SSH with Federated Identities using OIDC

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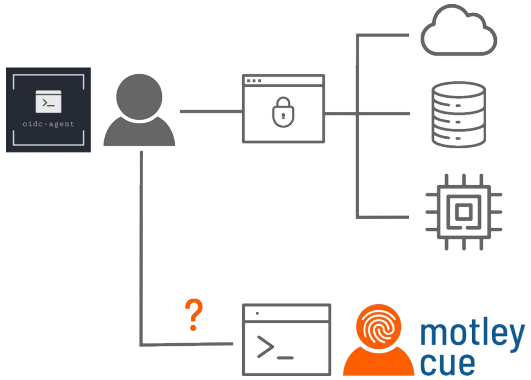
Motivation

- Enhance Security
  - Remove need for ssh-keys
- Enable federated access to shell-based services
  - Federated Identity Management → OpenID Connect (**OIDC**)
  - **Shell-based services** → **Secure** Shell (**SSH**), local identities

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

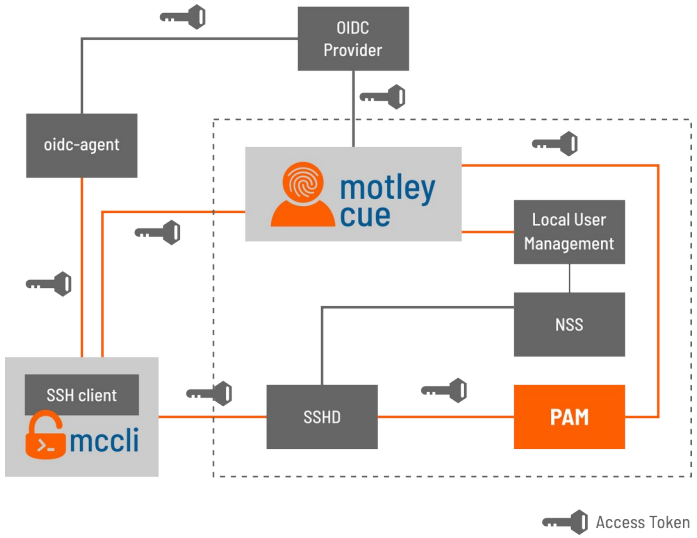
- Single Sign-On (SSO)
- No additional service credentials
- No need for SSH key management
- No prior registration

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)
- 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

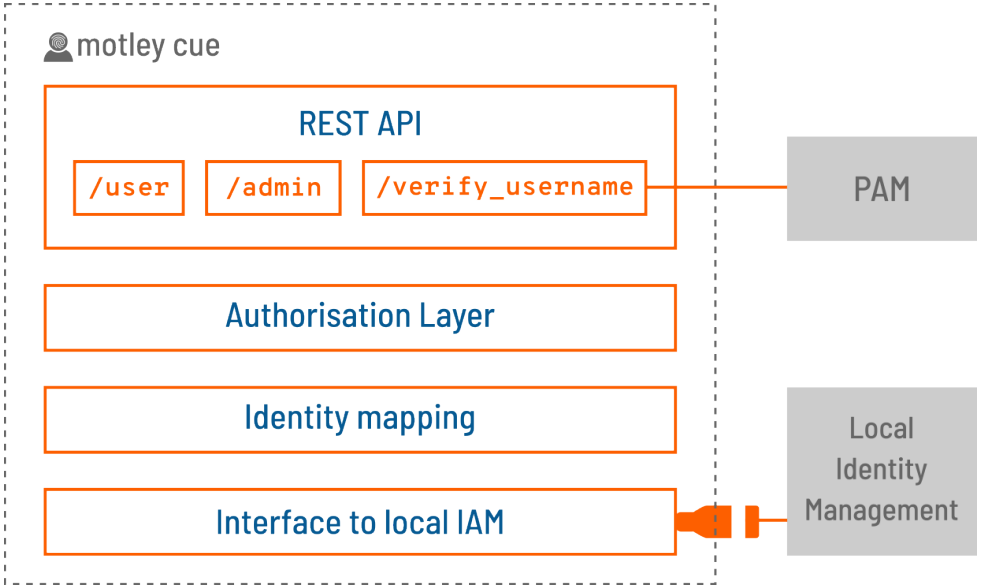


- Server side:
  - Use PAM module with oidc support: **pam-ssh-oidc** (PSNC/Pracelab.pl)
  - Add REST interface to ssh-server to manage the details: **motley-cue**
- Client side:
  - **oidc-agent** for obtaining tokens
  - Enable **ssh-clients** to use tokens

No modifications of **ssh** or **sshd**

Server Side

motley-cue architecture



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
- Identity mapping: `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

```
$ curl -X 'GET' \
   $motley_cue_endpoint/verify_user&username=$username \
   -H “Authorization: Bearer $token”

{
  "state": "deployed",
  "verified": true
}
```

Technical details

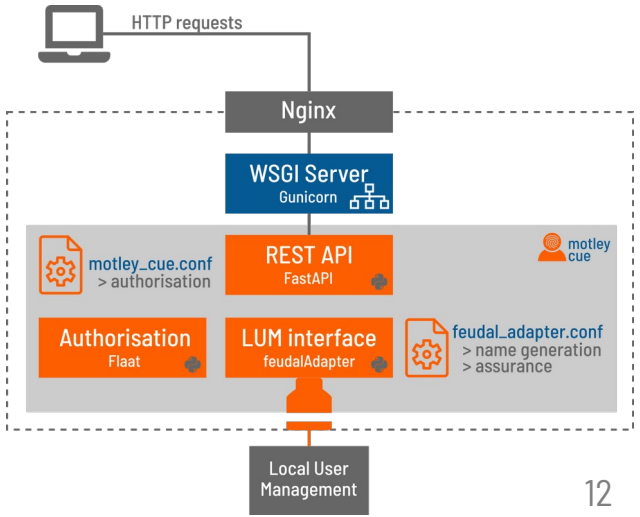
- Easy deployment
  - Packages for most common Linux distributions
  - systemd integration
- Python, FastAPI
- Nice to know
  - SSH daemon is not modified
  - PAM module may be combined with other modules

Possible:

ssh-key + password + OIDC + 2nd factor (linotp)

http://repo.data.kit.edu

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



Client Side

SSH Clients

mccli

- 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

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

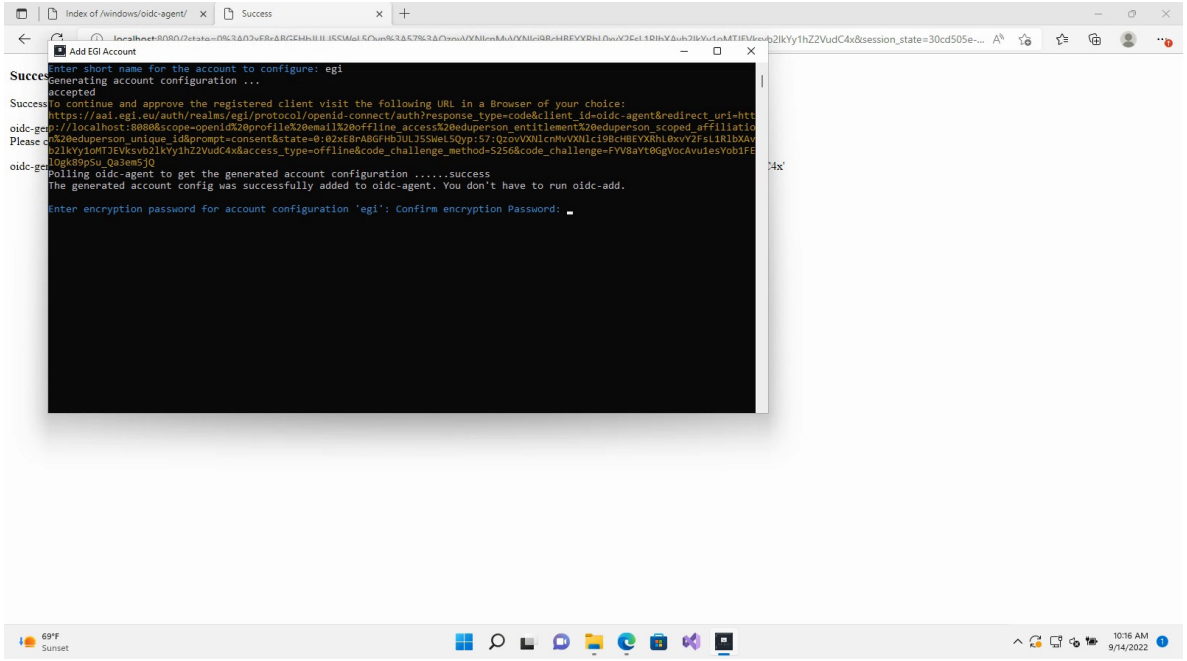
Demo

https://ssh-oidc-demo.data.kit.edu/

https://youtu.be/OUaEcm1nbNw

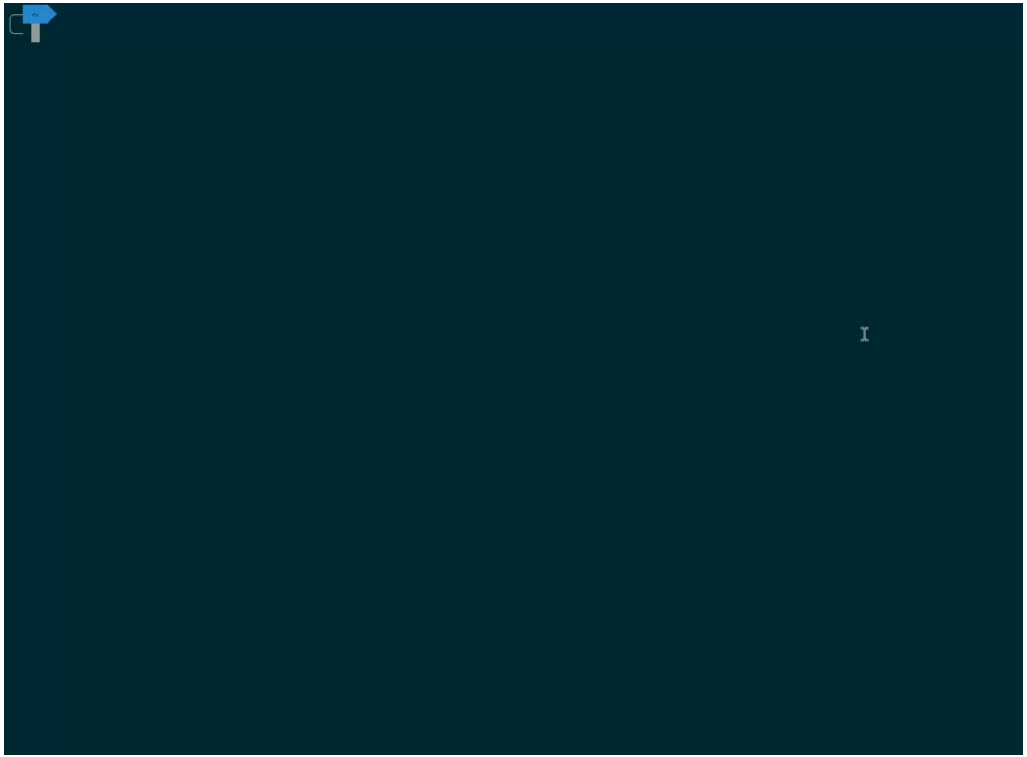
Demo Windows (recorded)

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



https://youtu.be/IrwmnHmxbTQ

Demo Linux (live)



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
- 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

https://repo.data.kit.edu/windows/oidc-agent

- Documentation

https://github.com/EOSC-synergy/ssh-oidc

- Contact

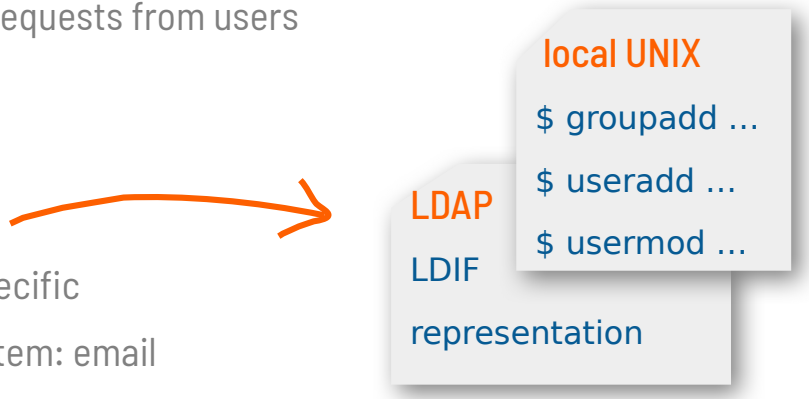
m-contact@lists.kit.edu

Backup slides

Approval workflow

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

- 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



LDAP backend

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

- 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