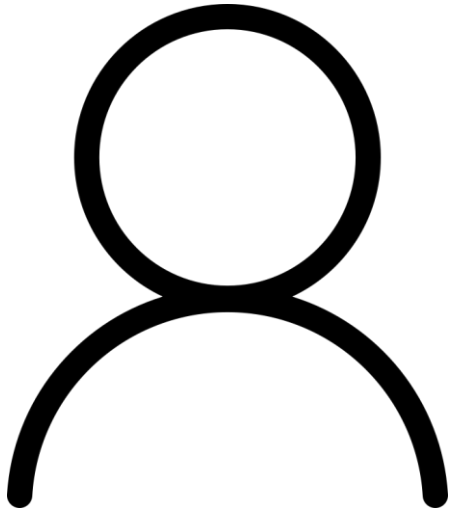
JUPYTERHUB OUTPOST

START SERVICES ON MULTIPLE REMOTE RESOURCES

MAY 15, 2024 | TIM KREUZER

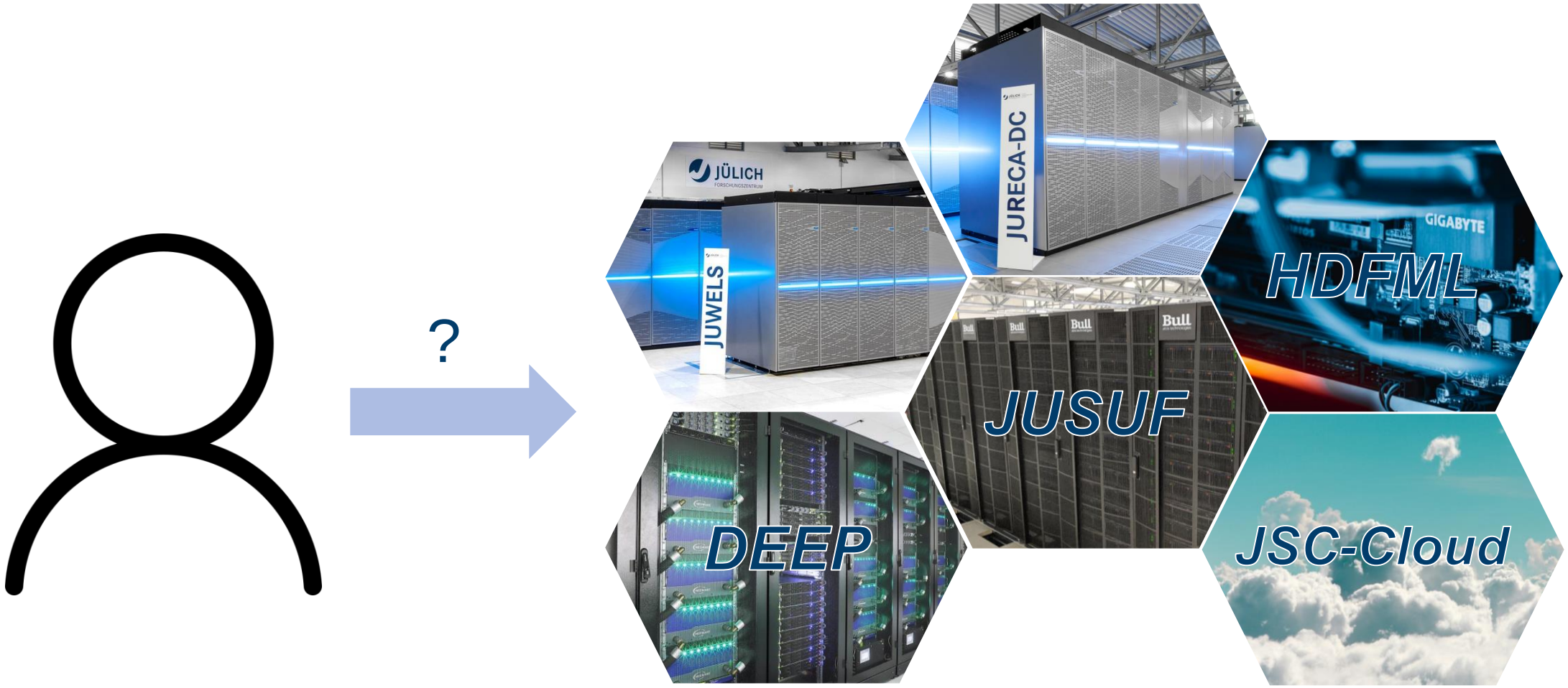
MOTIVATION



- 3.400+ accounts at HPC-systems in Juelich
- Each user is part of various HPC-projects
- Each HPC-project has access to different partitions on different systems

- Users are experts in their field, but not everyone is an expert in computer science
- Easy, unified access to all systems

MOTIVATION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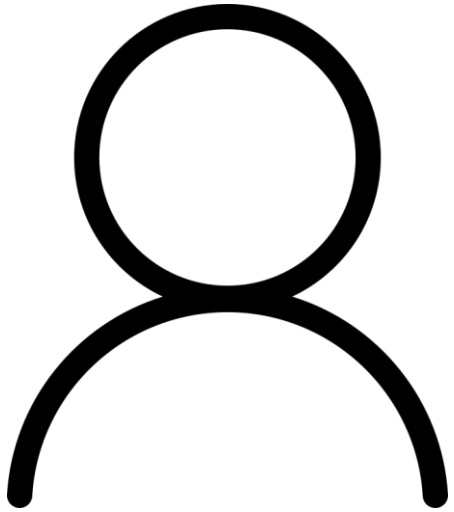
MOTIVATION



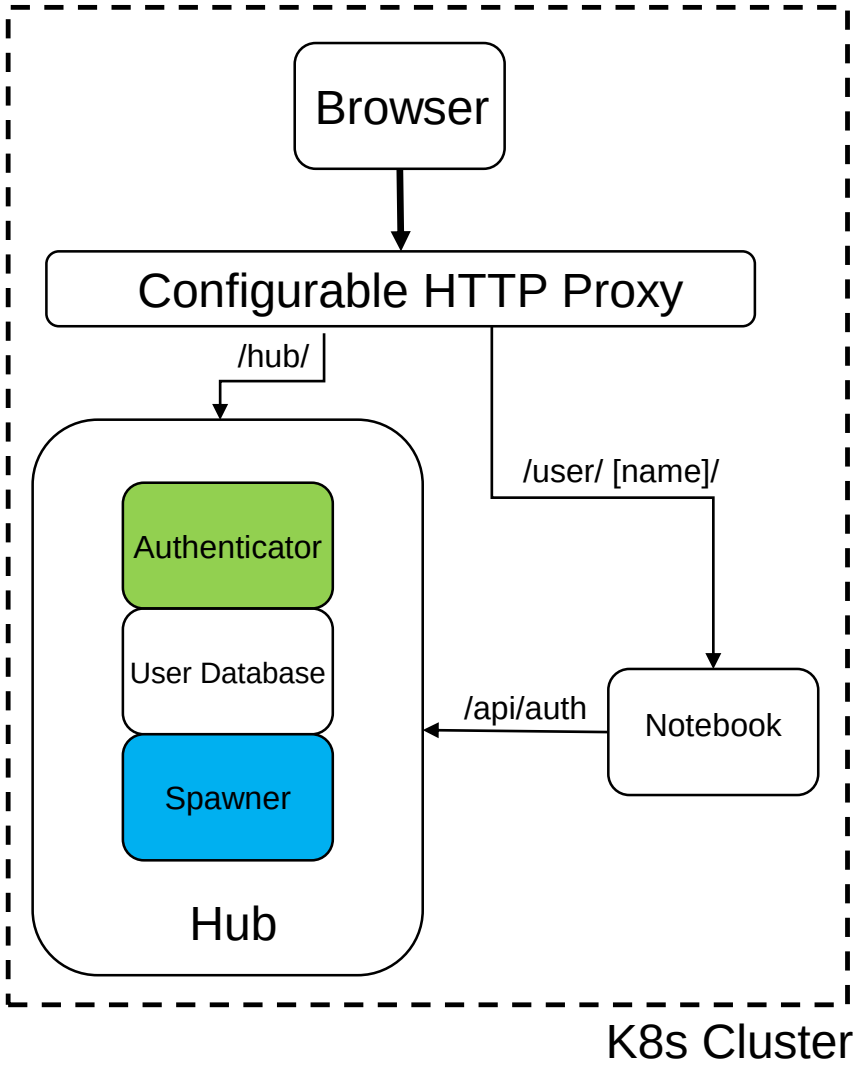
jupyterhub

REQUIREMENTS

- One central JupyterHub should be able to start a notebook server on each system
- Add more systems in the future with different resource types (k8s, slurm, torque, etc.)
- Each system has to keep full control over its resources
- Compatible with vanilla JupyterHub – no patches or changes required

ARCHITECTURE

JupyterHub



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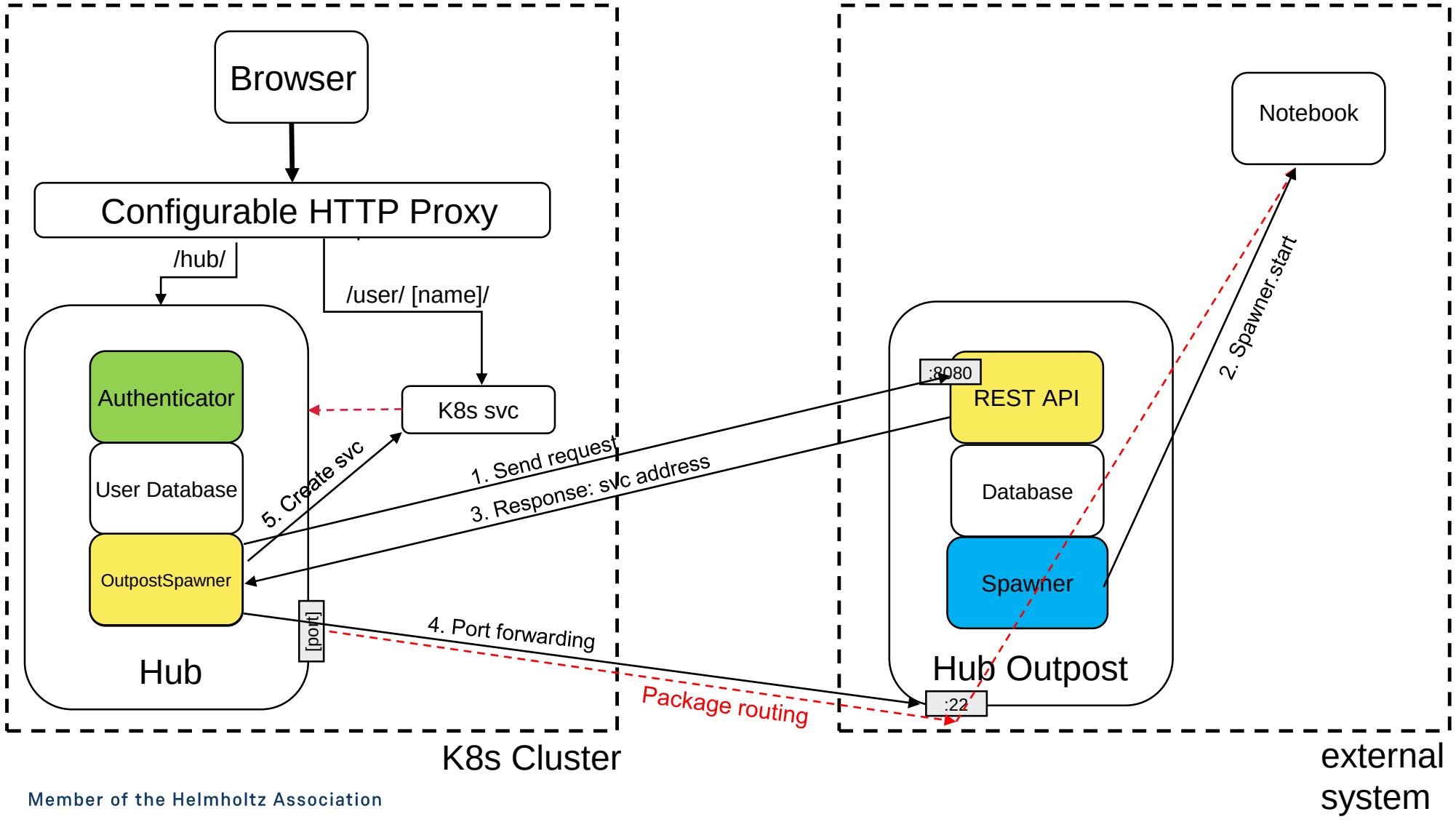
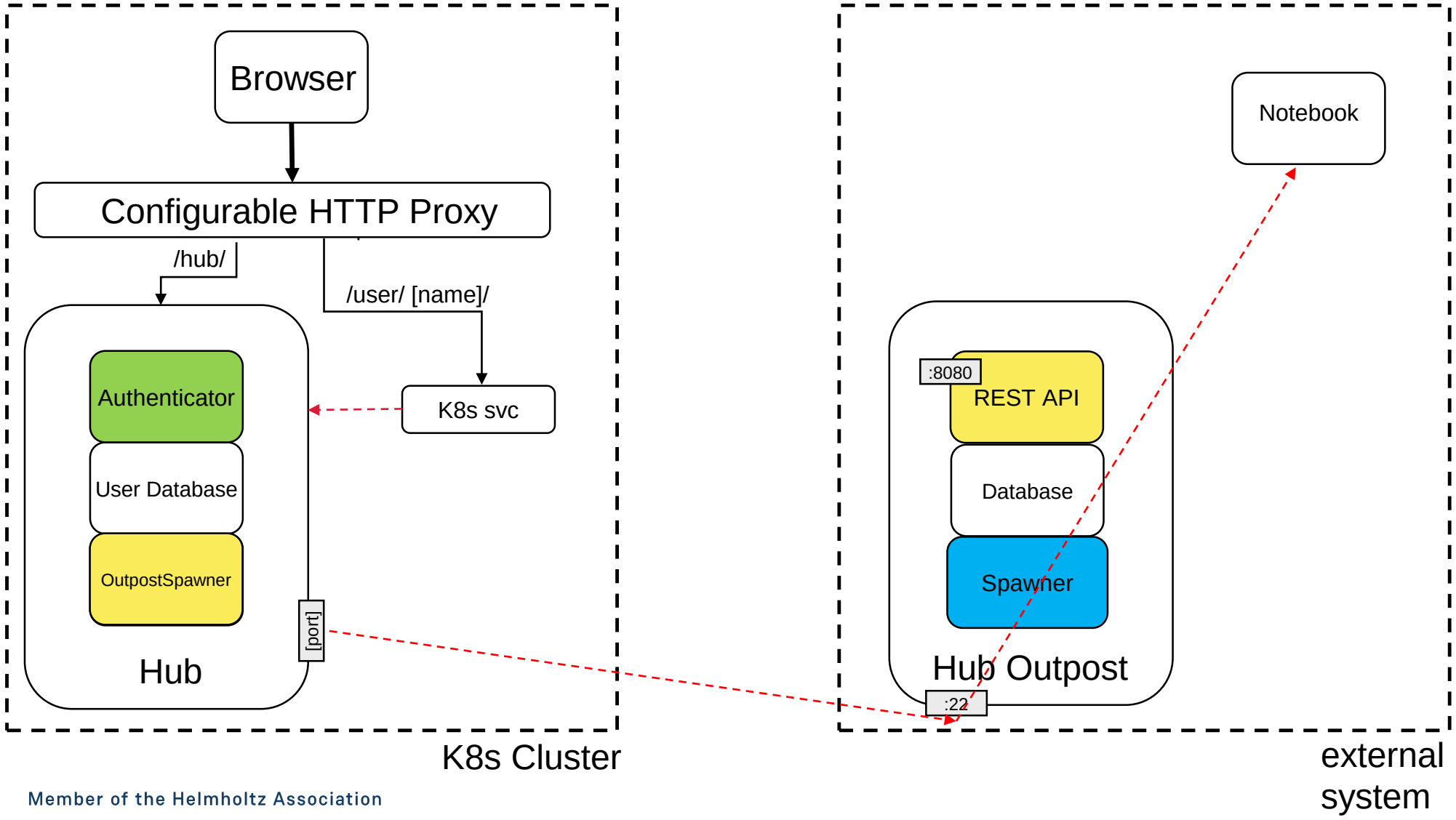
JupyterHub



ARCHITECTURE

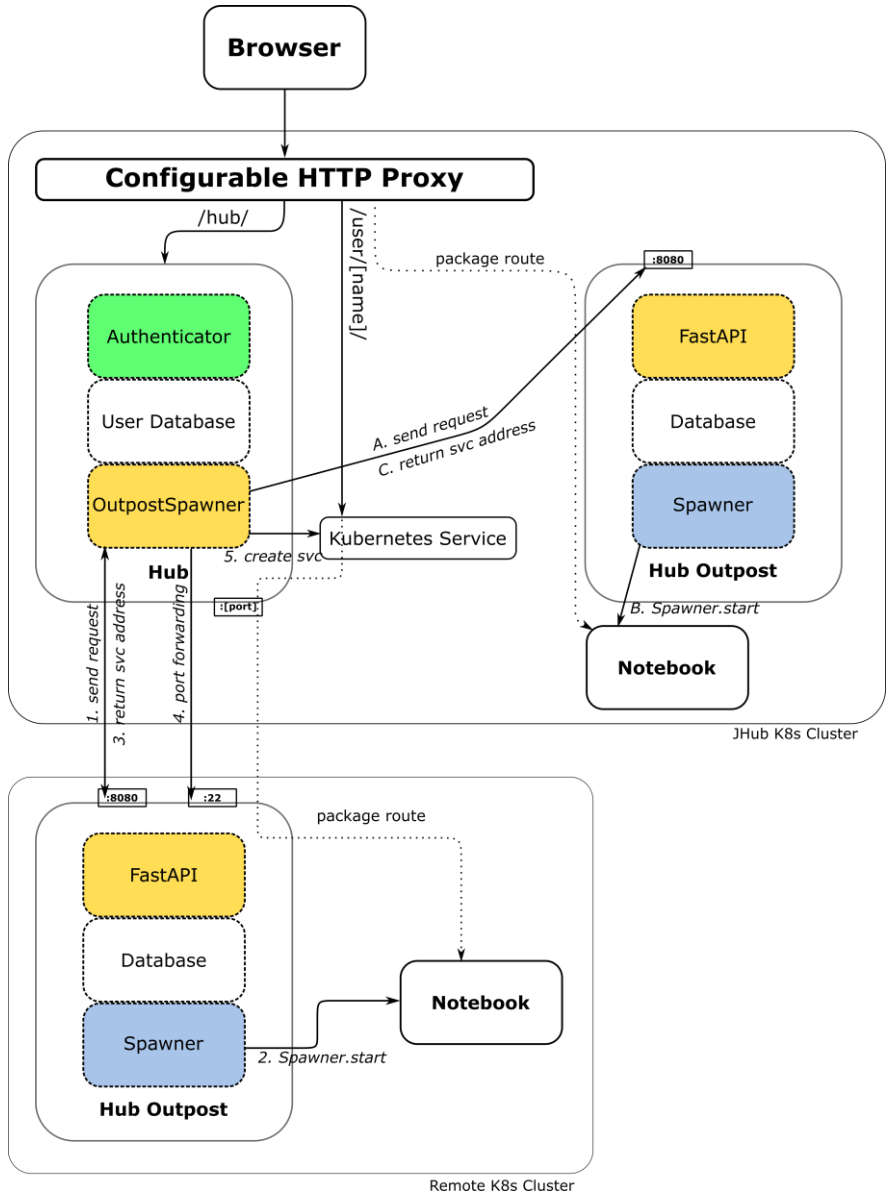
JupyterHub



ARCHITECTURE

Start Jupyter-server on two systems

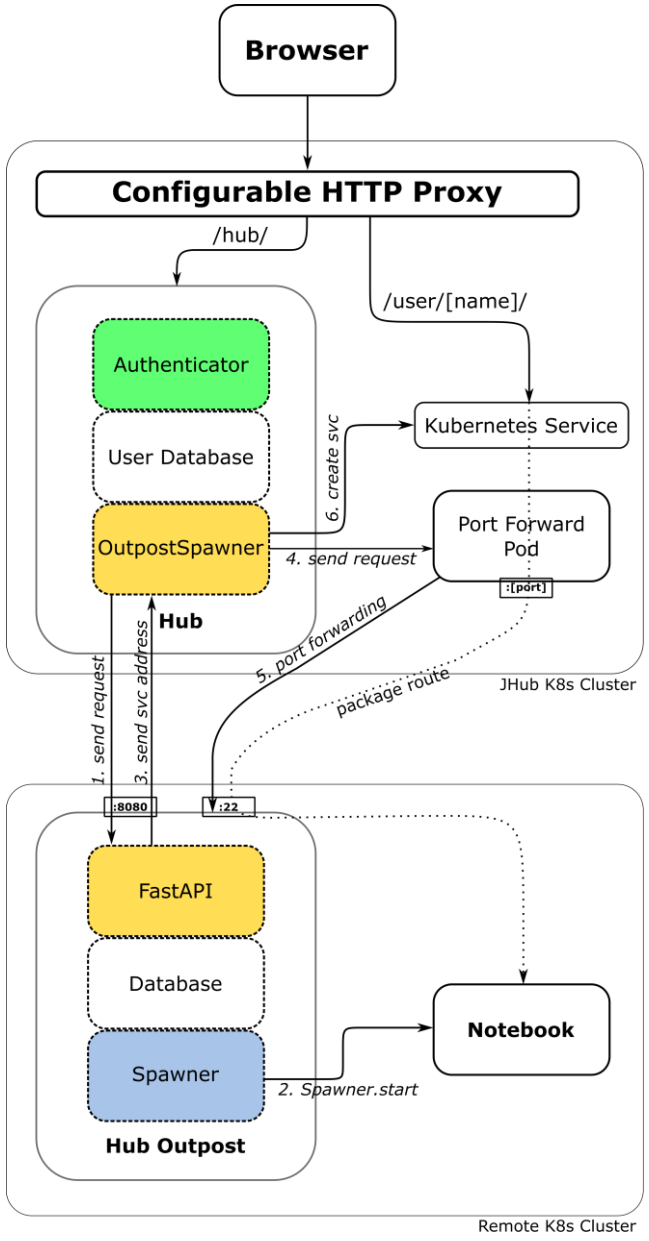
- Simple Setup to allow start on two different K8s clusters
- Remote cluster can be managed by different administrator
- Remote cluster has full control of their resources via flavors



ARCHITECTURE

External Tunneling

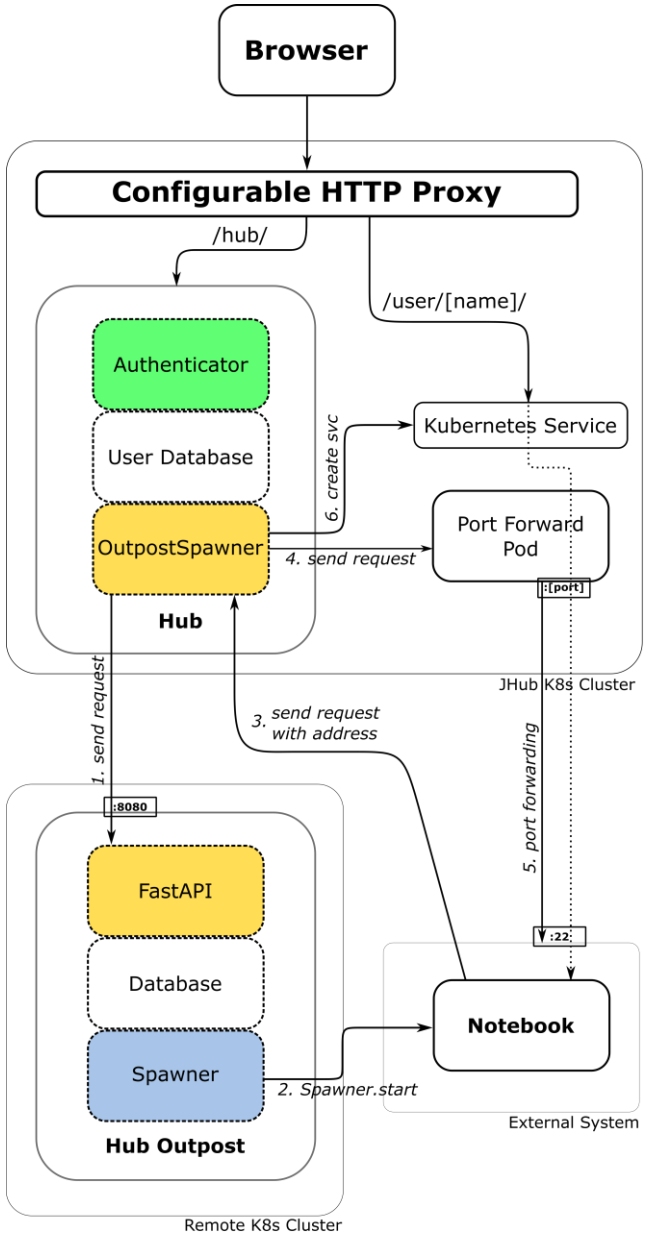
- External tunneling pod responsible for ssh port-forwarding
- Create your own solution, or use an existing one
- Users keep access to their running servers if JupyterHub is unavailable



ARCHITECTURE

Delayed Tunneling

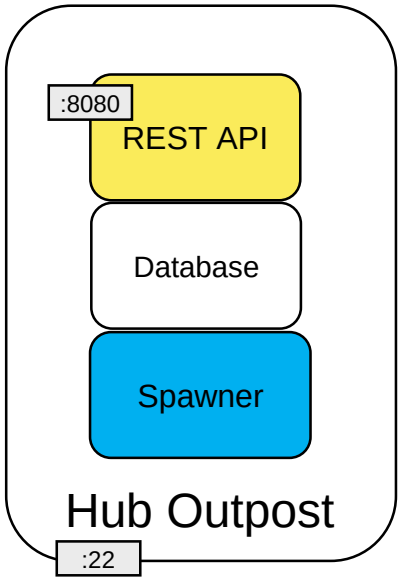
- Jupyter server may run on external system
- Perfect for hpc systems, if the svc address is not known during start time
- Start process of jupyter server has to send a request with its address to the Outpostspawner



OUTPOST

Key features

- Start jupyter server on remote systems, using classical JupyterHub spawner
- A central JupyterHub may use multiple Outposts, each with its own administrator and configuration
- Each Outpost may be used by multiple JupyterHubs
  - Each JupyterHub uses its own credentials, so they don’t interfere with each other
- Override Spawner configuration for each jupyter server possible
  - e.g. user selects docker image which should be used, if allowed by Outpost
- Flavors – Configure how many resources should be used by a hub or user
  - Hub-based flavors: Different hubs may use different amount of resources
  - User-based flavors: Allow resource usage for each individual user



OUTPOST

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  administrato
- Each Outpos
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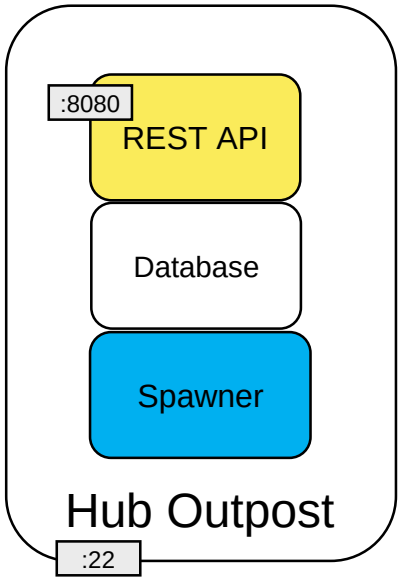
- Override Spa
  - e.g. user
- Flavors – Co
  - Hub-base
  - User-bas

Configured at each Outpost

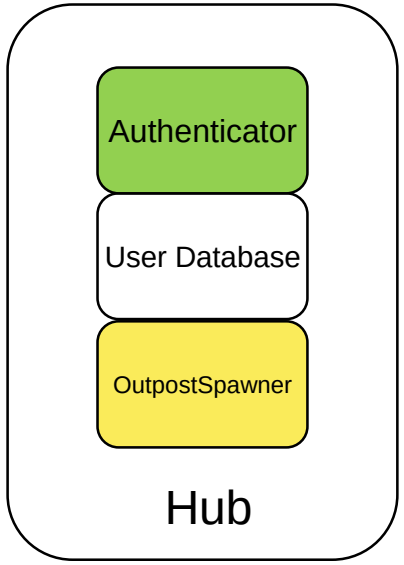
```
from kubespawner import KubeSpawner
c.JupyterHubOutpost.spawner_class = KubeSpawner
c.KubeSpawner.image = “jupyter/minimal-notebook:notebook-7.0.3”
c.KubeSpawner…. = … # use any Spawner with any configuration you like

flavors = {
    “m1”: {
        “max”: 5,
        “display_name”: “2GB RAM, 1 VCPU, 120 hours”,
        “description”: “Service will run for maximum 5 days with 2GB RAM”,
        “runtime”: { “days”: 5 }
    }
}
c.JupyterHubOutpost.flavors = flavors # may also be a function
# c.JupyterHubOutpost.user_flavors = … # create a function to allow \
different flavors for each user
# c.JupyterHubOutpost.flavors_undefined_max = 10 # used when no flavor \
is used, limits the number of servers to 10 overall
…
```



OUTPOSTSPAWNER

Key features



- Remote jupyter server management via POST/GET/DELETE requests
  - Send all required information to the Outpost, which will then use a classical spawner to start the jupyter server.
- Additional API Endpoints
  - List all running servers. May be used by Outpost to cleanup servers no longer running
  - SpawnEvents – Outpost (or start process of jupyter-server) may send information about current spawn status
  - SetupTunnel – May be used by jupyter-server start process, to create ssh tunnel to running server
  - TunnelRestart – Inform hub that tunnels to a certain node must be recreated
  - Flavor Update – Outpost may update the flavors for its own system

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Key features

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  - SpawnEve

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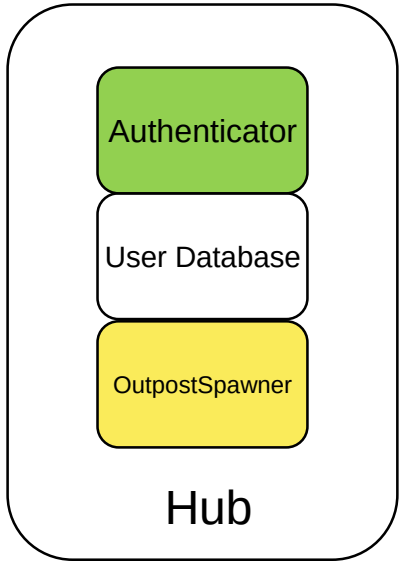
  - SetupTunn
  - TunnelRes
  - Flavor Upd

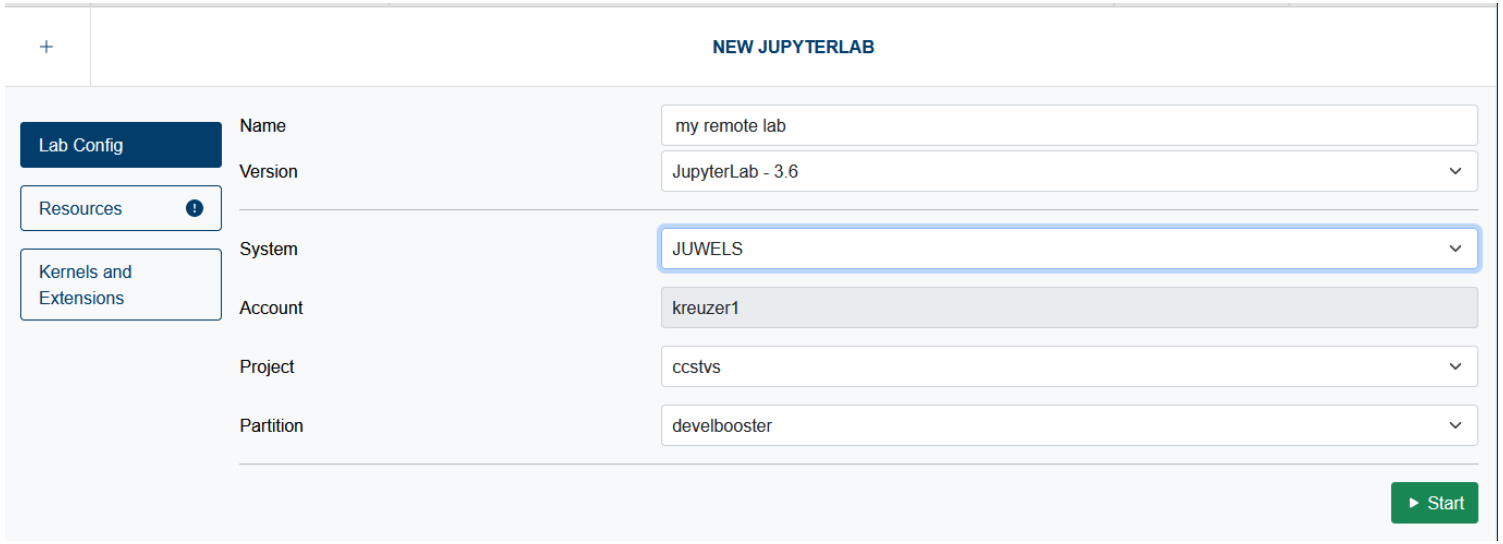
Configured at central JupyterHub (e.g. z2jh)

```
c.JupyterHub.custom_scopes = { … } # define scopes for API-Endpoints
from outpostspawner import OutpostSpawner
c.JupyterHub.spawner_class = OutpostSpawner
c.OutpostSpawner.options_form = """
    Choose a system:
    <select name="system">
        <option value="Local">Local</option>
        <option value="Remote-A">Remote A</option>
        <option value="Remote-B">Remote B</option>
    </select>
"""
def my_request_url(spawner, user_options): …    # define your own logic
def my_request_headers(spawner, user_options): … # for each system
c.OutpostSpawner.request_url = my_request_url
c.OutpostSpawner.request_headers = my_request_headers
… # full example: https://github.com/jupyterhub/team-compass/issues/722
```



SUMMARY

- The JupyterHub Outpost allows us to reach multiple systems with one central Hub
- Remote systems keep full control over their resources
- Using Kubernetes ingress + https enables a secure connection between Hub and Outposts
- Using `c.JupyterHub.internal_ssl` feature allows secure connection between Hub and Jupyter server
- Already in use at https://jupyter.jsc.fz-juelich.de and a few more project specific JupyterHubs



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