

# Future Internet in Smart Grid Communications

## FINESCE WP5 Stream II

Ramon Martín de Pozuelo, FUNITEC – La Salle  
[ramonmdp@salleurl.edu](mailto:ramonmdp@salleurl.edu)

# Outline

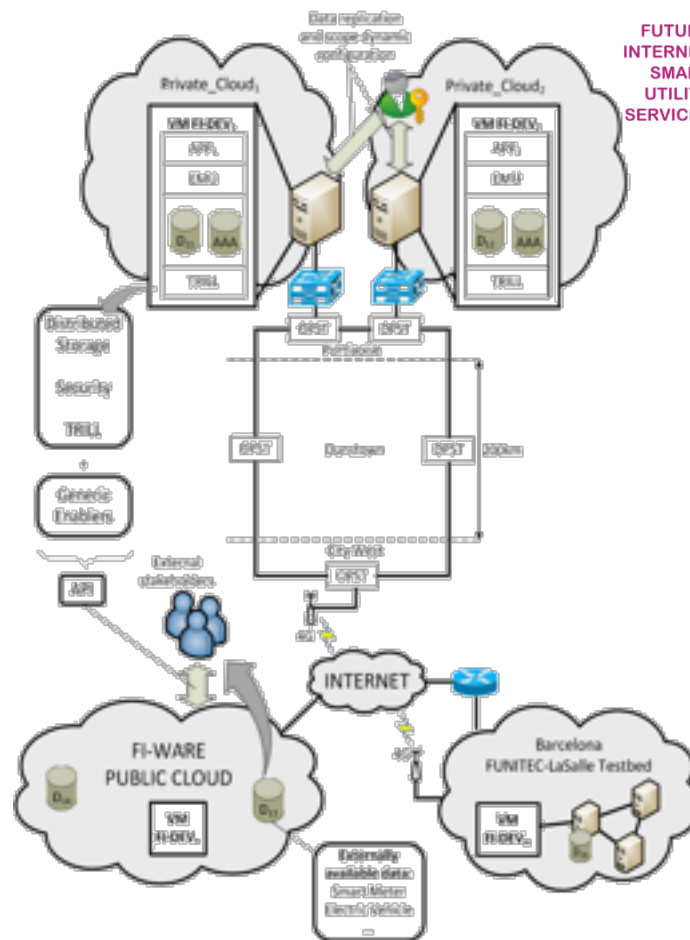
FUTURE  
INTERNET  
SMART  
UTILITY  
SERVICES

FINESCE

- Scenario
- Objectives
- GE Analysis
- GE Evaluation
- GE Integration
- DSE and API
- Final trial demonstrator
- Conclusions

# Scenario

- Hybrid Cloud Data Storage and Management Platform for power utilities.
- Flexible interoperation of the data storage services provided by:
  - Public Cloud: FIWARE Lab Object Storage
  - Private Cloud: Distributed Smart Grid Cloud storage system, based on the interconnected FIDEVs (evolution from FP7 INTEGRIS machines)



# Objectives

## Security

- Usage of GEs for assessing security and privacy on data storage and management by utilities.
- Knowledge of the performance of the Security GEs in critical infrastructures.

## Data Storage

- Dynamic data management of electric applications from utilities and third parties based on a Public-Private Cloud infrastructure



### Security

Identity Management  
Keyrock GE

### Cloud Hosting

Object Storage GE

# GE Analysis

Name of the GE	Usage
<b>Object Storage</b>	Facilitates the integration between private (FIDEVs' distributed storage system) and public (FIWARE Lab based) storage.
<b>Identity Management Keyrock</b>	Privacy-preserving attribute-based credentials (anonymous credentials) for authentication with accountability. Utility managers and external SME authentication to Hybrid Cloud infrastructure through RESTful API.

# GE Analysis

## Identity Management Keyrock GE

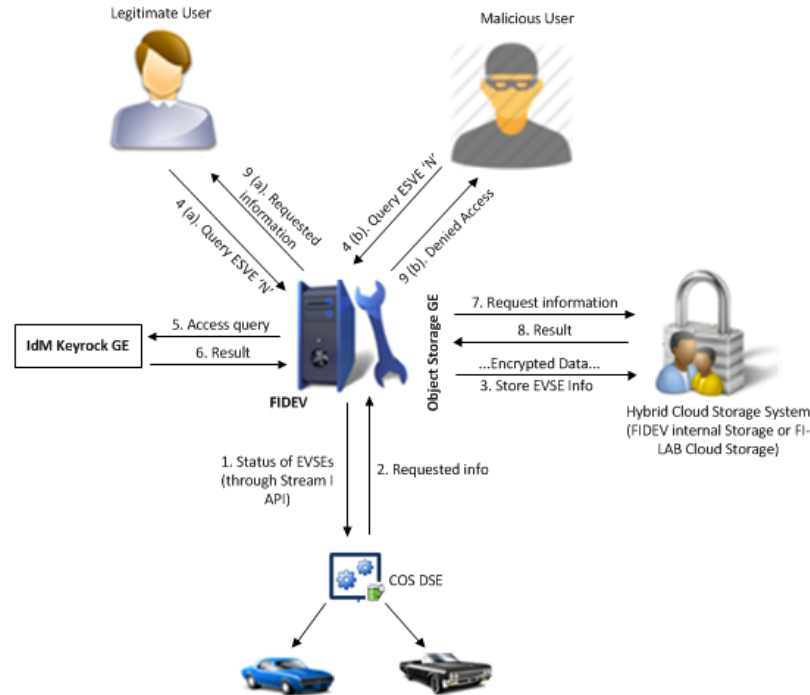
- The IdM Keyrock GE provides suitable documentation regarding the integration and usage of the GE.
- The GE source has been downloaded, deployed and tested locally.
- Although a local instance was deployed successfully and tested, the final trial only requires the interaction with FIWARE Lab instance.

# GE Analysis

## Object Storage GE

- The OS GE provides suitable documentation regarding the integration and usage of the GE.
- The GE supports features very likely to be integrated in Stream II, such as the selection of containers for the integration of different storage systems (FIDEV internal storage and external storage).
- Multiple authentication and authorization systems are supported (Tempauth, Keystone, IdM Keyrock)
- Security integration with IdM. Security can rely on the authentication system that uses Swift.

# GE Evaluation

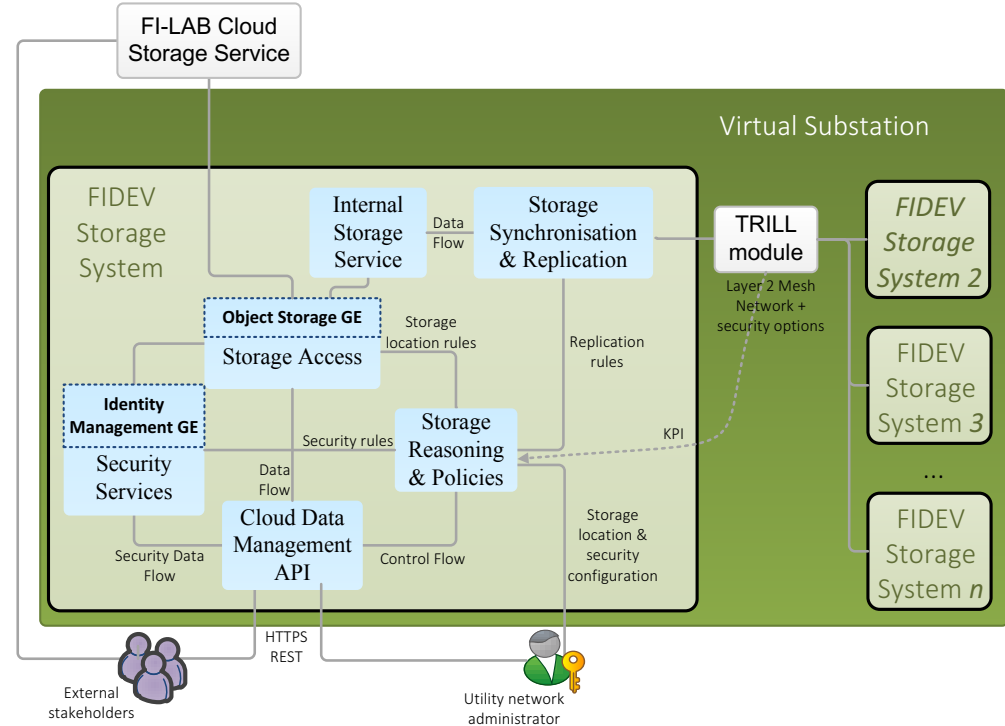




# GE Integration

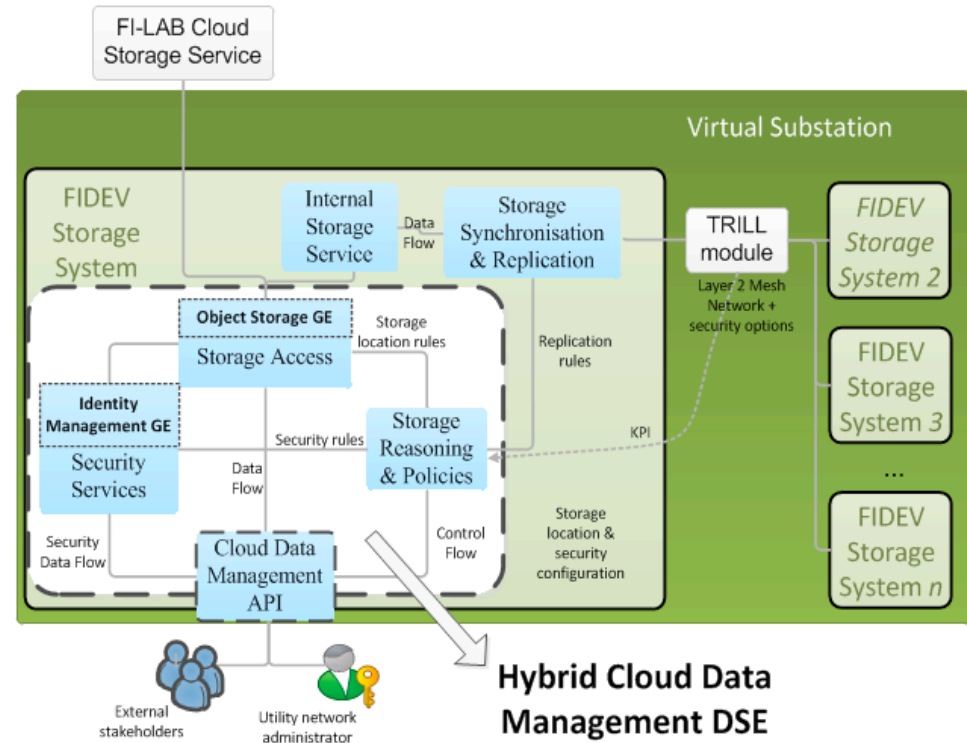
## FIDEV: Update of IDEV machines from FP7 INTEGRIS:

- Empower IDEVs' Distributed Storage and Security subsystems using the selected GEs.
- Object Storage GE provides robust, scalable object storage functionality through the open, standardised interface CDMI.
- Identity Management Keyrock GE will be combined with OS GE for secure user access and management, providing centralized authentication through FIWARE Lab service.



# Hybrid Cloud Data Management (HCDM) DSE

- A component for the "Software Define Utility": to provide transparent access to the Hybrid Cloud infrastructure for the data management.
- It combines and integrates functionalities from Object Storage GE local and FIWARE Lab instances.
- It authenticates through Identity Management Keyrock GE;
- It can encrypt/decrypt stored objects using atREST solution of OpenStack Swift.
- Access through a RESTful API.



**Hybrid Cloud Data Management DSE**

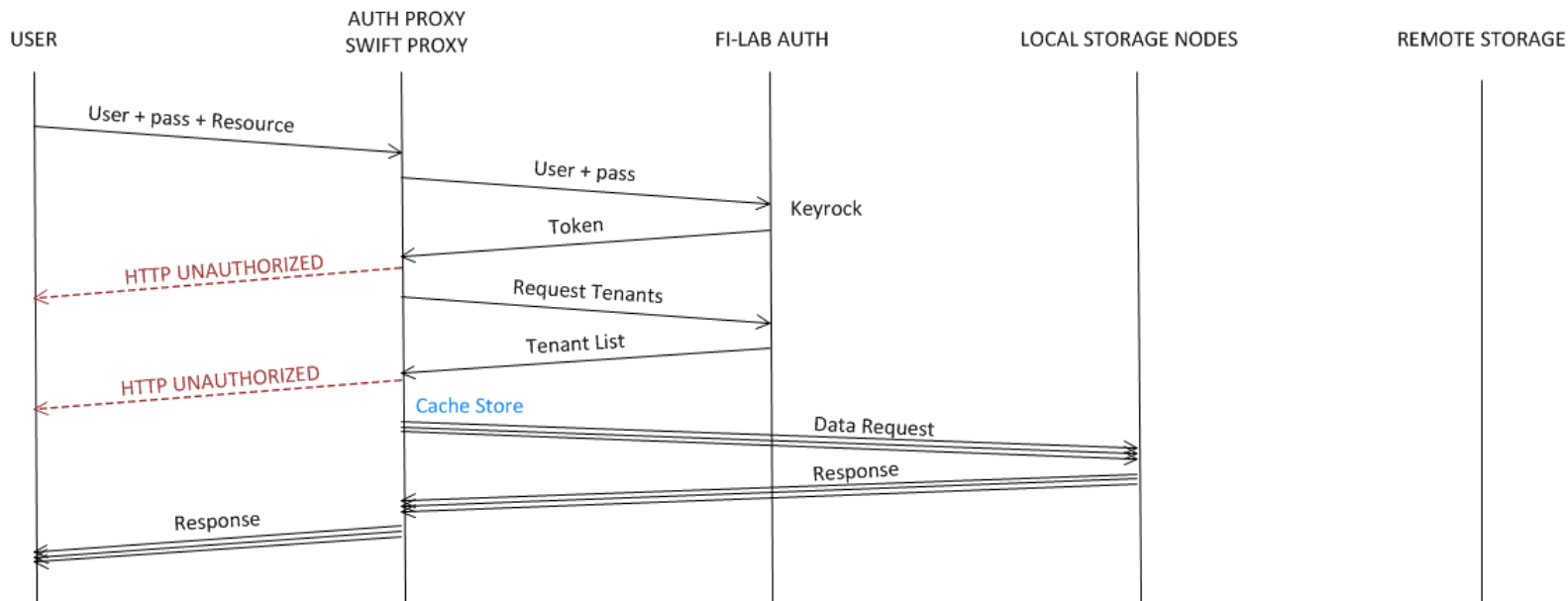
## HCDM API

- **Authenticate**
- **List**
- **Create**
- **Delete**
- **Download**
- **Upload**
- **Others**

[illegible]

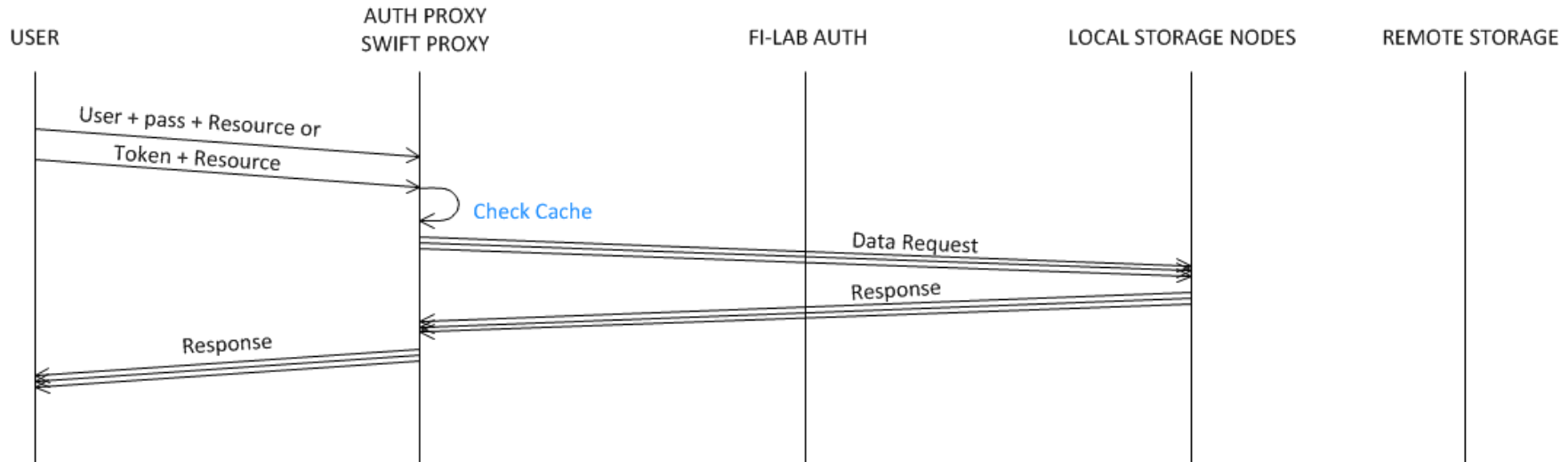
# HCDM API

- Authentication process:



# HCDM API

- Simplified authentication (memcache server):



# HCDM API

- Authentication function:

```
# authenticates via HTTPS
function authenticateHTTPS {
    # Authenticate HTTPS
    response=`curl -k --silent -X GET
"https://$host:$portHTTPS/api/authenticate?username=$username&password=$password"` >/dev/null
token=`echo $response | awk -F ":" '{print $2}' | awk -F '"' '{print$2}'`
auth=`echo $response | awk -F ":" '{print $6}' | awk -F '"' '{print$2}'`
if [ -z $token ]; then echoError "Error Authenticating"; end 1; fi
if [ -z $auth ]; then echoError "Error Authenticating"; end 1; fi
echoOk "Authentication successful via HTTPS"
ok=$((ok+1))
}
```

- Authentication response:

```
{"items":["esb\/","finesce\/","firstContainer\/","funitec\/","incense\/"]}
{"items":["home\/"]}
```

# HCDM API

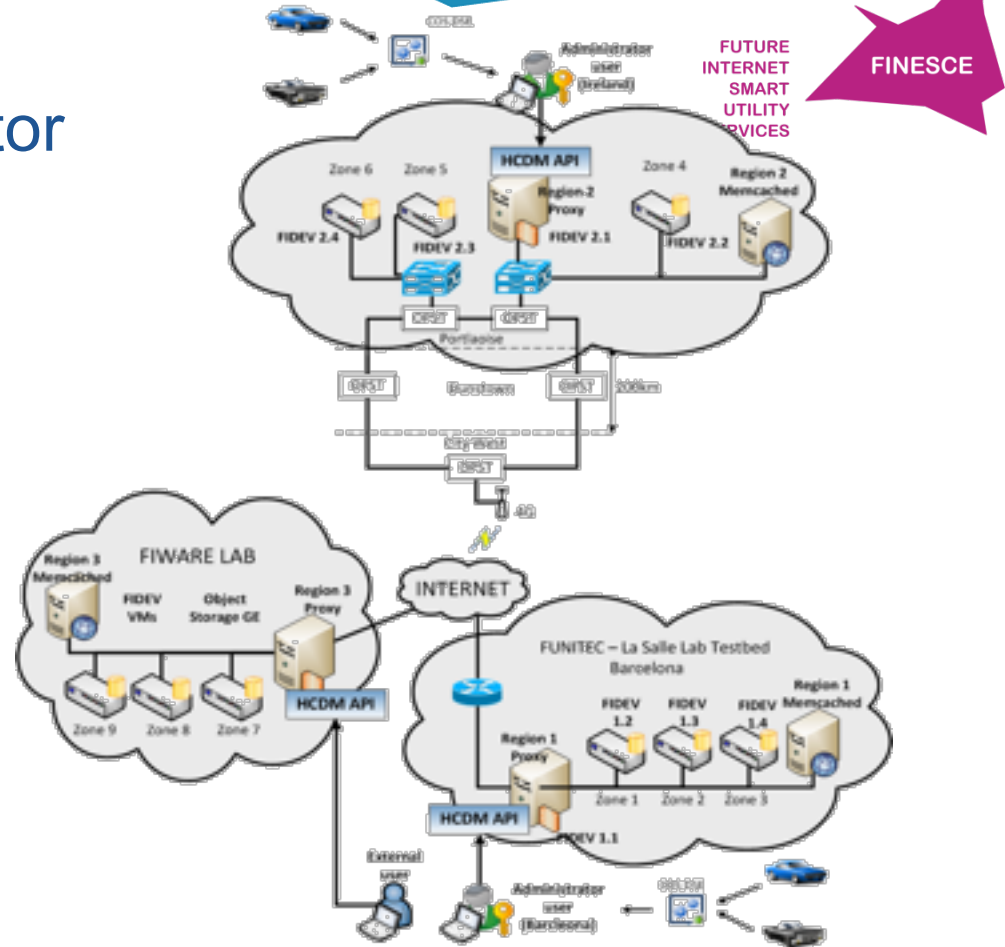
FUTURE  
INTERNET  
SMART  
UTILITY  
SERVICES

FINESCE

NAME	LIST		
METHOD	GET/POST/PUT/PATCH/DELETE		
URL	/api/list		
PARAMETERS	token	Required	string
	auth	Required	string
	host	Optional	IP or hostname
	container	Optional	If not set, the / is used
RESPONSE	Encoding	JSON	
	CODE	201	{"status": "ok"} (created)
		400	Bad Request. Parameters are incorrect
		401	Token or Auth incorrect
		404	Not Found. The container trying to list doesn't exist
		500	INTERNAL ERROR
TYPICAL RESPONSE		504	Gateway Timeout (provably using a wrong host)
	<pre>{   "items": [     "api/", "cdmiAPI_CONTAINER/", "cookies/", "cookies2/", "cookies3/", "demoA/", "demoB/", "demoC/", "demoU/", "demoV/", "demoW/", "demoX/",     "demoY/", "demoZ/", "home/"   ] }</pre>		

# Stream II Trial demonstrator

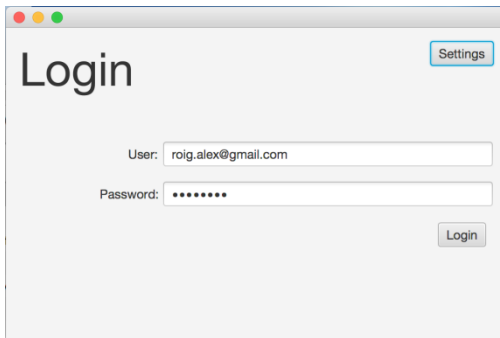
- FIDEVs' integration and interconnection in three sites (Barcelona, Ireland, FIWARE Lab).
- Each region:
  - Proxy: Endpoint for HCDM API + storage.
  - 3 storage nodes emulating different replication zones.
- Test using data from Electric Vehicle charging points.
- Manager users (from ESB or FUNITEC) and external users to public containers.





# Stream II Trial demonstrator

Front-end Hybrid Cloud Manager → Using HCDMAPI



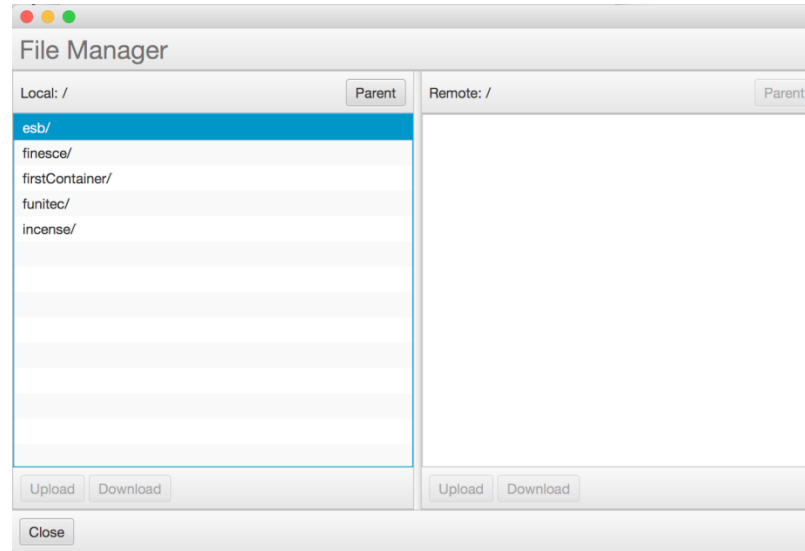
Login

Settings

User:

Password:

Login



File Manager

Local: / Parent

Remote: / Parent

esb/

finesce/

firstContainer/

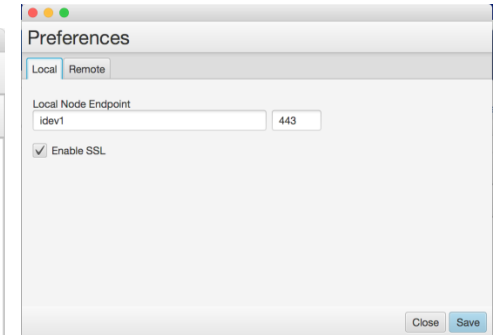
funitec/

incense/

Upload Download

Upload Download

Close



Preferences

Local Remote

Local Node Endpoint

idev1 443

☒ Enable SSL

Close Save

# Conclusions

- GE used (Identity Management Keyrock and Object Storage) provide the functionalities required. After an in-depth security analysis, there are still some improvements to be made in order to be used in real critical infrastructures, but they represent a good opportunity to speed up service deployment with standard security requirements.
- HCDM DSE represents a good example of the combination of GEs in order to create a flexible service using open source software that is already available. It can help to other stakeholders (such as SMEs) to learn how to use GEs and assess the benefits of the FIWARE ecosystem.
- Issues have arisen during the evolution of the project, but both GEs used have reached a level of stability and maturity that allows to rely on them for long-term services and solutions.

# Future Internet in Smart Grid Communications

## FINESCE WP5 Stream II

Ramon Martín de Pozuelo, FUNITEC – La Salle  
[ramonmdp@salleurl.edu](mailto:ramonmdp@salleurl.edu)