SSH access with OIDC tokens

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Motivation

- Enable federated access to shell-based services
  - Federated Identity Management → OpenID Connect (OIDC)
  - Shell-based services → Secure Shell (SSH), local identities
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Our solution: server & client side tools
- Works with standard SSH software
- Uses OIDC tokens for AuthN & AuthZ
- Manages local identities
Why would you use it?

...as a user

- Single Sign-On (SSO)
- No additional service credentials
- No need for SSH key management
- No prior registration
Why would you use it?

...as a service provider

- Benefits of federated AAI
  - Offload identity management to home organisation
  - Offload authorisation management to federation (VOs)
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...as a service provider

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- Bridges the gap from federated to local identity
  - Manages the mapping of federated to local accounts
  - Manages the lifecycle of local accounts (create, update, suspend)
  - Manages access control based on federated authorisation models
  - OIDC-based authentication → no need for managing additional credentials (passwords, ssh keys)
Approach

- **Server side:**
  - Use PAM module with oidc support: `pam-ssh-oidc` (PSNC/Pracelab.pl)
  - Add REST interface to ssh-server to manage the details: `motley-cue`

- **Client side:**
  - `oidc-agent` for obtaining tokens
  - Enable `ssh-clients` to use tokens
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No modifications of `ssh` or `sshd`
Server Side
motley-cue architecture

REST API
- /user
- /admin
- /verify_username

Authorisation Layer

Identity mapping

Interface to local IAM

PAM

Local Identity Management
Authorisation

- Support for multiple OIDC Providers
- Based on VO membership
- Based on assurance
- Individual users via sub+iss
Account provisioning

- Interface to site-local identity management systems
  - Extensible, plug-in architecture
  - Supported identity backends: UNIX accounts, LDAP, KIT RegApp
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- Identity mapping: \texttt{sub + iss → local username}
  - Stored directly in the local IdM system
  - Username generation strategies → uniqueness
    - Friendly: preferred username, first_last, ...
    - Pooled: egi001, egi002, ...
  - VOs mapped to local groups
Advanced features

- Approval workflow → admins oversee all deployment requests
- LDAP backend → for managing local accounts
- Audience → restrict access to tokens released for configured audience
- Long tokens → 1kB too long for SSH, generate one-time tokens
PAM-OIDC

- Based on OIDC access token authentication
  - user is prompted for an **Access Token** instead of Password
- Written in **C**
- Query **motley_cue** service API for:
  - token validation
  - authorisation
  - username match

```bash
$ curl -X 'GET' \n   $motley_cue_endpoint/verify_user&username=$username \n   -H "Authorization: Bearer $token"
{
  "state": "deployed",
  "verified": true
}
```

developed at PSNC
Technical details

- Easy deployment
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- Easy deployment
  - Packages for most common Linux distributions

http://repo.data.kit.edu
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  - Packages for most common Linux distributions
  - systemd integration

http://repo.data.kit.edu

$ apt install motley-cue pam-ssh-oidc-autoconfig
$ vim /etc/motley_cue/motley_cue.conf
$ systemctl restart motley-cue
Technical details

- Easy deployment
  - Packages for most common Linux distributions
  - systemd integration
- Python, FastAPI

```
$ apt install motley-cue pam-ssh-oidc-autoconfig
$ vim /etc/motley_cue/motley_cue.conf
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```
Technical details

- Easy deployment
  - Packages for most common Linux distributions
  - systemd integration
- Python, FastAPI
- Nice to know
  - SSH daemon is not modified
  - PAM module may be combined with other modules

Possible:

```plaintext
ssh-key + password + OIDC + 2\textsuperscript{nd} factor (linotp)
```

$ apt install motley-cue pam-ssh-oidc-autoconfig
$ vim /etc/motley_cue/motley_cue.conf
$ systemctl restart motley-cue
Client Side
SSH Clients

- 2 Simple changes on the command line:
  - add our wrapper tool mccli
  - replace username with identity provider

  Old:  
  ssh diana@ssh-oidc-demo.data.kit.edu
  New: mccli  ssh ssh-oidc-demo.data.kit.edu --oidc egi

- Tools to install:
  $ pip install mccli
  $ apt-get install oidc-agent

- Again: packages provided for all major Operating Systems

http://repo.data.kit.edu
SSH Clients

- Everything is different on Windows ;)
- PuTTY SSH client required source code modifications
  - Joint effort with Simon Tatham (PuTTY main developer)
  - General Plugin Interface (available in putty-0.78: https://www.chiark.greenend.org.uk/~sgtatham/putty/prerel.html)
- `oidc-plugin` and `oidc-agent` installed and shipped together
  http://repo.data.kit.edu/windows/oidc-agent
SSH Clients

- What do the clients do:
  - Deploy account on server and get username
  - Retrieve access token from oidc-agent
  - Start SSH session with obtained username
  - Input access token when prompted
  - oidc-agent forwarding by default
- Standard SSH possible if username is known
Demo

https://ssh-oidc-demo.data.kit.edu/
Demo Windows (recorded)

- This demo shows the first-time setup on Windows
- Choices are cached. User only enters password **once** (for each Windows reboot)
Demo Linux (live)

https://youtu.be/IrwmnHmxbTQ
Requirements

✔ Unmodified SSH & SSHD
✔ No a priori provisioning of user on the server → motley_cue API & client integration
✔ Mitigate sharing of SSH keys → by not using SSH keys, but access tokens for AuthN
✔ Non-interactive client logins → with oidc-agent integration
✔ Delegation → via oidc-agent forwarding, the token is available on server
✔ MFA → possible with additional PAM modules
✔ Revocation → two options:
  ▪ Revocation of tokens (access token / refresh token) possible
  ▪ /admin endpoint to suspend/resume users
Future work

- Account **deprovisioning**
- More flexible **VO → local group** mapping: regex filtering and naming
- **mytoken** integration
- **Kubernetes** integration
Future work

- Account **deprovisioning**
- More flexible **VO → local group** mapping: regex filtering and naming
- **mytoken** integration
- **Kubernetes** integration
- Evaluating integration with **SSSD**

- Increase **adoption →** current use cases:
  - EGI ACE → access to HPC resources
  - IM integration for VM deployment on public & private clouds
  - Helmholtz Cloud → cloud orchestration for imaging use case
  - PUNCH4NFDI → compute resources for particle physics
Contributors

- **PAM module (pam-ssh-oidc):** Pracelab.PL (Pawel Wolniewicz (PSNC), Damian Kaliszan (PSNC))
- **User provisioning (feudal):** KIT (Lukas Burgey, Joshua Bachmeier, Diana Gudu, Marcus Hardt)
- **Integration serverside (motley_cue):** HIFIS (Diana Gudu (KIT), Andreas Klotz (HZB))
- **HPC Integration and testing:** EOSC-Synergy (Diana Gudu (KIT), Rubén Díez, CESGA)
- **Integration, consulting, and review:** Enol Fernandez (EGI), Viet Tran (IISAS), Mario David (LIP), Mischa Salle (Nikhef)
- **Infrastructure Manager Integration:** Miguel Cabeller (UPV), German Molto (UPV)
- **oidc-agent integration:** KIT (Gabriel Zachmann (KIT))
- **putty-integration:** Dmytro Dehtyarov (KIT/GEANT), Jonas Schmitt (KIT), Simon Tatham (Putty)
More information

- Download oidc-agent for Windows & PuTTY
  
  ![QR Code](https://repo.data.kit.edu/windows/oidc-agent)
  
  [https://repo.data.kit.edu/windows/oidc-agent](https://repo.data.kit.edu/windows/oidc-agent)

- Documentation
  
  ![QR Code](https://github.com/EOSC-synergy/ssh-oidc)
  
  [https://github.com/EOSC-synergy/ssh-oidc](https://github.com/EOSC-synergy/ssh-oidc)

- Contact
  
  ![QR Code](m-contact@lists.kit.edu)
  
  [m-contact@lists.kit.edu](mailto:m-contact@lists.kit.edu)
Backup slides
Approval workflow

- Admins can oversee all deployment requests from users
- How it works:
  - User triggers deployment
  - Admin (and user) is notified
    - notification is backend-specific
    - supported notification system: email
  - Admin accepts or rejects the request manually
  - Users are not notified of acceptance/rejection → pull model
- Subsequent deployment requests
  - notify the admin only when updates are necessary

https://github.com/dianagudu/egi-2022-demo

local UNIX
- $ groupadd ...
- $ useradd ...
- $ usermod ...

LDAP
LDIF
representation

$ groupadd ...
$ useradd ...
$ usermod ...
LDAP backend

- Local accounts are managed in an LDAP
  - OIDC unique ID stored in a configurable attribute
  - Required LDAP schemas: inetOrgPerson, posixAccount, posixGroup

- Modes
  - **read-only**: local user management fully controlled by LDAP admins, including mapping
  - **pre-created**: motley-cue adds the mapping information to pre-created accounts
  - **full-access**: motley-cue has full control to provision users and groups in LDAP