N2Q0Yi0wMjFkLTRmN2YtOTc0Yy1iY2E2YThlM2JlNDgifQ.O4ZyWE
ZwAlLygd-uMHgKkNSggz7xuxa4iMy48u9B964QXPDuyi2wdJzeaKt2XAyHlkUyxO_FQglGmPPcNJXJcrN6Mtkh7P3W
Vs0A9Oq8B_0JfJT4ajNBNj_teMPwK8pKxgU5BJvOopNkwE_wzkuUM9SteX8MTXqLT7pDhuzvVgM
```

HEADER: ALGORITHM & TOKEN TYPE

```
{
  "typ": "JWT",
  "alg": "RS256"
}
```

PAYLOAD: DATA

```
{
  "scope": "read:/protected write:/store/u25321",
  "aud": "https://demo.scitokens.org",
  "iss": "https://demo.scitokens.org",
  "sub": "bbockelm@cern.ch",
  "exp": 1526954997,
  "iat": 1526954397,
  "nbf": 1526954397,
  "jti": "78c44ce9-62bb-43e8-a7a6-f035f7ebd42b"
}
```

OAuth2 and OpenID Connect (OIDC)

- Standard frameworks for
  - User to authenticate with issuer and obtain a token
  - Service to validate a token presented by a user
- Widely used in industry
  - E.g. Google, Amazon, Facebook, Microsoft
- Lots of software and language support

SciTokens vs WLCG Tokens

- Both are based on OpenID Connect
  - WLCG tokens follow standard more strictly
- Both define file- and job-based authorizations
  - Additional authorization types are possible
- Format of scope names differs
  - SciTokens: read:/foo CONDOR:/READ
  - WLCG Tokens: storage.read:/foo compute.read
- HTCondor accepts both for job control

Token Discovery

- HTCondor tools look here for a token to use for authorization
  - `$BEARER_TOKEN`: value has token data
  - `$BEARER_TOKEN_FILE`: file has token data
  - `$XDG_RUNTIME_DIR/bt_u<id>`: file has token data
  - `/tmp/bt_u<id>`: file has token data
- First location with a valid token is used

Submitting to an HTCondor-CE

- E.g., the factory use case
  - Using local AP to submit jobs to a remote AP
- Token must be in a file
- Add to your submit file
  - `scitokens_file = <filename>`
- Or if BEARER_TOKEN_FILE in environment, add this
  - `use_scitokens = true`

Token Info in the Job Ad

- Some token claims placed in the job ad
  - `AuthTokenId = "ddb63eca-0aff-4f6b-8bb4-89dc15ec33f7"`
  - `AuthTokenIssuer = "https://demo.scitokens.org"`
  - `AuthTokenScopes = "condor:/READ,condor:/WRITE"`
  - `AuthTokenSubject = "jfrey"`
- Can’t get altered by the user
- Can be used for CE routing

Authorizing SciTokens

- Specify in /etc/condor-ce/mapfiles.d/*
  - Which tokens/issuers to accept
  - Which identity (i.e. user account) to map them to
  - `SCITOKENS <issuer>,<subject> <username>`
- Accept specific token issuer and subject (exact match)
  - `SCITOKENS https://demo.scitokens.org,jfrey jfrey`
- Accept all tokens from an issuer (regular expression)
  - `SCITOKENS /https:\/\/demo.scitokens.org,.*/ jfrey`
- Set audience name of daemons
  - `SCITOKENS_SERVER_AUDIENCE = $(COLLECTOR_HOST)`

SciToken Authorization Plugins

- When issuer and subject aren’t enough
- Delegate authorization/mapping decisions to external program(s)
- SciTokens library still does token validation
- Interface compatible with ARC CE

Plugin Example

› Map file

-
  ```
  # Plugin for specific token issuer
  SCITOKENS /^https:\/\/phys.uz.edu,.*/ PLUGIN:A

  # Plugins for all other token issuers
  SCITOKENS /.*/ PLUGIN:B,C
  ```

› Configuration file

-
  ```
  # Plugin A for specific issuer with fixed mapping result
  SEC_SCITOKENS_PLUGIN_A_COMMAND = $(LIBEXEC)/A.plugin
  SEC_SCITOKENS_PLUGIN_A_MAPPING = physgrp

  # Plugins B,C for all other tokens
  SEC_SCITOKENS_PLUGIN_B_COMMAND = $(LIBEXEC)/B.plugin
  SEC_SCITOKENS_PLUGIN_C_COMMAND = $(LIBEXEC)/C.plugin -A
  ```

Plugin Interface

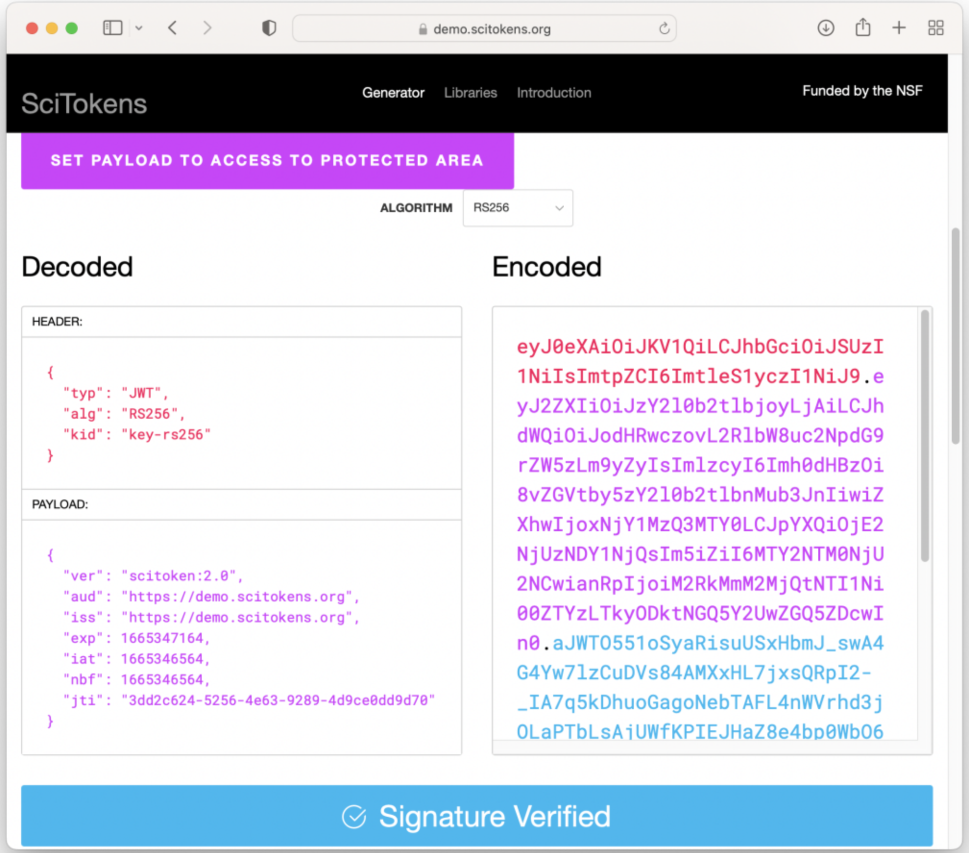
- Token body provided via stdin
- Claims provided in environment variables
  - Same interface as ARC CE
- Exit code
  - 0: accept token
  - 1: decline token, check other plugins
  - default: reject token
- Stdout (needed if `_MAPPING` config not set)
  - Mapping result (HTCondor identifier)

EGI CheckIn Tokens

- Now supported out-of-the-box
  - Tokens need `aud` and `scope` claims
- Plugin available
  - https://github.com/EGI-Federation/check-in-validator-plugin

Simple Testing with SciTokens

- https://demo.scitokens.org
- Will issue any token you want
- Don't use in production!
- Add these keys
  - "aud: "ANY"
  - (Or set to match CE's SCITOKENS_SERVER_AUDIENCE)
  - "sub": "jfrey"
  - "scope": "condor:/READ condor:/WRITE"
- Configure CE to accept this issuer



ALGORITHM RS256

Decoded

HEADER:

```
{
  "typ": "JWT",
  "alg": "RS256",
  "kid": "key-rs256"
}
```

PAYLOAD:

```
{
  "ver": "scitoken:2.0",
  "aud": "https://demo.scitokens.org",
  "iss": "https://demo.scitokens.org",
  "exp": 1665347164,
  "iat": 1665346564,
  "nbf": 1665346564,
  "jti": "3dd2c624-5256-4e63-9289-4d9ce0dd9d70"
}
```

Encoded

eyJ0eXAiOiJKV1QiLCJhbGciOiJSUzI
1NiIsImtpZCI6ImtleS1yczI1NiJ9.e
yJ2ZXIiOiJzY2l0b2tlbjoyLjAiLCJh
dWQiOiJodHRwczovL2RlbW8uc2NpdG9
rZW5zLm9yZyIsImlzcyI6Imh0dHBzOi
8vZGVtby5zY2l0b2tlbnMub3JnIiwiZ
XhwIjoxNjY1MzQ3MTY0LCJpYXQiOjE2
NjUzNDY1NjQsIm5iZiI6MTY2NTM0NjU
2NCwianRpIjoiM2RkMmM2MjQtNTI1Ni
00ZTYzLTkyODktNGQ5Y2UwZGQ5ZDcwI
n0.aJWTO551oSyaRisuUSxHbmJ_swA4
G4Yw7lzCuDVs84AMXxHL7jxsQRpI2-
_IA7q5kDhuoGagoNebTAFL4nWVrhd3j
OLaPTbLsAjUWfKPIEJHaZ8e4bp0WbO6

Signature Verified

Advanced Testing

- Impersonate a known issuer
  - `condor_test_token`
    ```
    --issuer https://scitokens.org/osg-connect
    --subject jfrey
    --lifetime 3600
    --scope ‘condor:/READ condor:/WRITE’
    --audience ‘ce.foo.edu’
    ```
- Create fake token that CE will accept for a short period as if it came from the given issuer
- Good for testing authorization configuration

Quitting GSI (and X.509 proxies)

- HTCondor 9.0
  - GSI, WLCG/SciToken authentication
- HTCondor 10.0
  - WLCG/SciToken authentication (no GSI)
- HTCondor 10.X
  - EGI/WLCG/SciToken authentication
  - Token authorization plugins
- (X.509 Proxy for user jobs supported in all versions)

Quitting GSI (and X.509 proxies)

- HTCondor 9.0
  - GSI, WLCG/SciToken, SSL authentication
- HTCondor 10.0
  - WLCG/SciToken, SSL authentication (no GSI)
- HTCondor 10.X
  - EGI/WLCG/SciToken, SSL authentication
  - Token authorization plugins
- (X.509 Proxy for user jobs supported in all versions)

Plain SSL Auth with Grid Proxies

- Client config changes
  - `AUTH_SSL_USE_CLIENT_PROXY_ENV_VAR = True`
  - `AUTH_SSL_CLIENT_CADIR = /etc/grid-security/certificates`
- Client tools must have `X509_USER_PROXY` set in environment

Plain SSL Auth with Grid Proxies

- Server config changes
  - `AUTH_SSL_ALLOW_CLIENT_PROXY = True`
  - Uncomment in /etc/condor-ce/config.d/01-ce-auth.conf:
  - `AUTH_SSL_SERVER_CERTFILE = /etc/grid-security/hostcert.pem`
  - `AUTH_SSL_SERVER_KEYFILE = /etc/grid-security/hostkey.pem`
  - `AUTH_SSL_SERVER_CADIR = /etc/grid-security/certificates`
  - `AUTH_SSL_CLIENT_CERTFILE = /etc/grid-security/hostcert.pem`
  - `AUTH_SSL_CLIENT_KEYFILE = /etc/grid-security/hostkey.pem`
  - `AUTH_SSL_CLIENT_CADIR = /etc/grid-security/certificates`

Plain SSL Auth with Grid Proxies

› Add mappings to CE mapfiles

-
  ```
  # Exact match
  SSL  "/O=condor/OU=CHTC Pool/CN=James Frey"  jfrey
  # regex match
  SSL  /\/O=condor\/OU=CHTC\ Pool\/CN=.*/  jfrey
  ```

› Detailed explanation here:

- https://htcondor-wiki.cs.wisc.edu/index.cgi/wiki?p=HowToUseProxiesWithSsl

SciTokens vs IDTokens

- Both are JWTs and look similar
- SciTokens use asymmetric key
  - Anyone with issuer’s public key can verify
  - Issuer must publish public key via https server
  - Suited for a VO accessing multiple services (including HTCondor pools)
- IDTokens use symmetric key
  - Issuer’s private key required to verify
  - Suited for a single HTCondor pool
  - Doesn’t use OAuth or OIDC

Ongoing and Future Work

- Improving SciTokens C++ library
  - Add non-blocking interface
  - Fetching issuer’s public key delayed by DNS problems
  - Update CE to use new interface
- Improve condor_test_token
  - Impersonate WLCG or EGI tokens

Thank You!

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