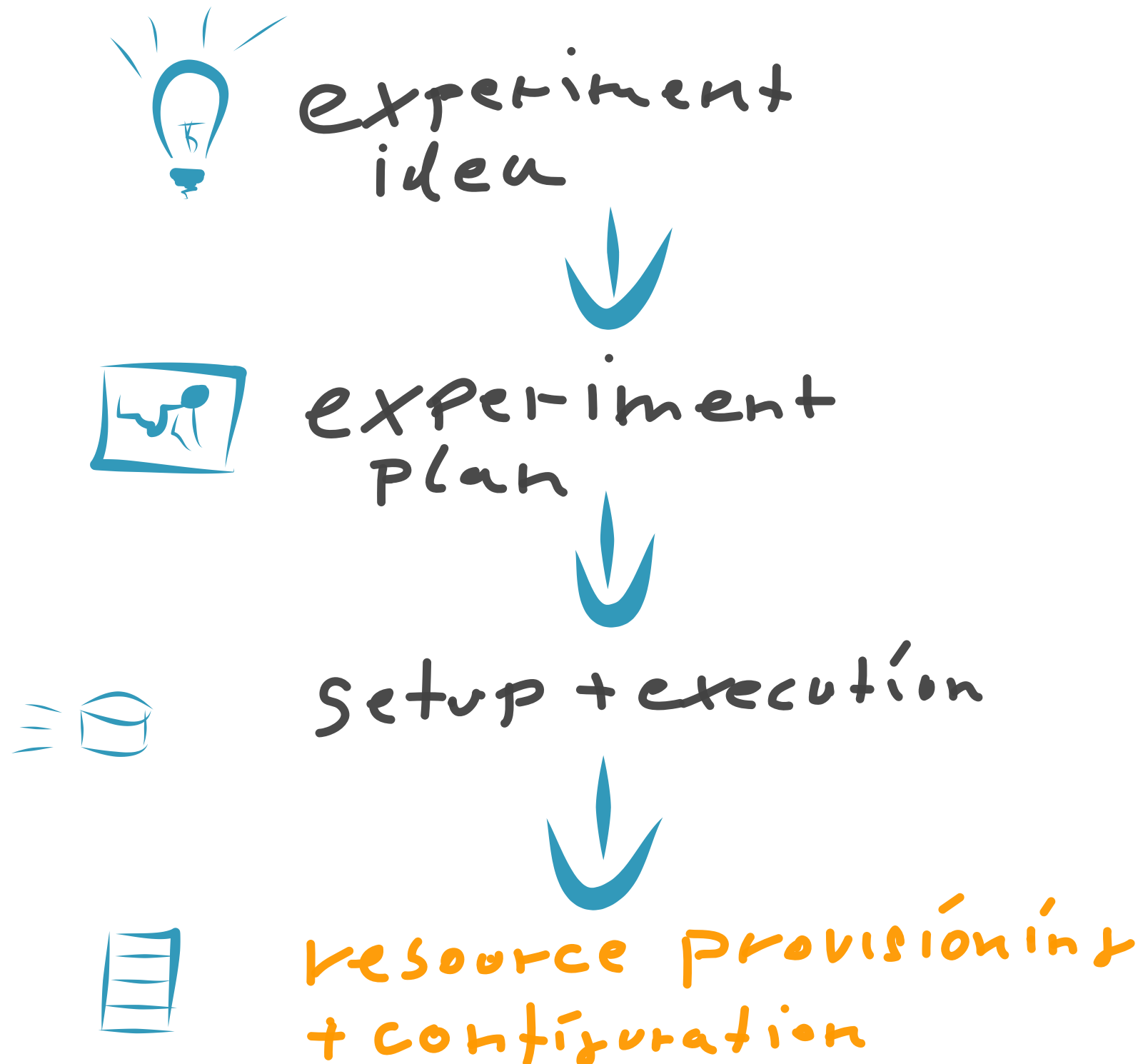


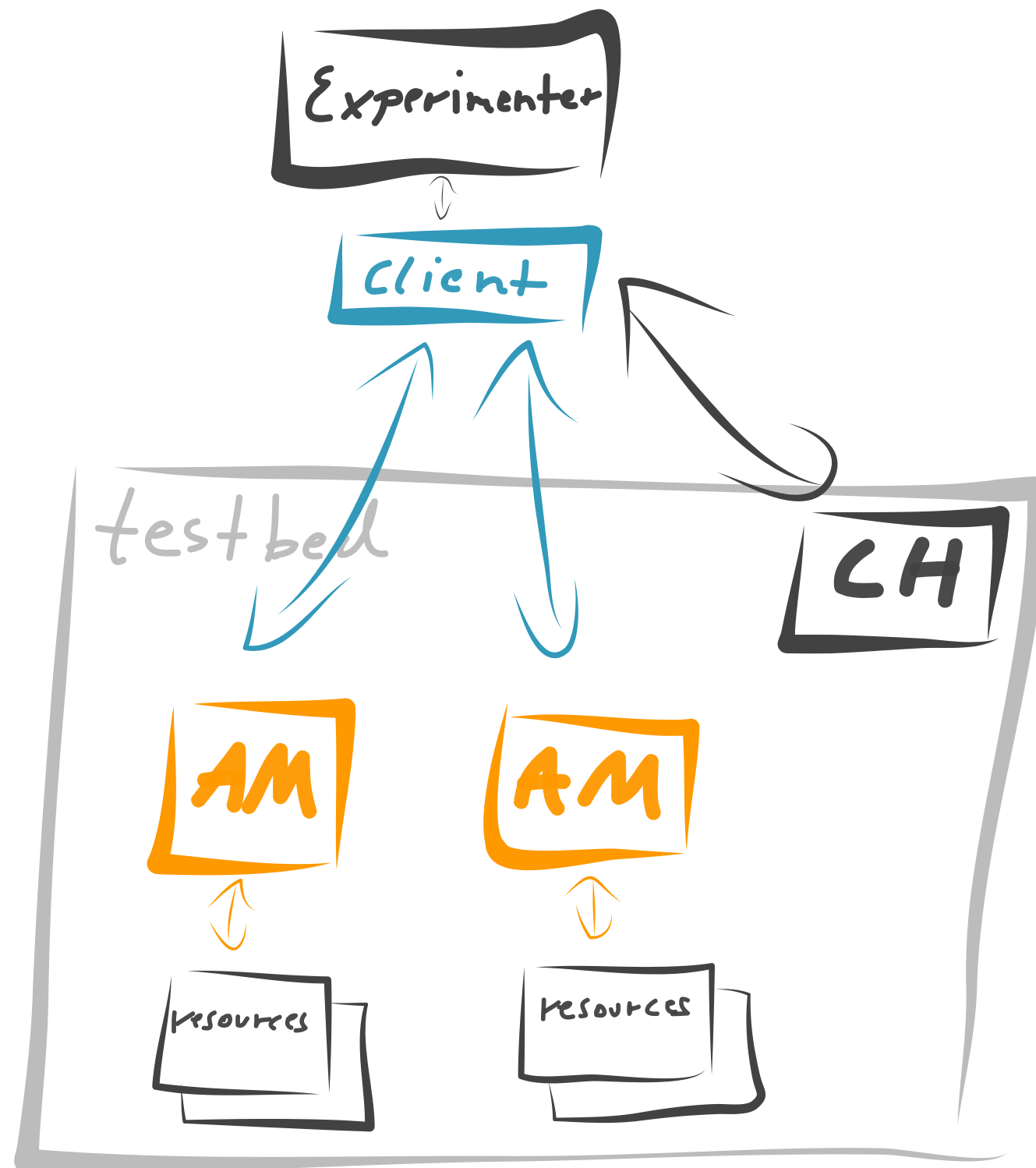
AMsoil

The glue for Aggregate Manager developers

researcher's goal



experiment execution

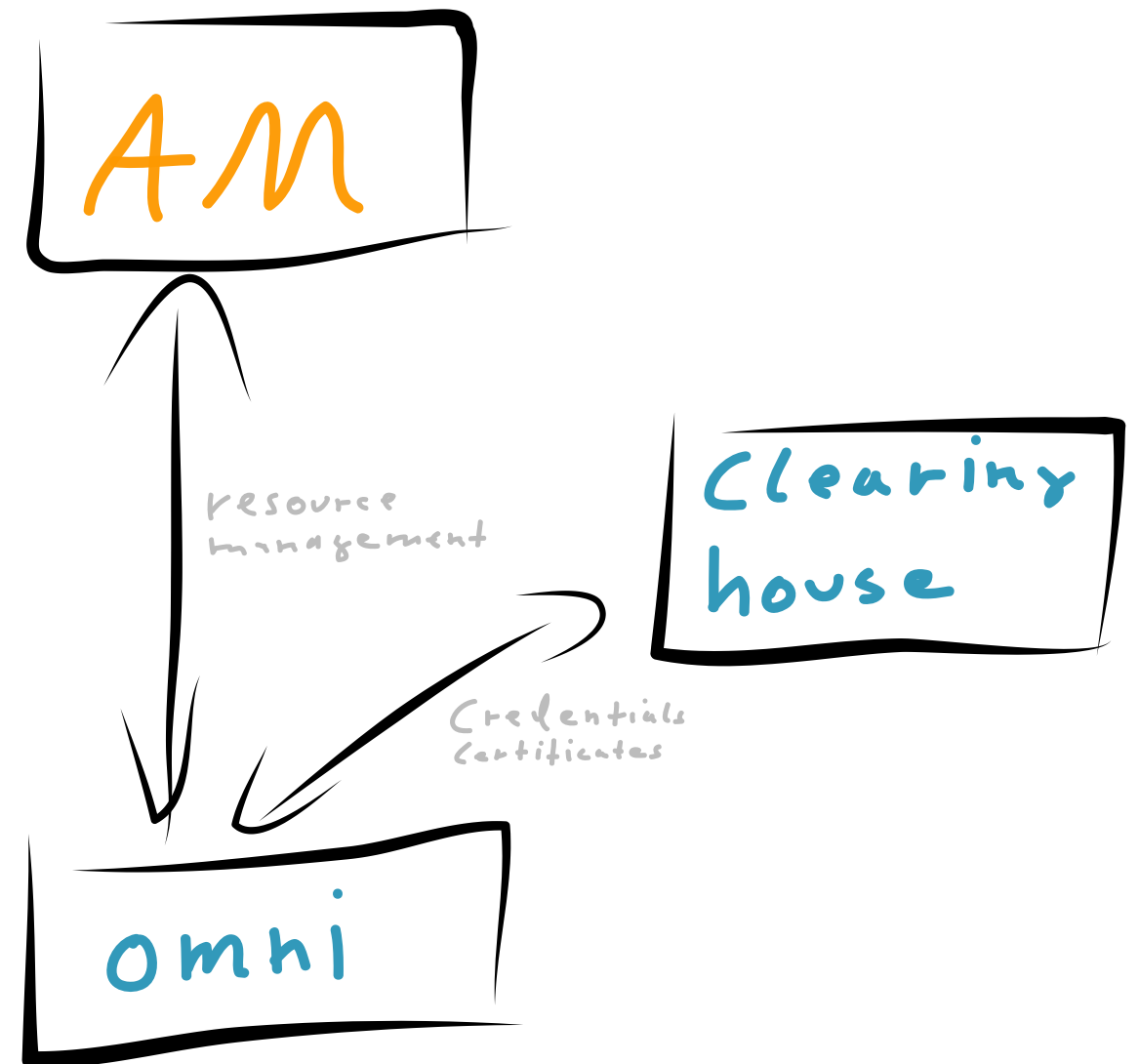


CH Clearinghouse

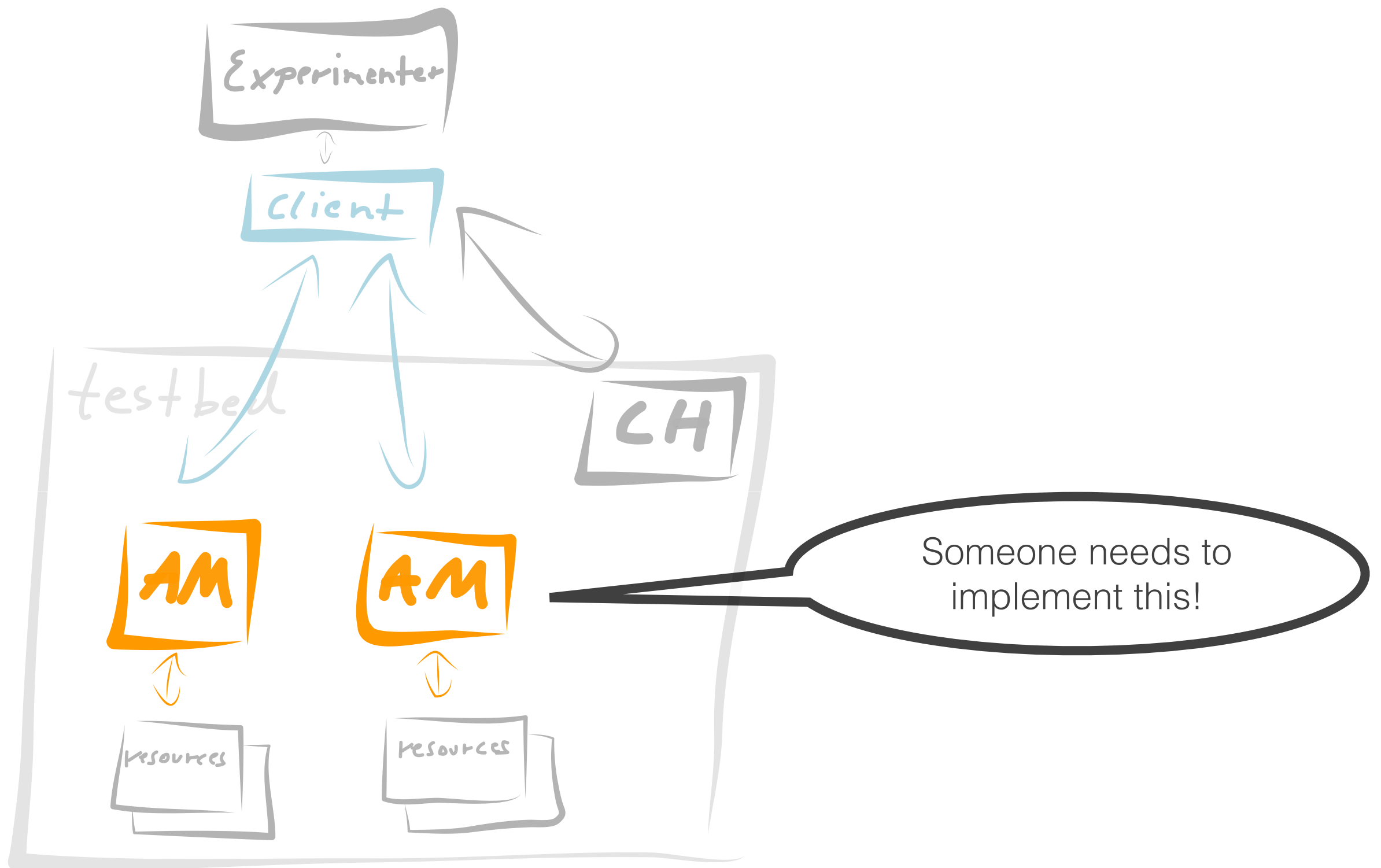
AM Aggregate Manager

test bed

- **Clearinghouse** manages certificates and credentials
- The **client** (*here: omni*) assembles the request and sends it to the Aggregate Manager
- **Aggregate Manager** manages, allocates and provisions resources



AMsoil?



AMsoil?

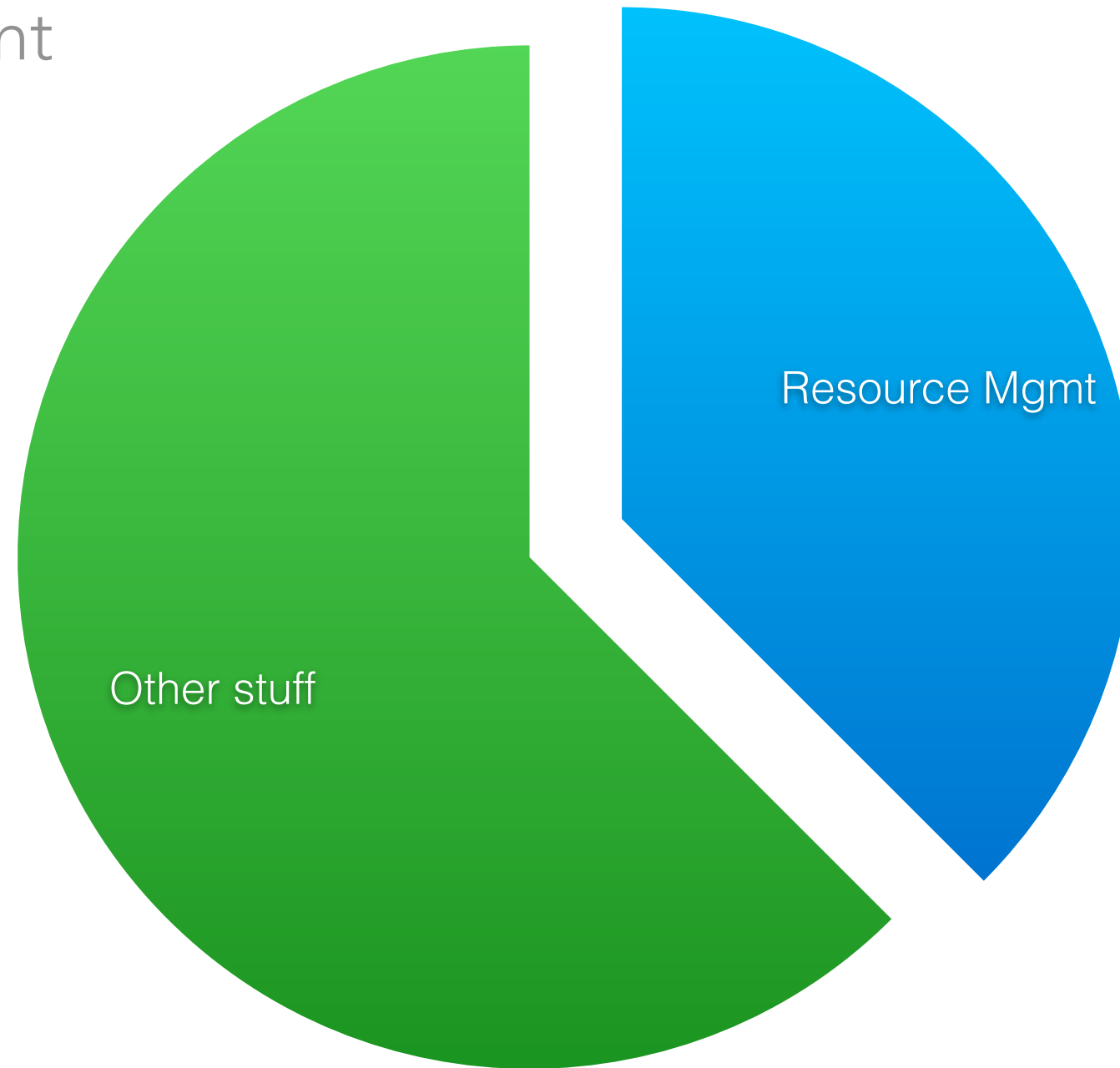


AMsoil is a light-weight [framework for creating Aggregate Managers](#) in test beds.

AMsoil is a pluggable system and provides the necessary glue between RPC-Handlers and Resource Managers . Also it provides helpers for common tasks in [AM development](#).

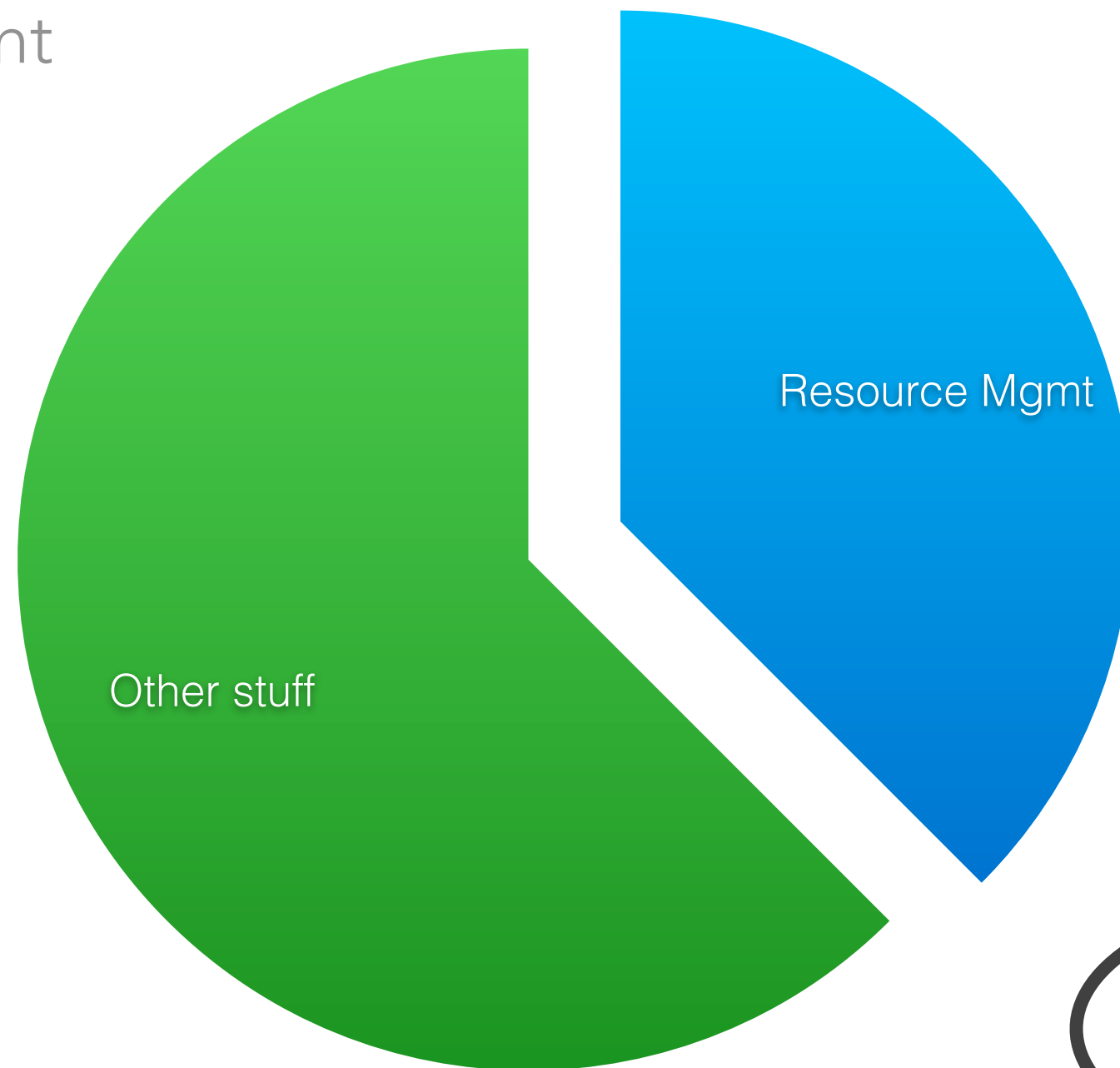
motivation

AM development
without AMsoil



motivation

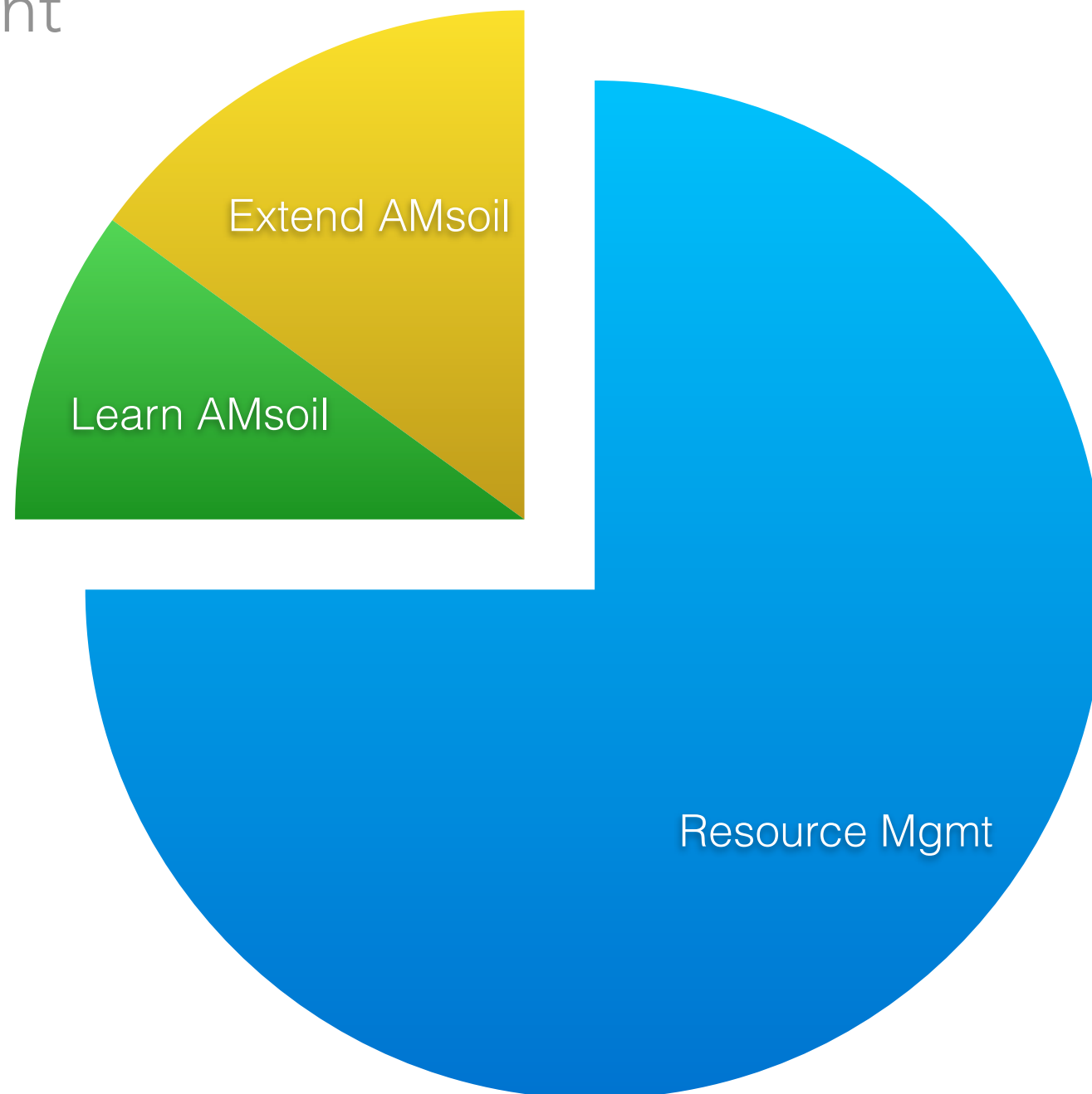
AM development
without AMsoil



This is why
you write an AM.
The rest is just annoying.

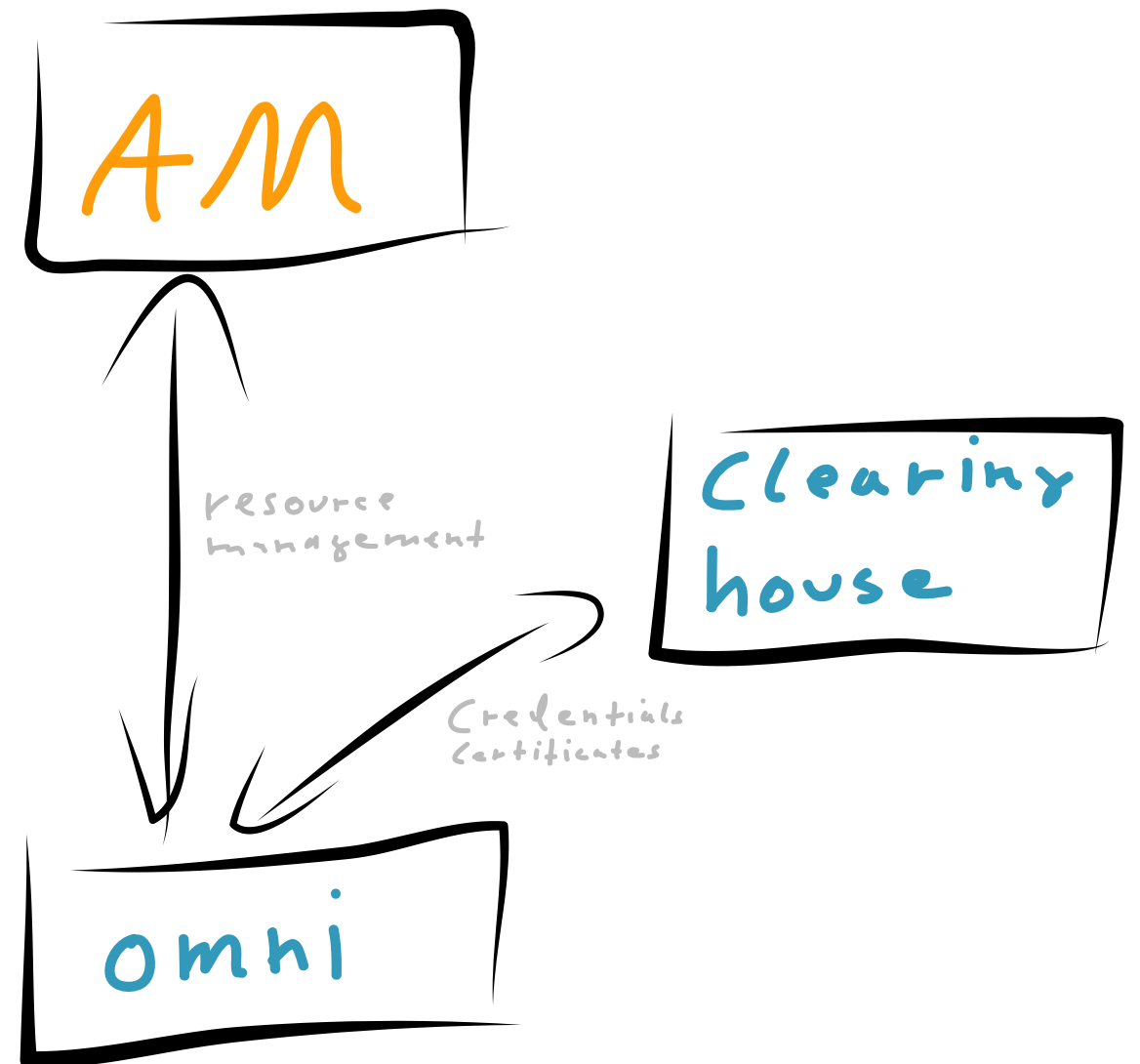
motivation

AM development
with AMsoil



how to write an AM

- Setup a little test bed
 - Install a Clearinghouse
 - Install a client
 - Install AMsoil
- Understand AMsoil
- Start hacking...



what now?

finish this presentation,

clone the repository [↗ https://github.com/fp7-ofelia/AMsoil.git](https://github.com/fp7-ofelia/AMsoil.git)

then **read** [↗ https://github.com/fp7-ofelia/AMsoil/wiki/Installation](https://github.com/fp7-ofelia/AMsoil/wiki/Installation)

what you need to know

- how [plugins](#) work
- how a [GENI](#) testbed works
- what plugins you [need to develop](#)
- what else [AMsoil](#) supports

a broad look

AMsoil's directory structure

```
|-- admin
|-- deploy
|   |-- trusted
|-- doc
|   |-- img
|   |-- wiki
|-- log
|-- src
|   |-- amsoil
|       |-- core
|       |-- vendor
|       |-- ...
|   |-- plugins
|       |-- ...
|-- test
```

Documentation

AMsoil's log

AMsoil's core implementation

Repository for (core) plugins maintained by AMsoil

Plugins to be loaded when bootstrapping AMsoil

why plugins?

- **Selection**

An administrator can add/remove plugins/functionality.

- **Exchangeability**

The interface remains, but the implementation be changed.

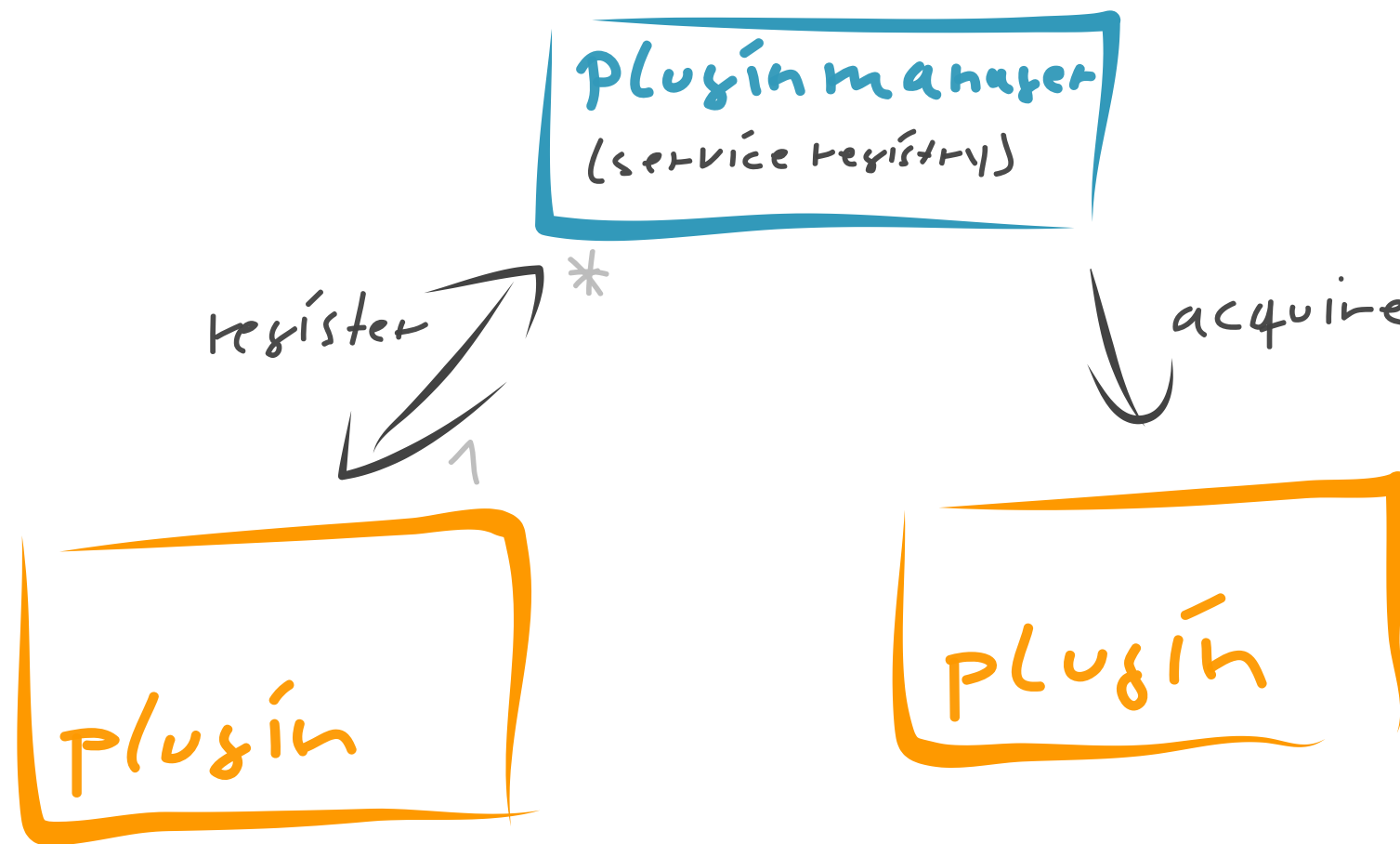
- **Clarity**

Provide a set of services and hide the details behind.

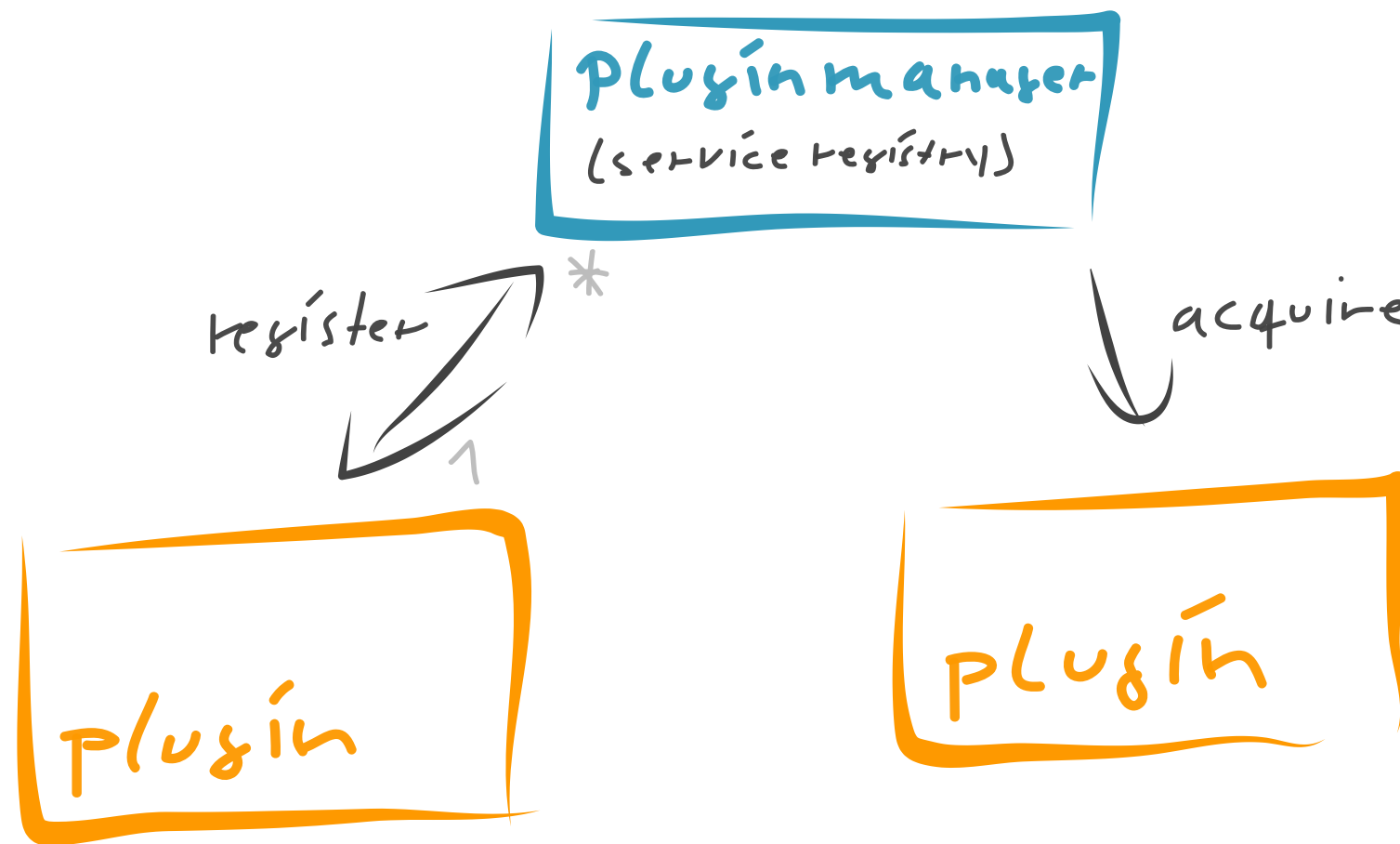
- **Encapsulation**

Protect implementations from other developers.

register and use plugins



register and use plugins



```
[plugin A] import amsoil.core.pluginmanager as pm
[plugin A] pm.registerService('myservice', serviceObject)

[plugin B] service = pm.getService('worker')
[plugin B] service.do_something(123)
```


what can be a service?

short version

everything which can be referenced in Python

long version

ints, strings, lists, dicts, objects, classes, packages

what can be a service?

short version

everything which can be referenced in Python

long version

ints, strings, lists, dicts, objects, classes, packages



yes even
packages!

where to put plugins?

```
| -- src
|   | -- amsoil
|   |   \ -- core
|   | -- vendor
|   |   \ -- ...
|   \ -- plugins
|       \ -- ...
\ -- test
```

where to put plugins?

```
| -- src
| | -- amsoil
| | `-- core
| | -- vendor
| | `-- ...
| `-- plugins
|   `-- ...
|-- test
```

create **symlinks** to
vendor plugins

where to put plugins?

```
-- src
|
| -- amsoil
|   \
|     -- core
|
| -- vendor
|   \
|     -- ...
|
| \
|   -- plugins
|     \
|       -- ...
|
| \
|   -- test
```

contains plugins
maintained by AMsoil

create **symlinks** to
vendor plugins

where to put plugins?

```
-- src
|
| -- amsoil
|   \
|     -- core
|
| -- vendor
|   \
|     -- ...
|   \
|     -- plugins
|       \
|         -- ...
|
| -- test
```

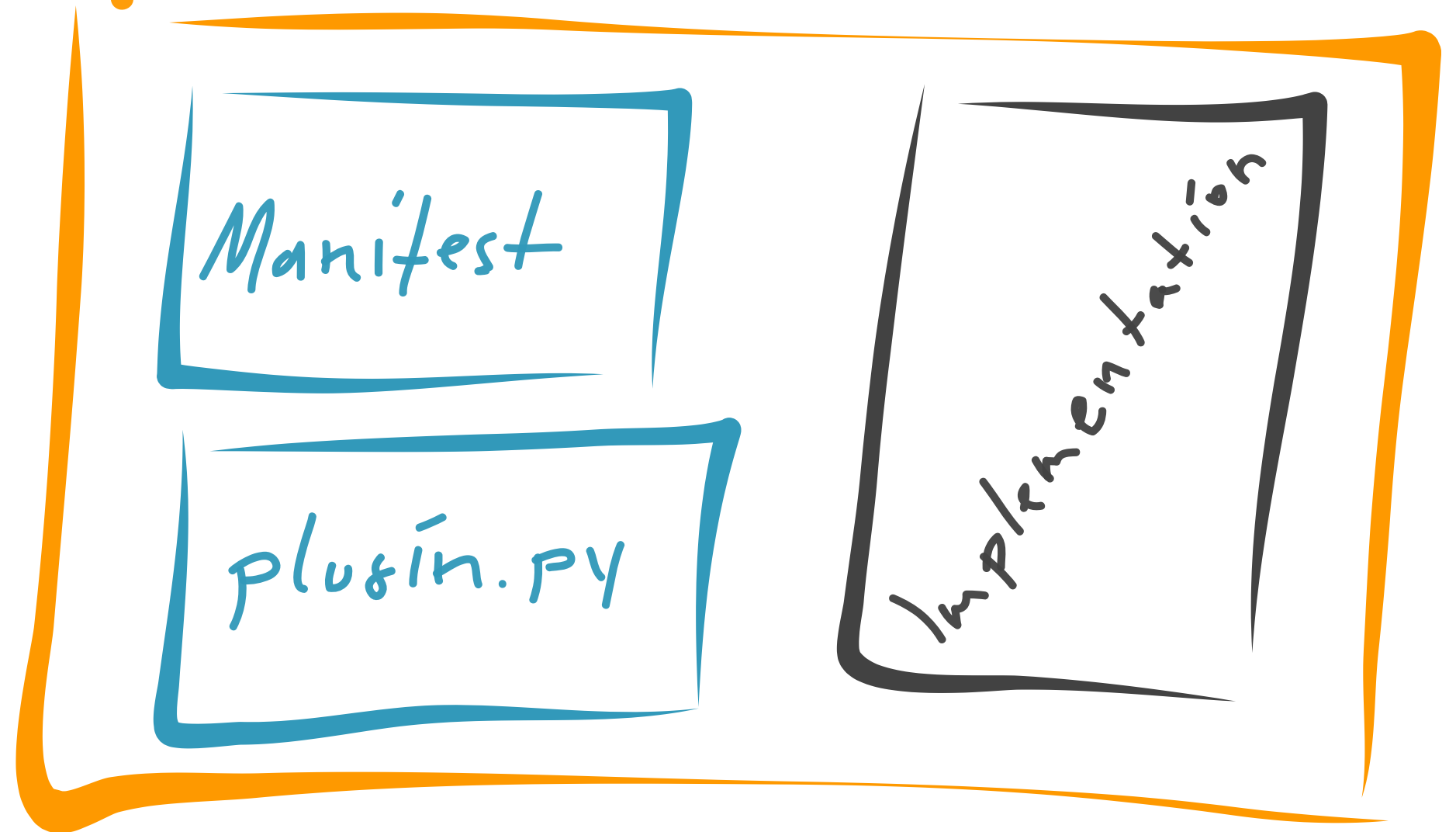
contains plugins
maintained by AMsoil

create **your plugin**
code here

create **symlinks** to
vendor plugins

under the hood

plugin



under the hood

plugin

describes
services & dependencies

Manifest

plugin.py

implementation

under the hood

plugin

describes
services & dependencies

Manifest

performs
initialization & registration

plugin.py

implementation

implement a plugin

- create a [new folder](#) in plugins
- remove symlinks to competing plugins in plugin folder
- create the [manifest.json](#)
- create the [plugin.py](#)
 - write a [setup\(\)](#) method
- [register](#) your services

implement a plugin

manifest.json

```
{
  "name"      : "My Plugin Name",
  "author"    : "Tom Rothe",
  "author-email" : "tom.rothe@eict.de",
  "version"   : 1,
  "implements" : ["myservice", "myclass", "mypackage"], # you'll register these services
  "loads-after" : ["somedependency"],                  # dependency needs to be loaded before the setup method
  "requires"   : []                                    # dependency can be loaded after the setup method
}
```

plugin.py

```
# ...imports...
def setup():
    # register a service
    pm.registerService('myclass', ServiceClass)
    pm.registerService('myinstance', SingleClass() )
    pm.registerService('mypackage', my.python.package)
```

@serviceinterface

The methods and attributes which can should be used are marked the annotation @serviceinterface.

implementation

```
from amsoil.core import serviceinterface

class MyService(object):
    @serviceinterface
    def do_something(self, param):      # can be used by the service user
        pass
    def do_more(self, param):          # not part of the service contract, NOT to be used
        pass
```

DOs and DON'Ts

- If you have plugin-specific exceptions, create a [package with all exceptions](#) and register the package as a service.
- Separate a plugin [into multiple plugins](#) if this improves re-usability.
- [Never import another plugin directly](#), always go via the pluginmanager via `pm.getService()`.

now what?

AMsoil managers are used in a GENI-like test bed.

Let's understand how GENI works.

names in GENI

- **Experimenter**

A human user who uses a client to manage resources via an AM.

- **Sliver**

A physical or virtual resource. It is the smallest entity which can be addressed by an AM

(e.g. an IP address, a virtual machine, a FlowSpace).

- **Slice**

A collection of slivers.



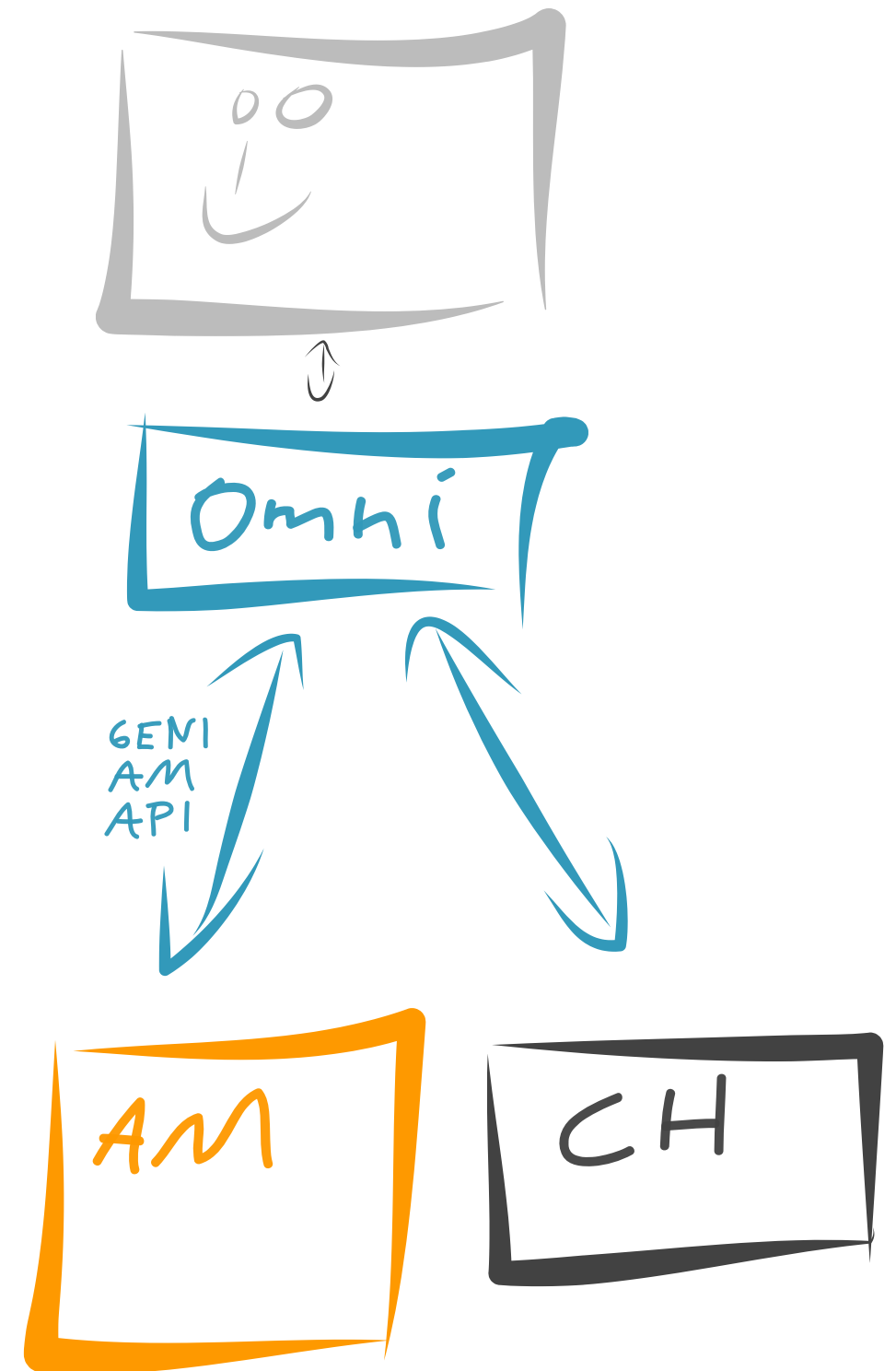
communication

- The Clearinghouse provides services to know who you are and what you may do.

(we don't care, just use it)

- The client speaks the GENI AM API to the AM.

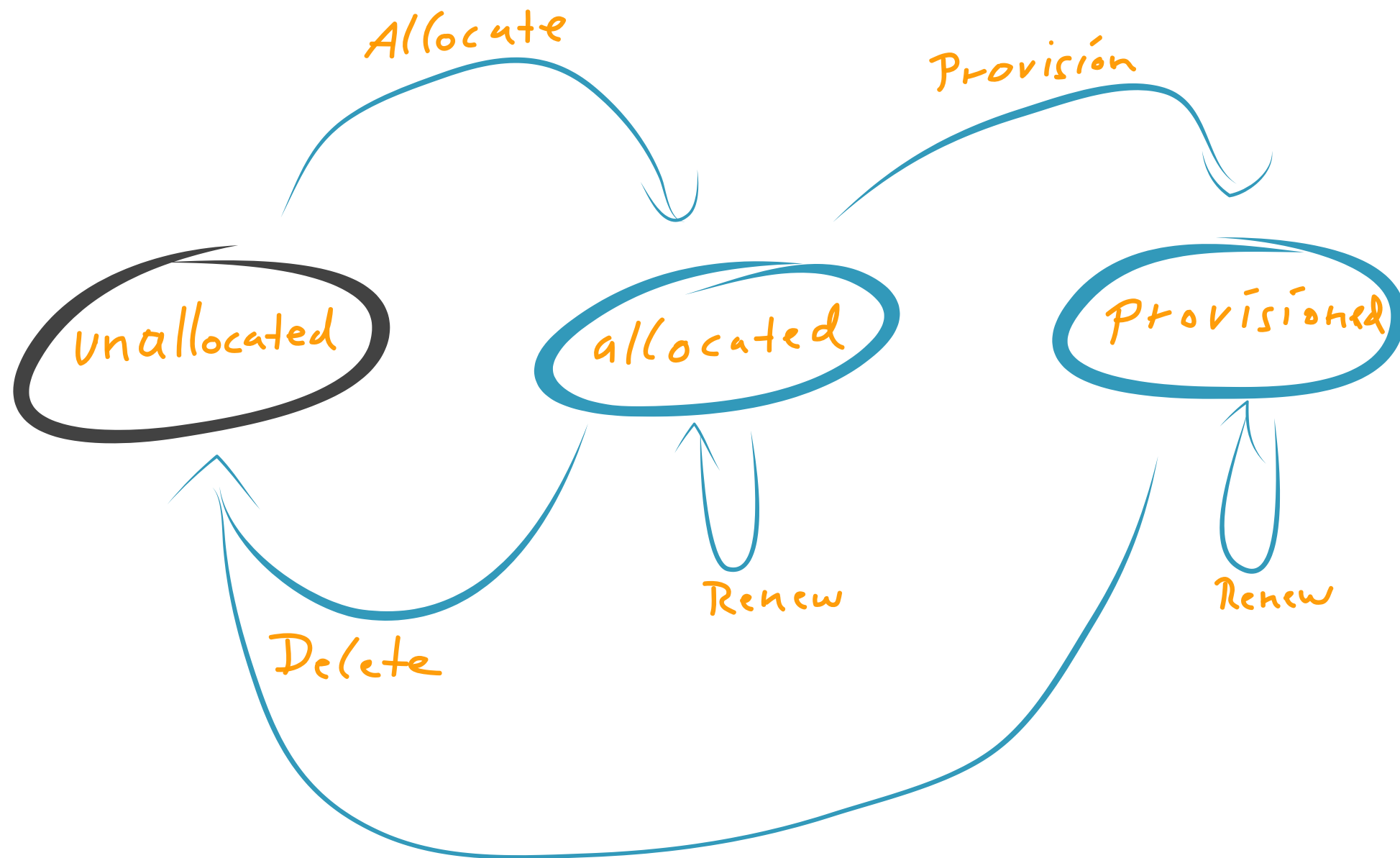
(we care, because we implement it)



what can the API do?

<code>GetVersion</code>	Get info about the AM's
<code>ListResources</code>	Info what the AM has to offer
<code>Describe</code>	Info for a sliver
<code>Allocate</code>	Reserve a slice/sliver for a short time
<code>Renew</code>	Extend the usage of a slice/sliver
<code>Provision</code>	Provision a reservation for a longer time
<code>Status</code>	Get the status of a sliver
<code>PerformOperationalAction</code>	Change the operational state of a sliver
<code>Delete</code>	Remove a slice/sliver
<code>Shutdown</code>	Emergency stop a slice

allocate *and* provision?



allocated only for a short time resources are only booked not provisioned
provisioned the slice/sliver actually takes up resources (is actually usable)

typical experiment

Imagine online shopping.

- **ListResources**

See what's available and browse through.

- **Allocate**

Put it in the virtual shopping cart (the cart is automatically emptied after an hour).

- **Provision**

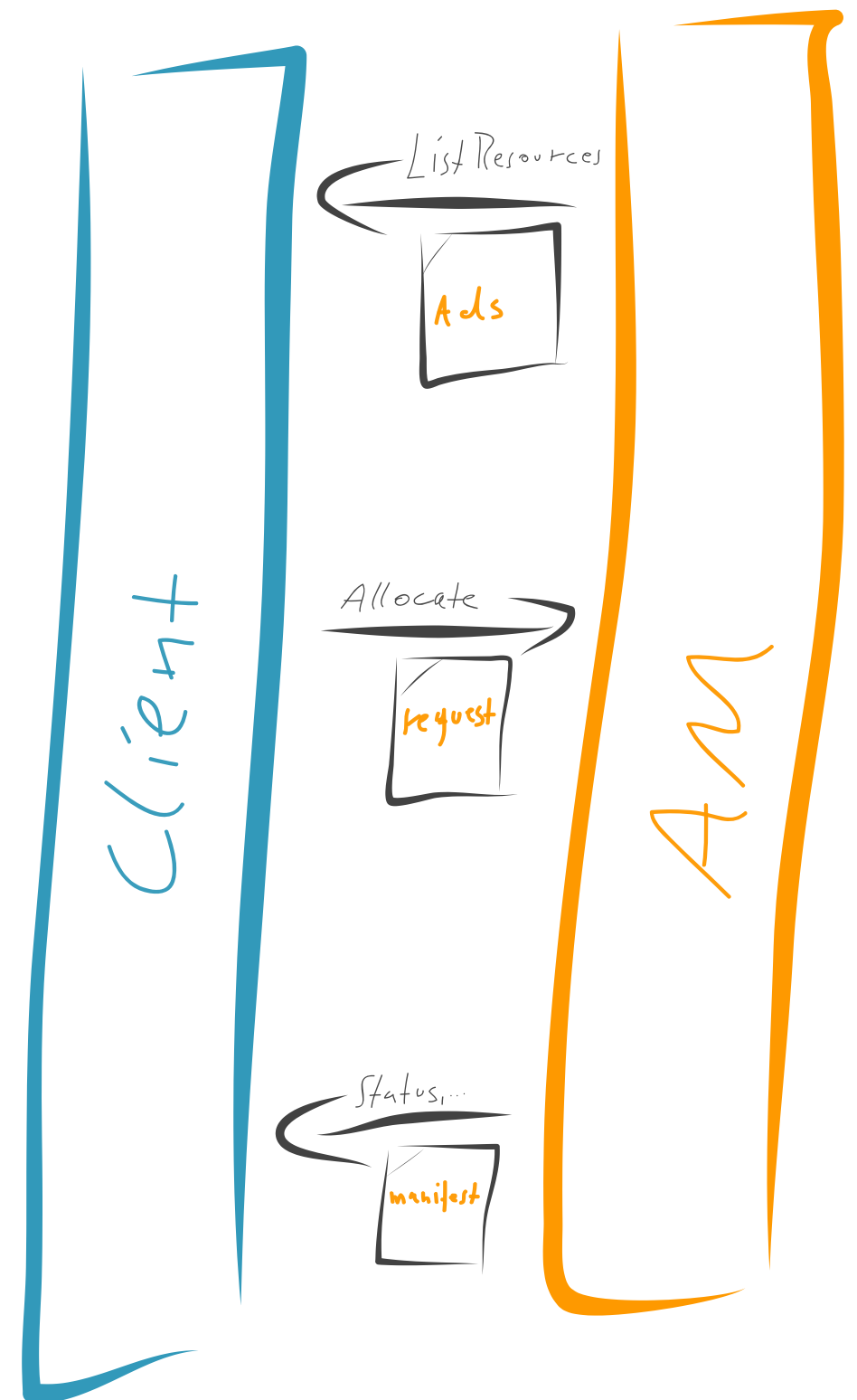
Go to the checkout and buy the item (and own it for a long time).

how do say what I want?

The resources are described with an XML document called RSpec.

There are three RSpec types:

- **Advertisement** *(short: ads)*
Announces which resources/slivers are available.
- **Request**
Specifies the wishes of the experimenter
- **Manifest**
Shows the status of a sliver



enough theory!

Now we know what plugins are and how GENI works.

Let's put it together and write an AM.

getting the requests

- **RPC Handler**

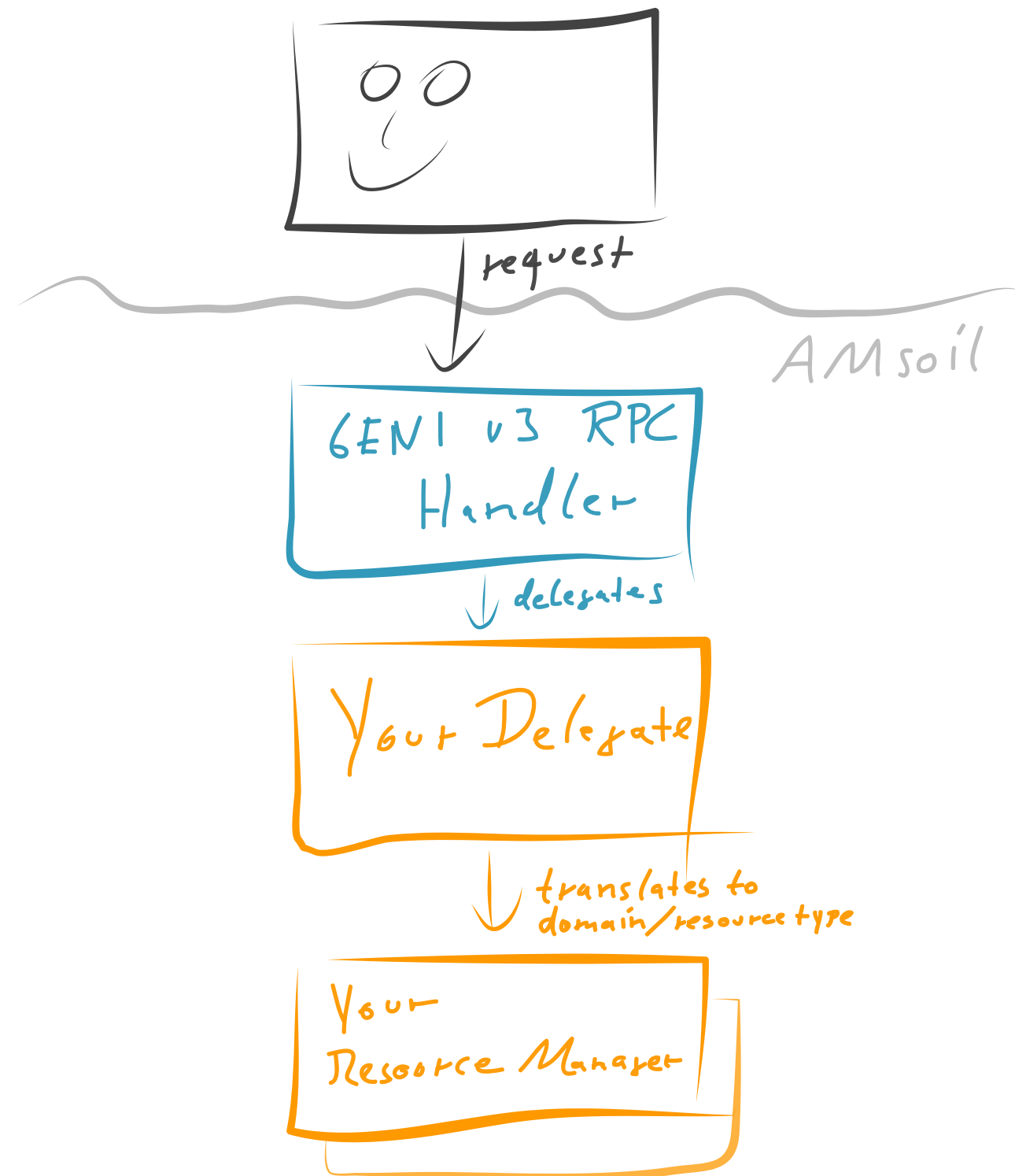
Retrieves the XML-RPC request, does some magic and passes the request on to the delegate.

- **Delegate**

Translates the GENI request into a language the Resource Manager can understand

- **Resource Manager** (short: RM)

Handles the actual allocation of the resources.



why RM *and* Delegate?



We need to **decouple** the RPC API from the resource management logic.

This enables AMsoil-based AMs to implement **multiple APIs** (e.g. GENI, SFA, OFELIA APIs) without having to re-write everything.

interfaces

- **Delegate**

Should derive from DelegateBase and overwrite the methods prescribed (e.g. list_resources, allocate, ...).

- **Resource Manager**

You make up the interface!

The methods, attributes, parameters are domain-specific and depend on the resource type being handled.

a new plugin is born

Create new plugins which handle the incoming requests from the client and do the actual resource management.

YourDelegate

- ✓ New folder for plugin
- ✓ manifest.json
- ✓ plugin.py
- ✓ a delegate object

YourResourceManager

- ✓ New folder for plugin
- ✓ manifest.json
- ✓ plugin.py
- ✓ a manager service

YourDelegate

yourdelegate/plugin.py

```
# ...imports...
GENIv3DelegateBase = pm.getService('geniv3delegatebase')
geni_ex = pm.getService('geniv3exceptions')

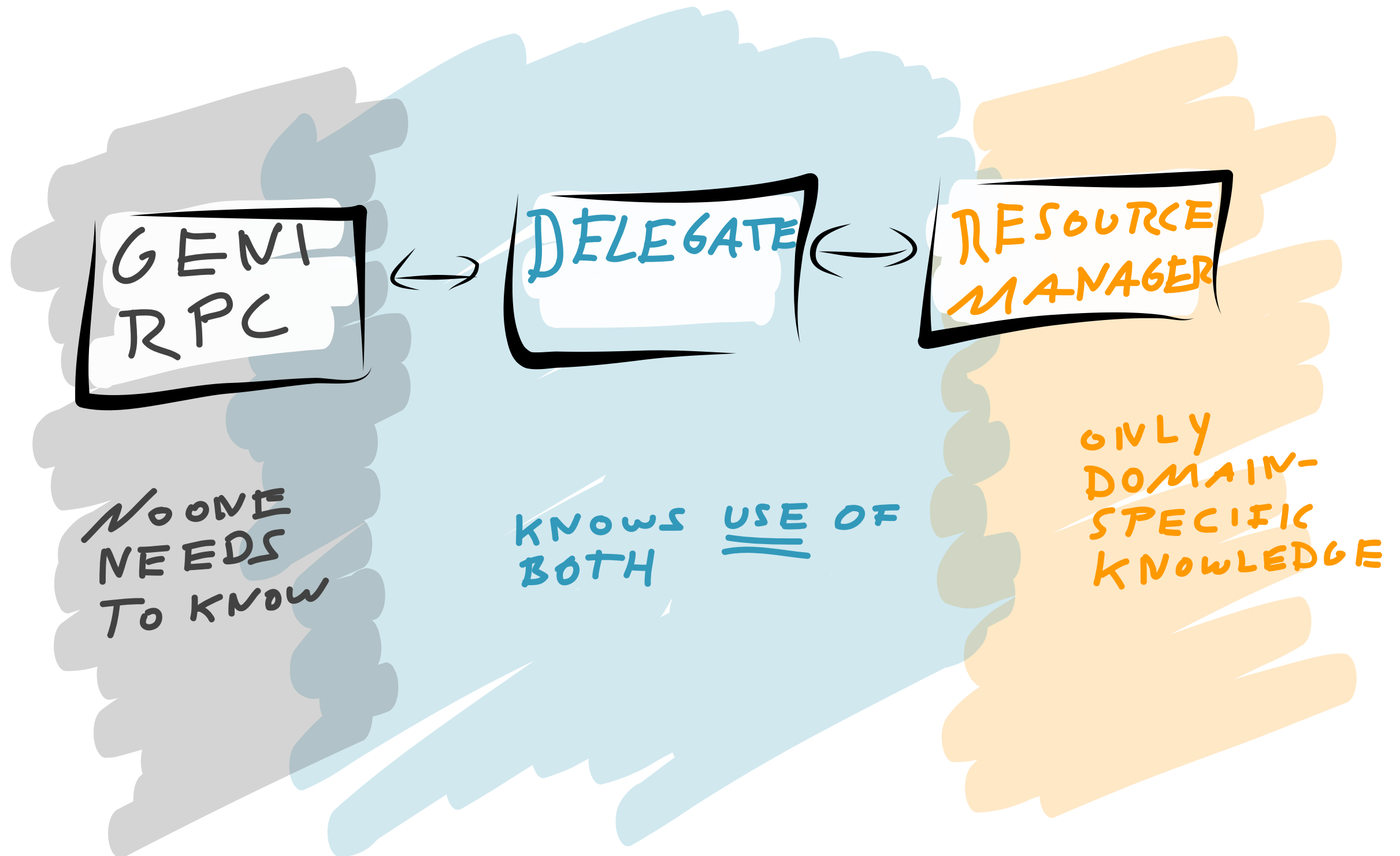
class MyDelegate(GENIv3DelegateBase): # derive from DelegateBase
    # ...
    def allocate(self, slice_urn, client_cert, credentials, rspec, end_time=None): # Overwrite DelegateBase method
        # perform authentication and check the privileges
        client_urn, client_uuid, client_email = self.auth(client_cert, credentials, slice_urn, ('createsliver',))

        rspec = self.lxml_parse_rspec(rspec) # call a helper method to parse the RSpec (incl. validation)
        # ...interpret the RSpec XML...
        try:
            # call a resource manager and make the allocation happen
            self._resource_manager.reserve_lease(id_from_rspec, slice_urn, client_uuid, client_email, end_time)
        except myresource.MyResourceNotFound as e: # translate the resource manager exceptions to GENI exceptions
            raise geni_ex.GENIv3SearchFailedError("The desired my_resource(s) could not be found.")

        return self.lxml_to_string("<xml>omitted</xml>"), {'status' : '...omitted...'} # return the required results

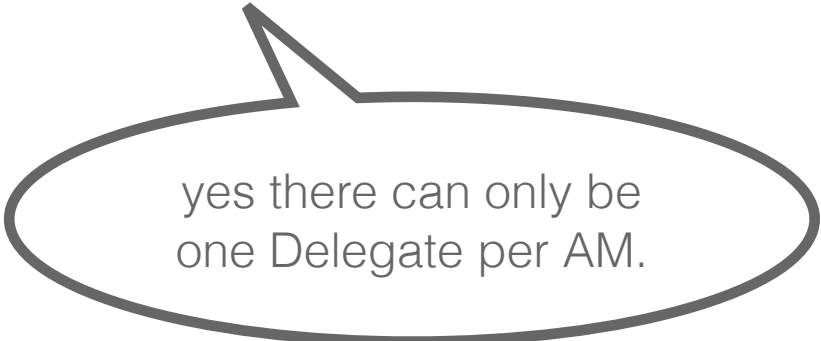
def setup():
    delegate = MyGENI3Delegate()
    handler = pm.getService('geniv3handler')
    handler.setDelegate(delegate)
```

needed knowledge



Delegate tasks

- Translate GENI API into Resource Manager(s) methods
- Translate the RSpecs into Resource Manager values (and back).
- Catch Resource Manager errors and re-throw as GENIv3....
- Translate the namespace from GENI to RM (e.g. URN ↔ UUIDs).
- Specify the needed privileges for authorization.
- De-multiplex to dispatch to different Resource Managers
(if you have multiple resource types in one AM).



yes there can only be one Delegate per AM.

RM tasks

- Instantiate resources
- Manage persistence of reservations and resource state
- Check policies
- Avoid collisions of resources reservations /
Manage availability
- Throw domain-specific errors

more info

- Please see the [wiki](#) for
 - Authentication / Authorization tools
 - RSpec generation assistance
 - More detailed description
- Checkout the code and look at the DHCP AM example
 - `plugin: dhcprm`
 - `plugin: dhcpgeni3`
 - API description of `geniv3rpc`

hands on tips

Let's see how we can make our life even easier.

testing

- ✓ Fire up the Clearinghouse
- ✓ Start the AMsoil server
- ✓ Run omni to send a request
 - ✓ Check AMsoil's logs

```
gcf#      python src/gcf-ch.py
amsoil#    python src/main.py
amsoil#    tail -f log/amsoil.log
gcf#      python src/omni.py -o -a https://localhost:8001 -V 3 getversion
```


development mode

- Use the configuration tool to set `flask.debug = True`
 - Now the server [reloads its files every time](#) you change a file.

!! Careful: The client's certificate is now read from a pre-configured file.
- For debugging
 - Throw exceptions or
 - Write to the log to see what's going on.

logging

anywhere.py

```
import amsoil.core.log
logger=amsoil.core.log.getLogger('pluginname')
# logger is a decorated instance of Python's logging.Logger, so we only get one instance per name.

def somemethod():
    logger.info("doing really cool stuff...")
    logger.warn("Oh Oh...")
    logger.error("Ba-Boooom!!!")
```

configuration

anywhere.py

```
import amsoil.core.pluginmanager as pm
config = pm.getService("config")      # get the service
myvalue = config.get("mygroup.mykey") # retrieve a value
config.set("mygroup.mykey", myvalue)  # set a value
```

plugin.py

```
import amsoil.core.pluginmanager as pm
def setup():
    config = pm.getService("config") # get the service
    config.install("mygroup.mykey", "somedefault", "Some super description.") # install a config item
```



Always install the config keys and defaults on the plugin's setup method (install will not re-create/overwrite existing entries).

worker

The worker enables dispatching jobs to an external process (e.g. to perform longer tasks without blocking the client's request response).

anywhere.py

```
worker = pm.getService('worker') # get the service
worker.add("myservice", "mymethod", "parameter1") # run as soon as possible
worker.addAsRecurring("myservice", "mymethod", [1,2,3], 60) # run every minute
worker.addAsScheduled("myservice", "mymethod", None, datetime.now() + timedelta(0, 60*60*2)) # run in 2 hours
```

fire up the server (needs reboot when changing code)

```
amsoil# python src/main.py --worker
```

persistence

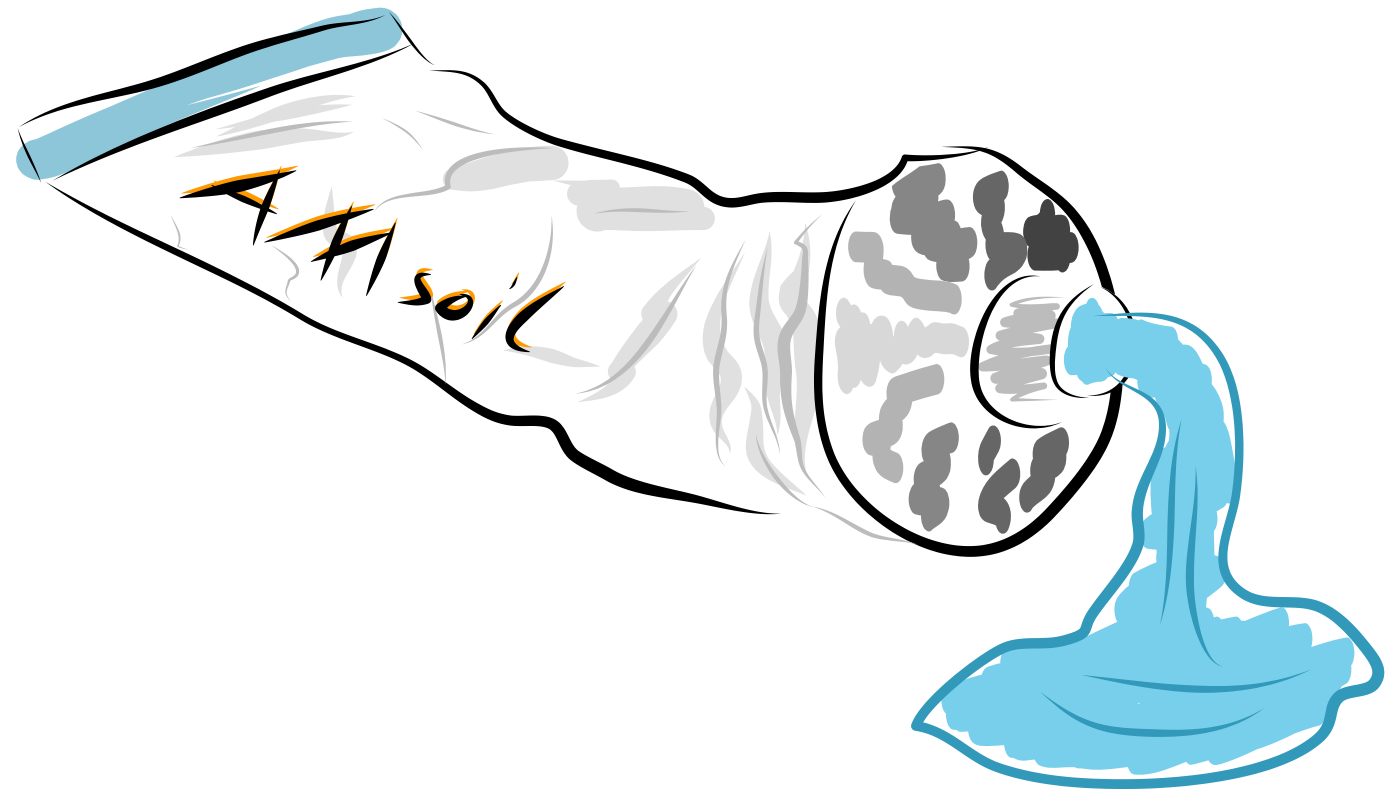
SQLAlchemy tutorial
7900 words

VS.

Need to know
926 words



you know it all



clone the repository

🔗 <https://github.com/fp7-ofelia/AMsoil.git>

then **read** the wiki

🔗 <https://github.com/fp7-ofelia/AMsoil/wiki>