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Abstract

This report is the accompanying document for deliverable *D5.2 HUBCAP Collaboration Platform Version 1*. The deliverable itself is the platform released at Month 12 (therefore of type ‘Other’) and deployed as an online tool available at <https://hubcap-portal.eng.it/>. Therefore, this document aims to provide an overview of the results and artefacts making the deliverable and highlighting the main features, with a focus on the updates since the previous version (prototype version as reported in D5.1). In particular this report provides the description of the platform, also detailing the baseline needs, principles and design choices behind this version of the Platform, along with a description of the services offered and the actual ways users can utilise them.

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Introduction

This document describes the HUBCAP Collaboration Platform developed in the scope of the HUBCAP project that fosters the collaboration among HUBCAP DIHs using modern IT solutions and methodologies developed in previous innovation initiatives as the core on top of which specific customizations (environment, catalogue and user journeys).

Starting from the prototype, deployed as an online tool at Month 6 (Deliverable D5.1), several experiments have been carried out on the available results from WP3 and WP6 and a specification process of the resulting requirements have guided the design of this first release of the Platform.

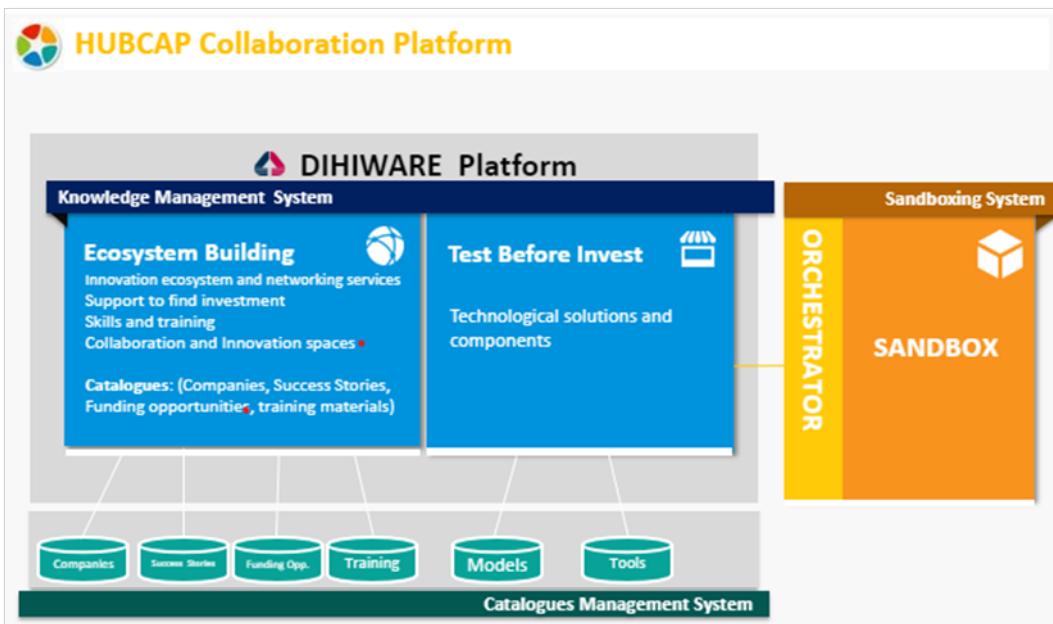


Figure 1 HUBCAP Platform architecture

Figure 1 summarizes the architecture of the HUBCAP platform. In **Section 2** we summarize the main elements and features of the **DIHIWARE platform** which provides both the Knowledge Management System and the Catalogues Management System. In **Section 3** we provide a description of the **Sandboxing Middleware**. Additionally, for this v1 release, an updated platform User Manual as well as the detailed User Guide for the Sandboxing Middleware Manager are provided as Annexes.

DIHIWARE Platform

Composed by the Knowledge Management System (KMS) and Catalogues Management System (CMS) sub-systems, the DIHIWARE Platform enables open collaboration, online community building and management as well as access to knowledge.

The DIHIWARE knowledge management capabilities, integrated in a collaborative oriented platform can build a new environment capable of giving rise to a Network of DIHs and SMEs fostering the interaction among hubs, information exchange and peer-learning.

The DIHIWARE platform can give to DIHs the possibility to become trusted advisors in their relationship with consumers becoming a vibrant link between consumers and providers, in exploring new opportunities, observing new trends within the industry and beyond, as well as seeing patterns between multiple sectors as well as across industries.

Secondly, the platform can provide SMEs with unprecedented opportunities to work directly with all key players in a highly secure environment and significantly increase their opportunities in maximizing their role as innovators.

The DIHIWARE Catalogue Management System could give the possibility to create a federation of catalogues enabling the birth of the one-stop-shop marketplace that is a central portal, used to provide access to all the solutions (models and tools) provided by internal and external SMEs, and also to services provided within the HUBCAP ecosystem of DIHs.

The DIHIWARE modular approach and its customization capabilities enable the customization (environment customization, catalogue designing and dedicated user journey for digital transformation) of a specific HUBCAP tailored environment, based on some of the DIHIWARE modules and in line with the project needs and requirements.

DIHIWARE is built to align objectives, and resources with the community requirements. This is why during those first project months effort has been put to try to find the right way to make DIHIWARE the environment suitable to be filled with the HUBCAP solutions and services creating a relationship between HUBCAP services and solution providers and IT platform provider to design and implement a good customization of the virtual environment.

The result of this work has led to have:

- The HUBCAP workspace structure consistent with the HUBCAP purpose.

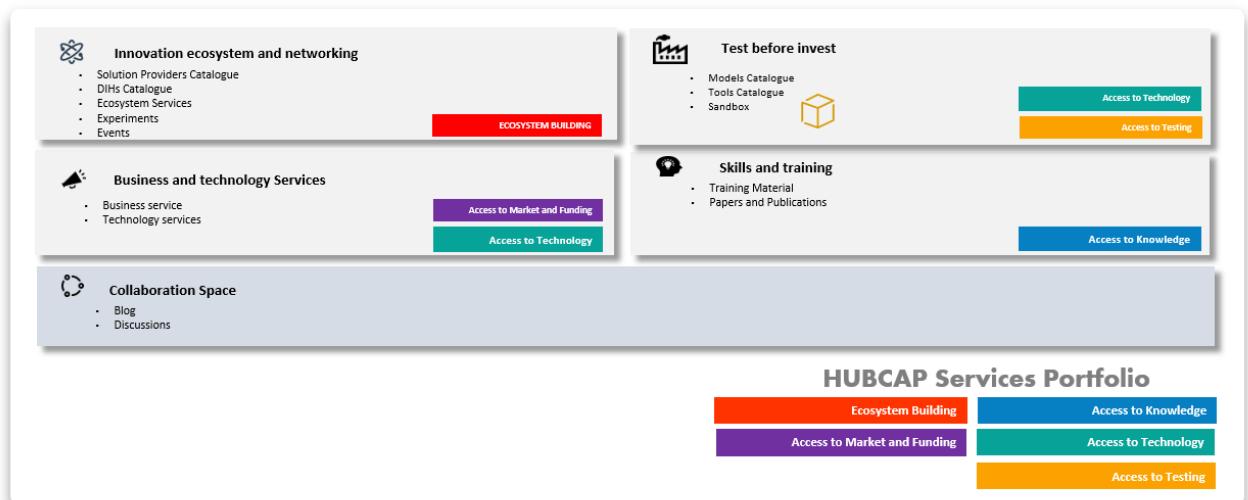


Figure 2 HUBCAP Workspace structure

- The catalogues implemented within the DIHIWARE, in line with the HUBCAP Ecosystem offer. A detailed structure of such catalogues is provided in specific tables as Annex III.



Figure 3 HUBCAP Offer and DIHIWARE Catalogues

- The Entry form of each entity, in line with the key details of the real entities (companies, models, tools ...) that populate the catalogues.

Integration between the DIHIWARE Platform and the Sandboxing Middleware

In this v1 release, two initial forms of integration between DIHIWARE and Sandboxing Middleware have been implemented. Firstly, the Sandboxing Middleware can be

accessed only from the DIHIWARE Platform, that makes authentication stronger (**two-factor authentication**). In fact, a user **already authenticated in DIHIWARE**, clicking the following button in Figure 4 from the DIHIWARE welcome page, will receive to his private e-mail a **sandbox temporary password** to access the Sandboxing Middleware front-end using the Apache Basic Authentication.

Secondly, with respect to the prototype, the Sandbox the WEB GUI has been updated and seamlessly harmonised with the DIHIWARE's one.

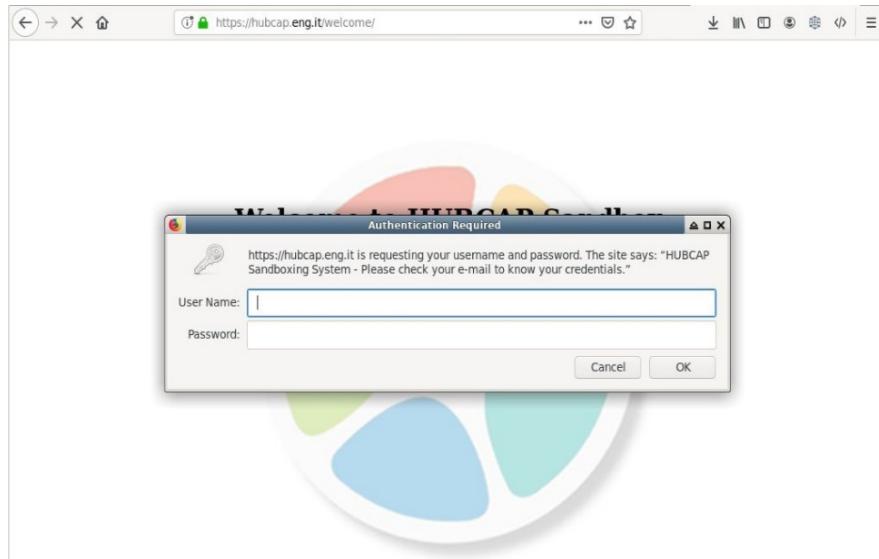


Figure 4 Access to the Sandboxing Middleware is granted through Apache Basic Authentication

Sandboxing Middleware

Introduction

The **Sandboxing Middleware** provides an environment where several sandboxes can be executed concurrently, safely, independently from each other and protected from the external world.

Figure 5 – The Sandboxing Middleware Homepage

A **sandbox instance (a Sandbox)** is a set of virtual machines (VMs) connected through a dedicated and isolated network (*Sandbox Isolated Network*) through which they can interact with each other and also access to a dedicated, private, and shared storage (*Sandbox Shared Storage*) where data - grouped in *directories* - are stored.

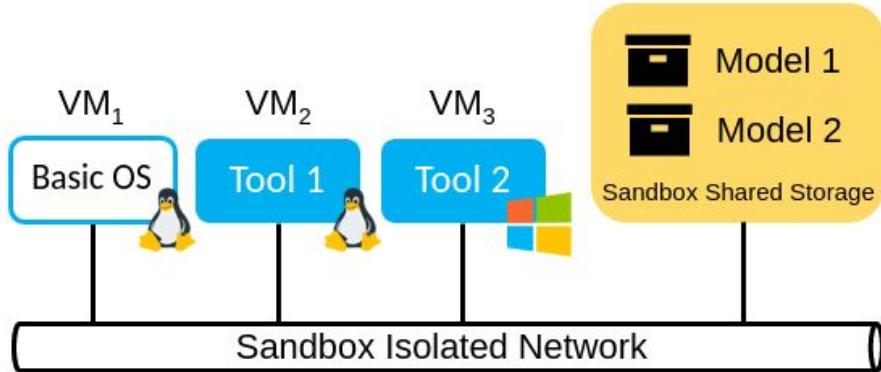


Figure 6 - A Sandbox with a basic OS and two Tools. On the right the Sandbox Shared Storage.

A **VM** can either contain a basic, ready-to-use **Operating System** (Linux or Windows) or one of such OSes previously customized by installing on it a **CPS Tool**.

A Sandbox Shared Storage **directory** contains an arbitrary set of sub-directories and files constituting – in general but not only – a **Model** provided to the Sandbox Tools. Distinct instances of the same *Operating System*, *Tool*, *Model* can be used simultaneously in many distinct Sandboxes. These entities are selected by the end-user - at a new Sandbox creation time - accessing the specific repository from the dedicated Web GUI section:



Figure 7 - Repositories available in the Sandboxing Middleware

Functionalities: experimentation and provisioning

In this release the two main functionalities offered by the Sandboxing Middleware, Experimentation and Provisioning, have been refined making the Web GUI navigation more fluid and fixing a few code bugs.

Experimentation

The experimentation phase is central to the Test-Before-Invest activity. In this phase, the consumer end-users interact with the Sandboxing Middleware to compose a new Sandbox by selecting the set of Tools and Models needed for the evaluation experiments. Tools and Models can be chosen from the repositories shown in Figure 8. Once ready, the Sandbox can be instantiated (Figure 9) by clicking on “Start new Sandbox”.

The screenshot shows the 'Tools' repository page. The left sidebar has a 'TOOLS' section with 'Operating Systems', 'Tools' (selected), and 'Models'. The main area is titled 'Tools' and lists three items in a table:

Name	Actions
Workcraft	Add to sandbox
IntoCPS_Ubu18_Wine_Empty	Add to sandbox
IntoCPS_Tut1_Win10	Add to sandbox

Figure 8 - Tools Repository

The screenshot shows the HUBCAP homepage. The left sidebar has a 'Sandbox Repositories' section with 'Operating Systems', 'Tools' (selected), and 'Models'. The main area has two sections: 'New Sandbox Items' and 'Ready-to-access Sandboxes'.

New Sandbox Items:

Name	Catalogue
Workcraft	Tools
IntoCPS_Ubu18_Wine_Empty	Tools

Ready-to-access Sandboxes:

You are owner of
Nothing

You are guest of
Nobody

Figure 9 - Homepage from which repositories can be accessed and sandboxes instantiated

Once the instantiation is complete, the user will be able to interact with the Sandbox Viewer (see Figure 10 below), which is composed of:

- a Tool Viewer (**red box**), to display in a HTML5 page a remote desktop,
- a Control Panel (**green box**), to manage the current Sandbox,
- a Tool Selector (**blue box**), to switch the Tool Viewer among the Sandbox tools.

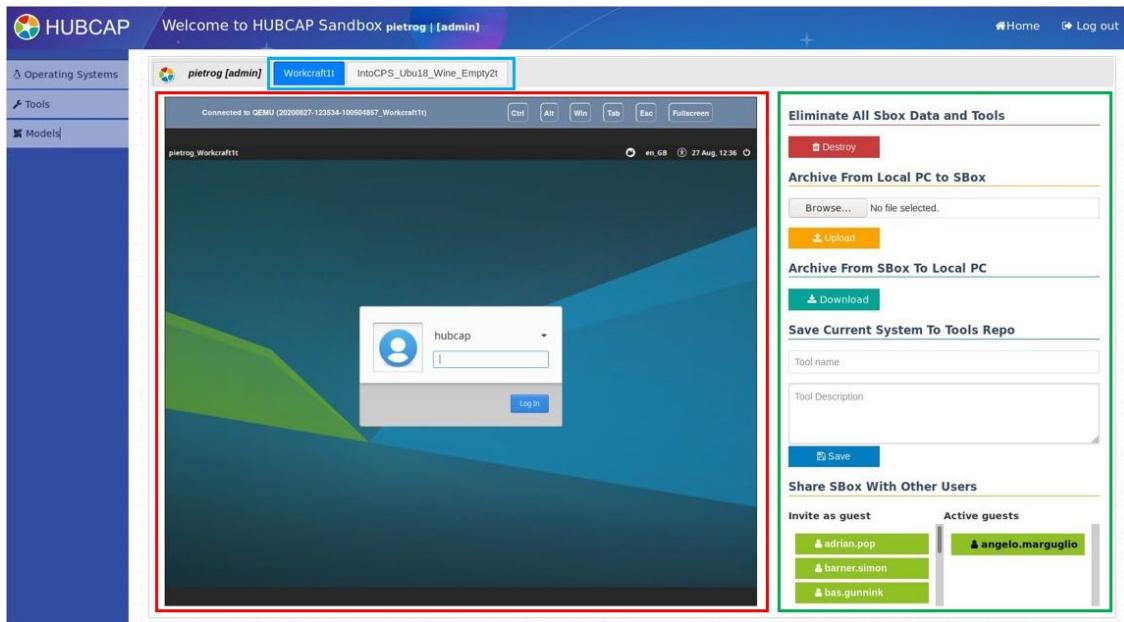


Figure 10 - Sandbox Viewer Web Interface

The Tool Viewer – as well as showing a Tool desktop - features a set of buttons that can be used to send special combinations of keys to the VM or to switch to full screen mode. The user can switch from a Tool to another one within the Sandbox by clicking on the corresponding tab in the Tool Selector.

From the Control Panel, the user can access the following set of features related to Sandbox and/or Tool management:

- “**Destroy Sandbox**” de-allocates permanently all the Sandbox components (Tools, Models, Shared Data, Private Network).
- “**Upload**” transfers a **compressed archive** (containing a populated directory) from the **user’s computer to the Sandbox**, extracting it on the **Sandbox Shared Storage**.
- “**Download**”, after **compressing** a Sandbox Shared Storage **directory** to an **archive**, transfers it to the **user’s computer**. For instance, the downloaded archive could contain the results of an experiment.
- “**Save Current Machine to Tools Repo**” freezes the current VM (as a sort of snapshot) and **stores it** in the Tools Repository. This could be a customized instance either of an *Operating System* or of an existing *Tool*.
- “**Share SBox with Other Users**” allows **other Sandbox Middleware Users** to access and interact simultaneously on the current Sandbox.

Sandbox Shared Storage

As already mentioned, an instantiated Sandbox features a *Sandbox Shared Storage* from where the end-user can:

- **access Models selected** during the Sandbox composition phase,

- **access Models uploaded** from the user's computer through the specific function,
- **determine the files that will be downloaded** from the Sandbox to the user's computer through the specific function.

The *Sandbox Shared Storage* is accessible from any of the VMs of a Sandbox through the pre-installed file manager pointing to the `/nfs/toolsdata` pre-defined folder.

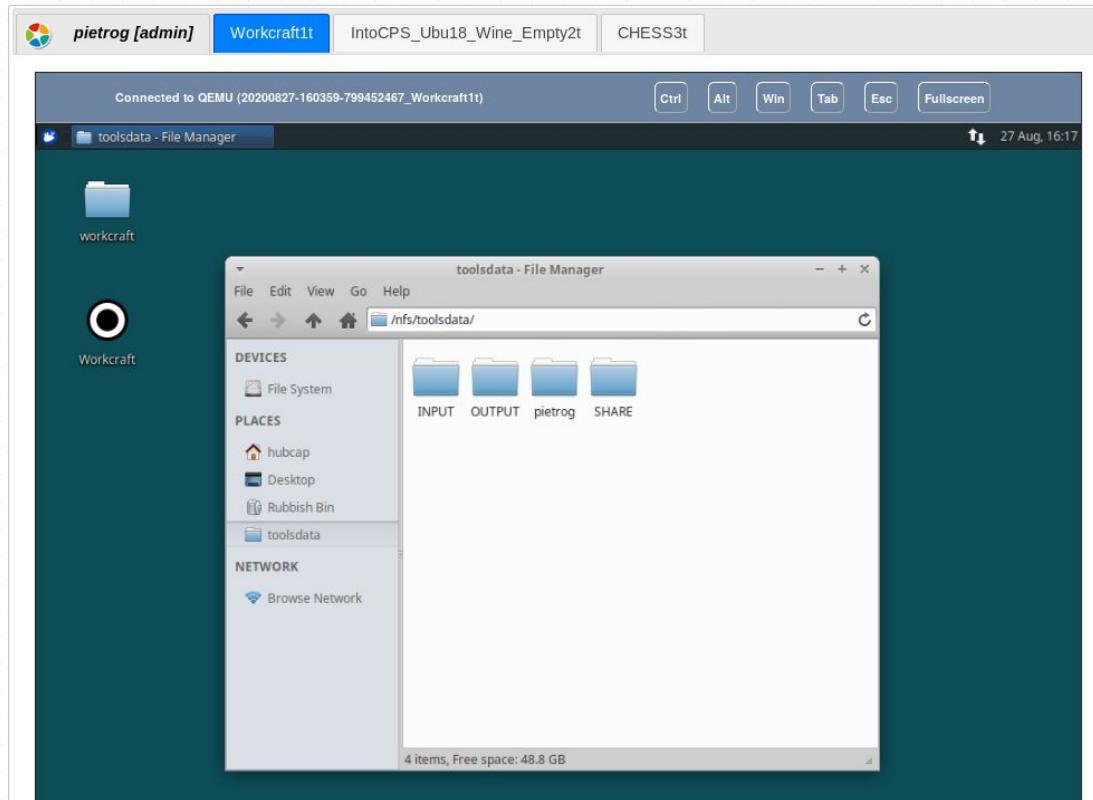


Figure 11 - File manager of a Tool within a Sandbox being used to access the Sandbox Shared Storage

Interaction among Tools

The interaction among Tools running within the same Sandbox can occur through:

1. the Sandbox Isolated Network,
2. the Sandbox Shared Storage.

In the first case the Tools can interact with each other as they would in a LAN by using either the hostnames or IP addresses of their VMs.

In the second case the data generated by a *Tool* and stored to the `/nfs/toolsdata` folder will be available to all the other Tools within the same Sandbox. This allows the Sandbox Tools to cooperate on the same dataset, thus allowing – for example – to the output of one to become the input of another one.

Sandbox Sharing

The user who has instantiated a *Sandbox* (the owner) can choose with which other users (the guests) to share it.

Share SBox With Other Users

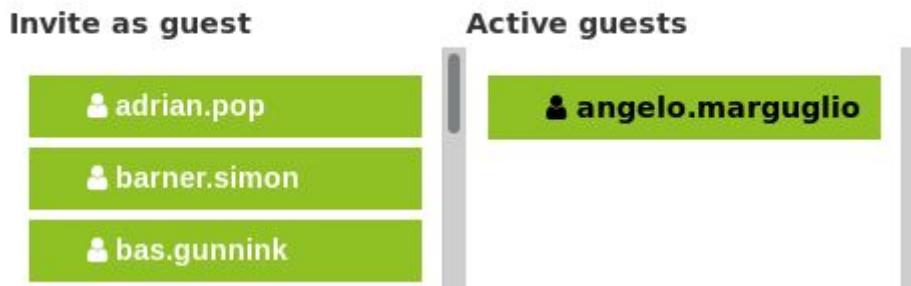


Figure 12 - Sandbox Sharing Panel from which guests can be invited

Once invited, the guest user can access the hosting user's *Sandbox* by clicking on a button in the homepage.

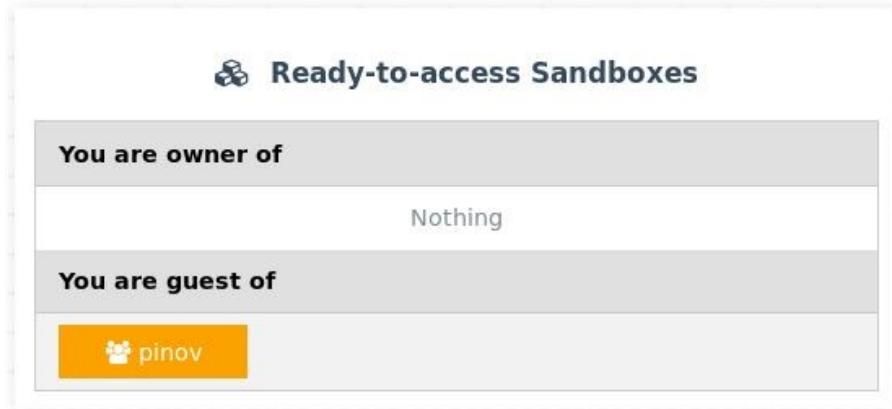


Figure 13 - Widget available in the homepage from which a guest user can access the Sandboxes shared with him/her

As a guest, a user will have access to a restricted set of functionalities and will not be able - for example – to destroy the hosting *Sandbox*.

Provisioning

The provisioning phase allows the provider end-users to contribute by adding Tools and Models to the respective repositories of the *Sandboxing Middleware*.

Tool Provisioning

A CPS software can be installed on a VM working directly with the *Sandbox Web Application* and using the Operating Systems provided by the *Sandboxing Middleware*. This approach allows to use **sandbox-ready preconfigured OSes**, making unnecessary the transfer of large VMs images (pre-installed externally and not yet

configured for the Sandbox environment) and making a **new tool immediately available** after saving it in the *Sandboxing Middleware* repository.

Save Current System To Tools Repo



Figure 14 - Area of the control panel available in the Sandbox Viewer from which the user can save the Tool

From that moment on, the *Tool* can be selected by the Sandboxing Middleware Users and included in their Sandboxes.

The following diagram in Figure 16 illustrates the procedure:

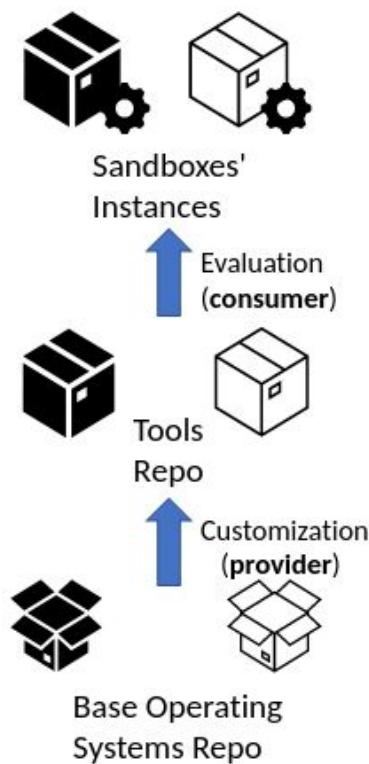


Figure 15 - Schematic view of the provisioning process

Models Provisioning

A provider user can add a model to the Models Repository simply uploading it as a compressed archive (.tar.gz or .zip) containing all the needed files and folders.

Models	
Upload New Model	
Name	Actions
Workcraft_BasicVendingMachine	Add to sandbox
IntoCPS_Tut_1	Add to sandbox
SenseSpacecraftRate	Add to sandbox

Figure 16 - Models Repository

Upload New Model

Go Back

Model name	<input type="text" value="Model name"/>
Description	<input type="text" value="Description"/>
Description	<input type="text" value=""/>
Select file	<input type="button" value="Browse..."/> No file selected. Choose a .tar.gz or .zip archive
	<input type="button" value="Upload Model"/>

Figure 17 - Upload new Model form

Sandboxing Middleware Architecture

Starting from the initial prototype (see HUBCAP D5.1) and taking into consideration the feedback received from the seed SMEs, the current implementation of the Sandboxing Middleware features all the components and interaction illustrated in the diagram in Figure 18.

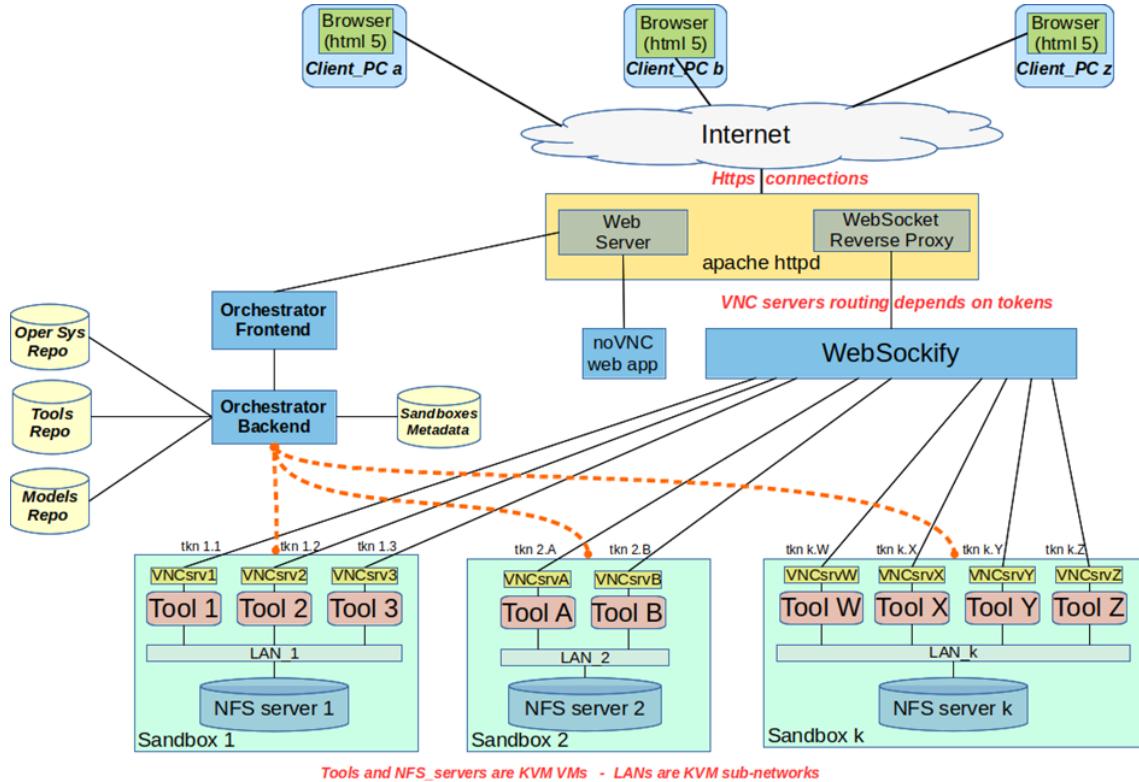


Figure 18 - Sandboxing Middleware Architecture

The main Sandboxing Middleware components are:

- **Apache HTTPD**,
- **WebSockify**,
- **Orchestrator Back-end**,
- **Orchestrator Front-end**.

Apache HTTPD

Acting as reverse proxy, it is the entry point of the HUBCAP Collaboration Platform. More details on the security aspects involving this component are provided below in the dedicated section (see Security Aspects).

WebSockify

It is a protocol adapter which allows a web client to use a remote desktop offered by a VNC server via a WebSocket connection. In the Sandboxing Middleware

implementation, it acts as a proxy to the VNC servers provided by the KVM hypervisor for each single VM.

Orchestrator Backend

The orchestrator is responsible for:

1. managing the life cycle of multiple Sandboxes, and
2. interacting with the DIHIWARE to collect the information needed to manage users' accesses and profiles.

It relies on **KVM** (Kernel Virtual Machines) to create and manage the VMs of a Sandbox and its isolated network. It also uses a database for metadata management including information about Tools and Models repositories, Users and Sandboxes.

The life cycle of a Sandbox consists of the following main phases:

Sandbox instantiation

1. The user selects the Operating Systems, Tools and Models to include in the Sandbox.
2. The orchestrator creates a KVM virtual subnet to connect Sandbox VMs with each other.
3. The orchestrator adds an NFS storage to the Sandbox. Being attached to the same subnet, this storage is shared by all the Tools of the Sandbox.

Sandbox usage

4. The owner can use the Sandbox resources (make experiments, install a new tool, customise pre-existent tools, ...)
5. The owner can host in his Sandbox other user (guests) and share with them some activities (training, demos, experiments, etc.).

Sandbox Termination

6. When the Sandbox owner terminates his activities, he can destroy the Sandbox and all the resources associated with it.

Orchestrator Frontend

It is a `node.js` web application which acts as interface between the end-user and the Orchestrator Backend, providing the GUI a user can navigate with a simple HTML5-compliant browser.

Security Aspects

Many refinements have been made to improve the security of the current Sandbox Middleware release.

The following schematic summarizes the key points where the security measures lie.

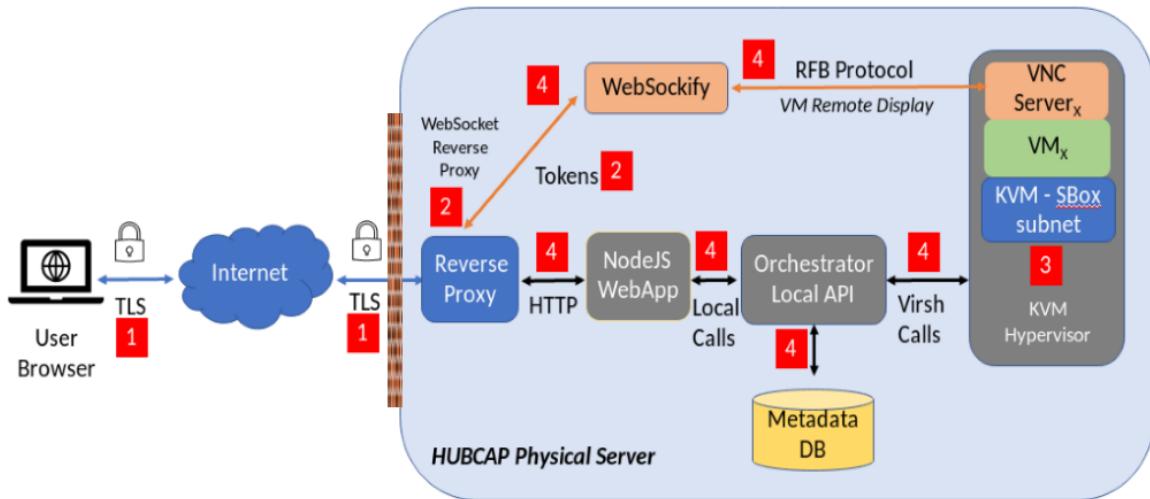


Figure 19 – Key security measures in the Sandbox Middleware

a. Boundary Protection

Two firewalls assure the boundary's protection for the physical server:

- the first one is offered by the server provider and can be configured remotely,
- the second one is on the Sandboxing Middleware server itself and is set by the local OS.

At the moment there are three open ports: 22, 80, 443. After the completion of the development activities, only port 443 will be open for sandbox access.

Note on VM firewall: no predefined firewall rules have been set on basic OSes on which the providers install their tools. There are two reasons for that:

- the eventual, open ports in a tool (VM) running in a sandbox are not accessible from the Internet (this is intentional for isolation and security purposes),

- a Tool (VM) running inside a sandbox could offer some services to other tools running on the same sandbox.

Nevertheless, a tool provider can set specific rules at VM OS level during the tool provisioning phase and that case, the VM firewall rules will be meaningful only within the *Sandbox Isolated Network*.

b. Sandbox Isolation

Each Sandbox is isolated by-design from the Internet and from the other Sandboxes, thanks to the use of a dedicated, private subnet. External access to the Sandbox VMs is provided to users only through a HTML5 Web Browser (no direct SSH access is possible).

c. Reverse Proxy (Apache Httpd)

The reverse proxy configured inside the Hubcap Platform, plays several roles in the security domain. In fact, it:

- listens on the 443 port only (HTTPS),
- provides TLS encrypted connections using certificates issued by official CA,
- allows the users to access using basic authentication,
- implements rules for securing the requests routing.

d. Two-factors authentication

As already mentioned, a user accessing the Sandbox Middleware must authenticate first on the DIHIWARE platform and only then he will be able to receive a password to access the Sandboxing Middleware Web Application using the Apache Basic Authentication.

The password is:

- long,
- randomly generated by the operating system for every user's session,
- sent automatically to the user's private e-mail,
- destroyed automatically after a short period of time.

e. WebSockify

WebSockify is able to identify the destination VNC servers based on **opaque tokens**, making the connections safer.

The opaque tokens are **destroyed immediately** after the WebSocket channel has been created and thus nobody will be able to reuse it to create a new connection.

f. Internal Communication

All Sandboxing Middleware internal components talk to each other using only the **localhost interface** of the HUBCAP server.

g. Data cleaning

All VMs and all data stored in the *Sandbox Shared Storage* will be **destroyed automatically** and **permanently** when their Sandbox is destroyed.

h. User Profiles and Roles

The Sandbox Middleware Users are grouped in two main classes (Profiles and Roles) in order to have more control over their allowed activities. That is another contribution to Sandbox hardening.

A Profile is assigned “statically” to a Collaboration Platform user and determines to which functionalities of the Sandboxing Middleware the user can access.

One or more Roles can be attached dynamically to a Sandboxing Middleware user and define the relationships between the user and the Sandboxes thus determining to which functionalities of a specific sandbox instance a user can access.

Profiles

1. **Consumer:** can instantiate sandboxes selecting tools and models from the Sandbox Middleware repositories (but cannot insert or destroy items from them).

2. **Provider:** in addition to the Consumer’s functionalities, a Provider can also:

- Instantiate Operating Systems Virtual Machines on which to install his own tools,
- Save these tools as well as upload models to the Sandboxing Middleware Repositories,
- Destroy the items he has previously added to the repositories.

3. **Null**: can browse the models and tools catalogues (and in general the DIHIWARE platform) but cannot access the Sandboxing Middleware.

Roles

1. **Owner**: is a Sandboxing Middleware user that instantiates a new Sandbox. As the owner, he can:

- a. destroy his own Sandbox,
- b. share it with other Sandboxing Middleware users (who become his guests),
- c. upload or download local archives to/from the Sandbox.

2. **Guest**: is a Sandboxing Middleware user invited to access one or more Sandboxes which they are not an owner of. Owner and Guests of the same Sandbox can collaborate with each other sharing the sandbox's screen, mouse and keyboard.

i. Logging

The events related to the life of each Sandbox life are recorded into a dedicated file. For example, the following is the real history of one Sandbox:

```
20200917-162622:SBOX_BIRTH:pietrog
20200917-162624:TOKEN_CONN:pietrog:ubuntu18_xfce1s
20200917-162625:TOKEN_CONN:pietrog:Workcraft2t
20200917-162709:VIEW_EXIT_:pietrog
20200917-162711:SBOX_RESUM:pietrog:owner
20200917-162713:TOKEN_CONN:pietrog:ubuntu18_xfce1s
20200917-162713:TOKEN_CONN:pietrog:Workcraft2t
20200917-171124:GUEST_ENAB:pietrog:pinov
20200917-171218:SBOX_RESUM:pinov:guest
20200917-171221:TOKEN_CONN:pinov:ubuntu18_xfce1s
20200917-171221:TOKEN_CONN:pinov:Workcraft2t
20200917-171340:SAVE_TOOL_:pietrog:TEST_PietroWorkcraft_tool
20200917-171345:SBOX_RESUM:pietrog:owner
20200917-171348:TOKEN_CONN:pietrog:Workcraft2t
20200917-171348:TOKEN_CONN:pietrog:ubuntu18_xfce1s
20200917-171348:LOGOUT__:pietrog
20200917-171415:SBOX_RESUM:pietrog:owner
20200917-171417:TOKEN_CONN:pietrog:Workcraft2t
20200917-171417:TOKEN_CONN:pietrog:ubuntu18_xfce1s
20200917-171421:SBOX_DEATH:pietrog
20200917-171507:SBOX_BIRTH:pietrog
20200917-171510:TOKEN_CONN:pietrog:TEST_PietroWorkcraft1t
20200917-171538:SBOX_DEATH:pietrog
```

Results of SMEs' Tests

The tests carried out by the seed SMEs throughout the last months revealed that for most of the tools and associated use cases, the Sandboxing Middleware and its mechanisms are appropriate to fulfil the experimentation needs.

However, in the case where a tool had to render heavily demanding 3D scenes, the user experience was unsatisfying because of bumpy visualization.

A few analyses seemed to detect at least the following reasons for this behaviour:

1. **shortage of graphical** computational resources on the **VM side**,
2. **inefficiency of remote desktop protocol while delivering** high frame-rate transmission,
3. **low bandwidth of connection** to the public network (especially **client side**).

Even if only one of these aspects were present, the user experience during some heavy 3D-simulations could become suboptimal.

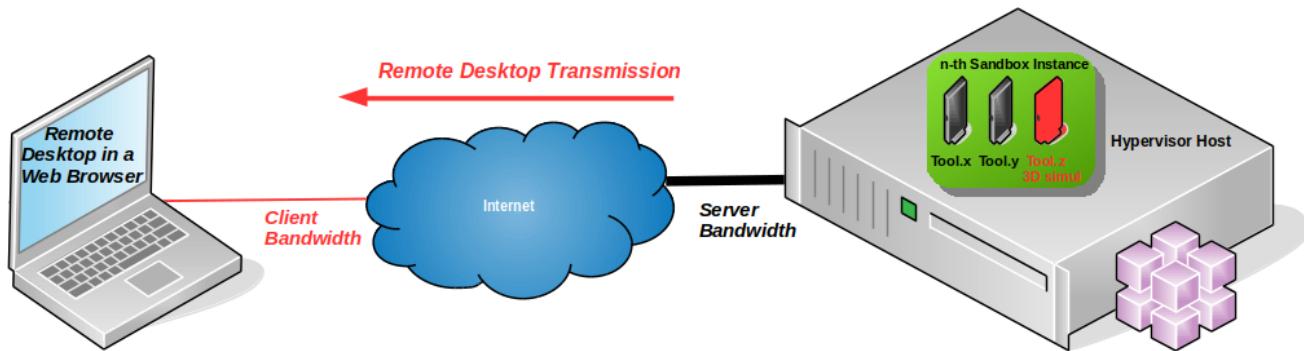


Figure 20 – Connection of the local user client to the server

Different approaches could be found to face each one of these limitations.

For example:

1. single KVM host or clustered KVM nodes, both based on powerful physical servers with accelerated, virtualizable graphics card;
2. protocols to interact with remote desktops that are optimized for visualization, and web-client equipped.

ENGIT have begun experimenting to evaluate the implementation complexity, the efficiency, and the feasibility of some of these extended architectures, so as to support the decision-making process related to the Sandbox Environment evolution.

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List of Abbreviations

DIH	Digital Innovation Hub
CMS	Catalogues Management System
IdM	Identity Management
KMS	Knowledge Management System
SSO	Single Sign On

Annexes

Annex I – Platform User Manual



Grant Agreement: 644047

Integrated Tool chain for model-based design of
CPSs



HUBCAP Platform User Manual

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1 Introduction

The Guide is designed to get you familiar with basics of the HUBCAP platform, powered by DIHIWARE.

The document contains following sections:

- A section describing the steps needed to join the platform,
- A section dedicated to the exploration of the main platform cross functionalities,
- A portion dealing with the workspaces structure and the specific services available.

2 How to join the platform

The current version of the platform is available at <https://hubcap-portal.eng.it>.

All participants joining to the platform are granted to access the network: they can use all the services and applications available in the workspace in accordance with the role assigned and permissions defined.

Access to the platform is controlled by an e mail and a password of personal user accounts, which are assigned by the platform administrator and notified to the user by the system administrator. In case users do not receive the email they can contact the platform provider at the following email address: HUBCAP-PlatformProvider@eng.it.

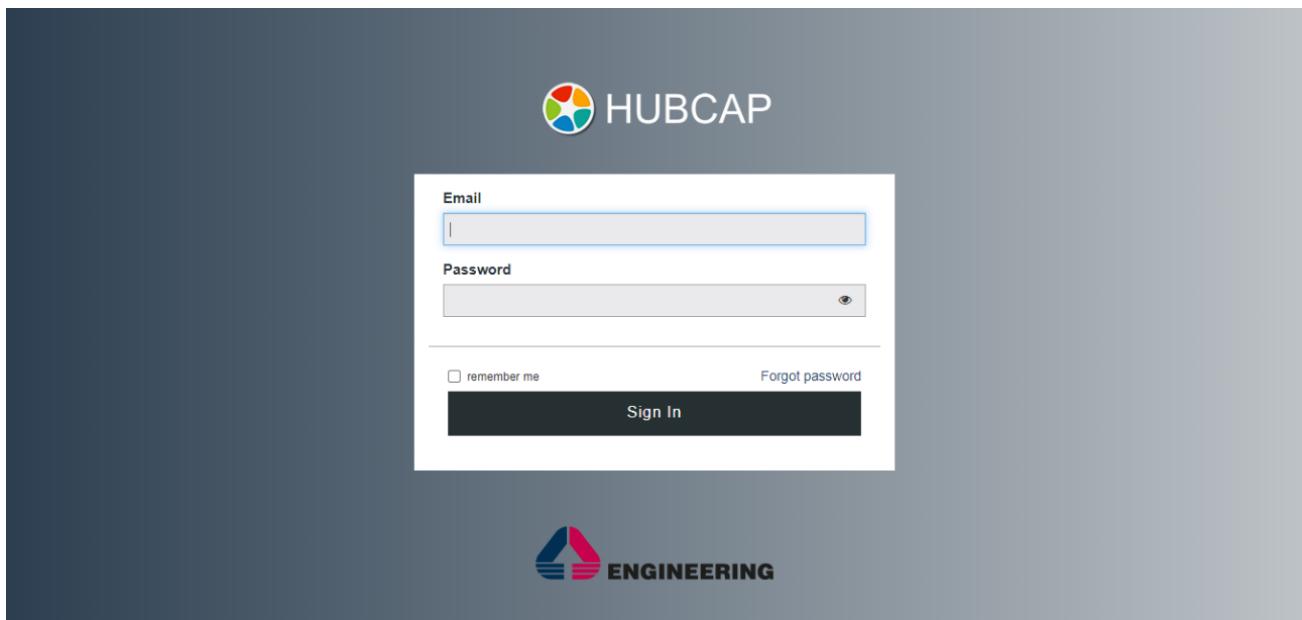


Figure 21 Platform login mask

During your first login user will be asked to:

- Authorize the portal to read your public information.

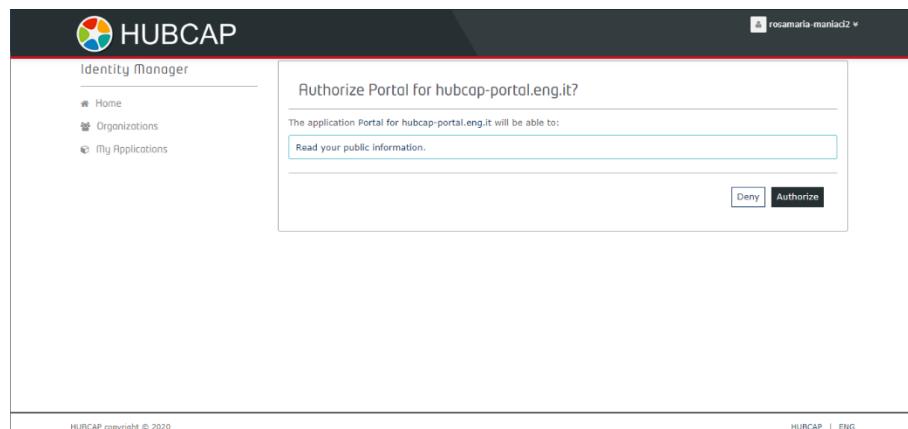


Figure 22 IDM Authorization

- Accept Platform Terms and Conditions

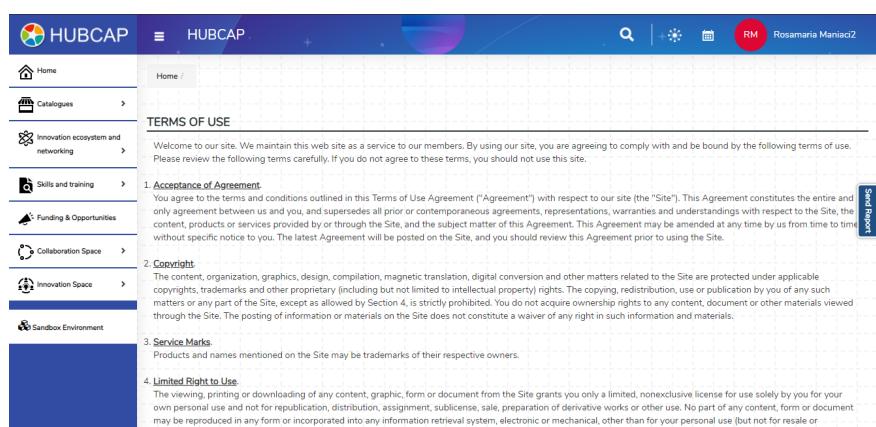
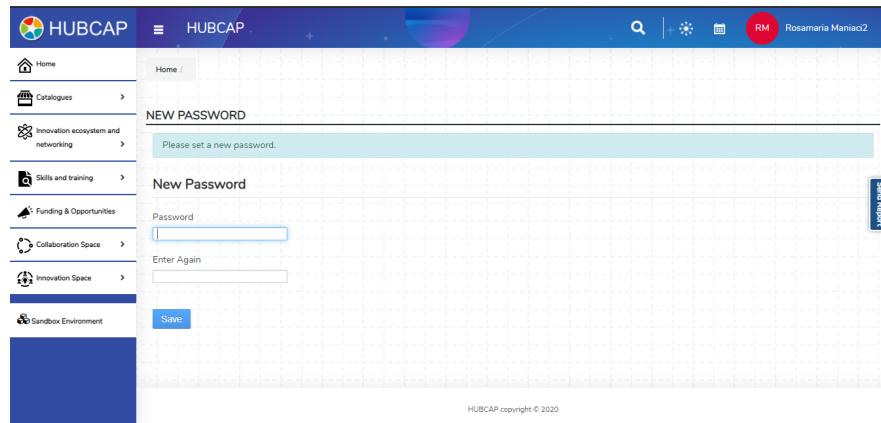


Figure 23 Platform Terms and Conditions

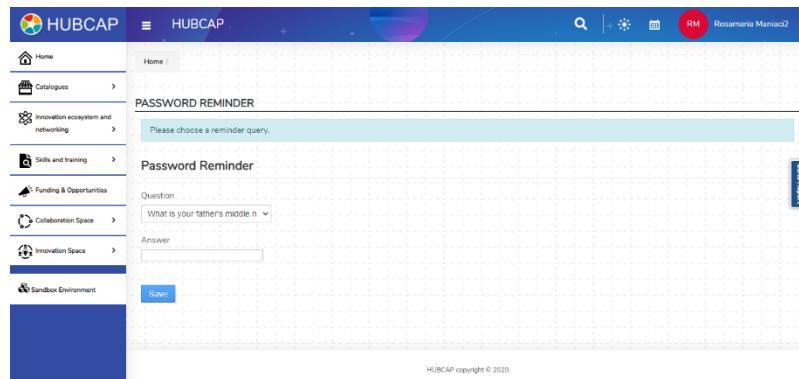
- Set a new password



The screenshot shows the HUBCAP platform's user interface. On the left is a vertical sidebar with icons and labels for Home, Catalogues, Innovation ecosystem and networking, Skills and training, Funding & Opportunities, Collaboration Space, Innovation Space, and Sandbox Environment. The main content area has a blue header bar with the HUBCAP logo and a search bar. Below the header is a section titled "NEW PASSWORD" with a sub-instruction "Please set a new password." It contains two input fields: "Password" and "Enter Again", both with placeholder text "I". A blue "Save" button is at the bottom. In the top right corner, there is a red circular icon with the letters "RM" and the name "Rosamaria Maniac2". The footer of the page says "HUBCAP copyright © 2020".

Figure 24 Change Password

- Choose a reminder query



This screenshot shows the "PASSWORD REMINDER" page of the HUBCAP platform. The layout is identical to Figure 24, with the same sidebar and header. The main content area has a section titled "PASSWORD REMINDER" with the instruction "Please choose a reminder query.". It includes a dropdown menu labeled "Question" with the option "What is your father's middle n" selected, and an "Answer" input field. A blue "Save" button is at the bottom. The top right corner shows the "RM" user icon, and the footer says "HUBCAP copyright © 2020".

Figure 25 Password Reminder

3 How to use the HUBCAP Workspace

The workspace is managed by a Site Administrator and offers a collaborative working environment, equipped with useful tools and functionalities, in order to support collaboration and collective knowledge management.

In the following figure, the main parts of the network are highlighted.

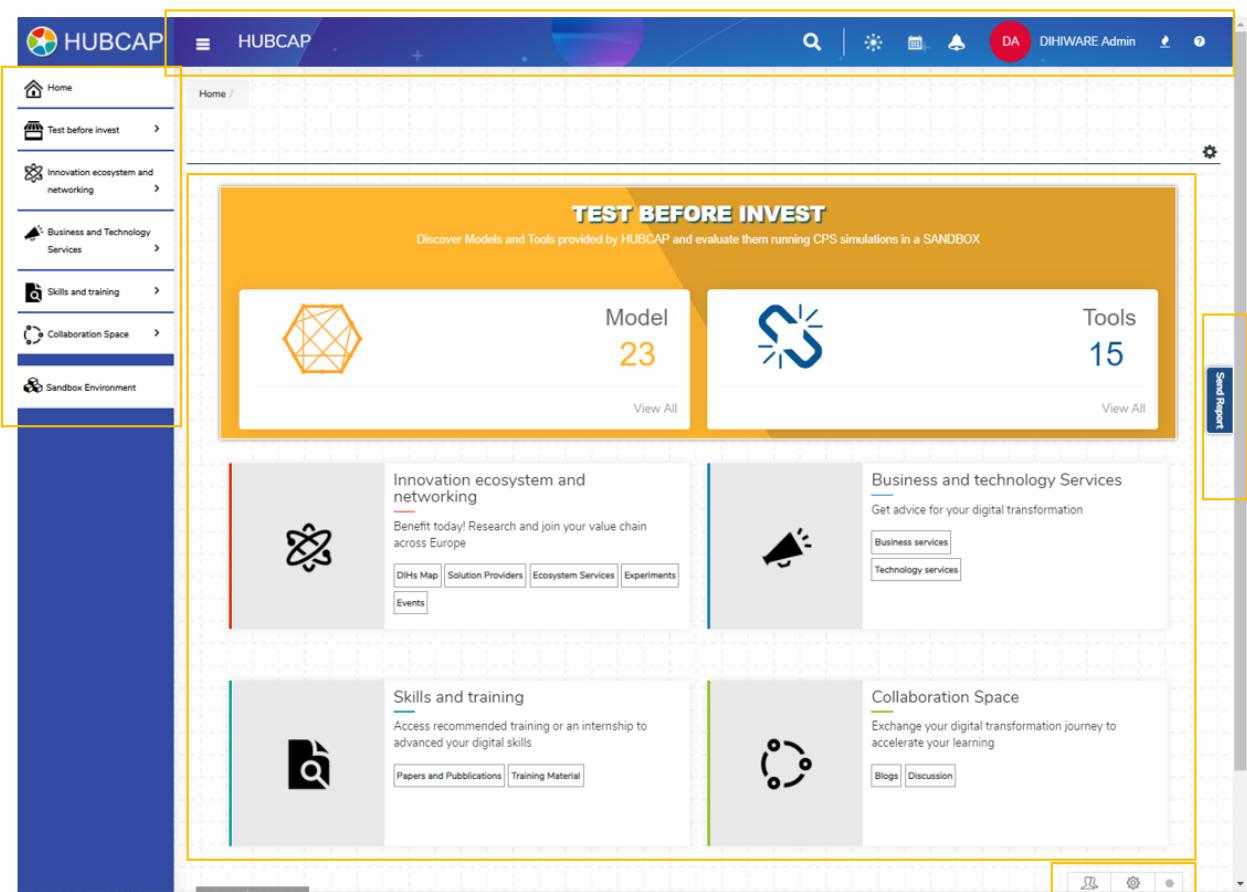


Figure 26 Platform workspace overview

3.1 Dock bar



Figure 27 Dock Bar

The functionalities available in the Dock bar, the bar on the top, are the following:

- **Universal Search**, where workspace participants can find all the portal content and people;
- **Around me**, through this functionality, workspace participants can get an overview of what is happening in real time in the activity stream;
- **Inbox notification**, workspace participants are alerted every time they receive a message or a notification;
- **Personal profile**, by clicking on the icon, workspace participants can access their profile, and sign out from the platform.

3.2 Issues Reporting

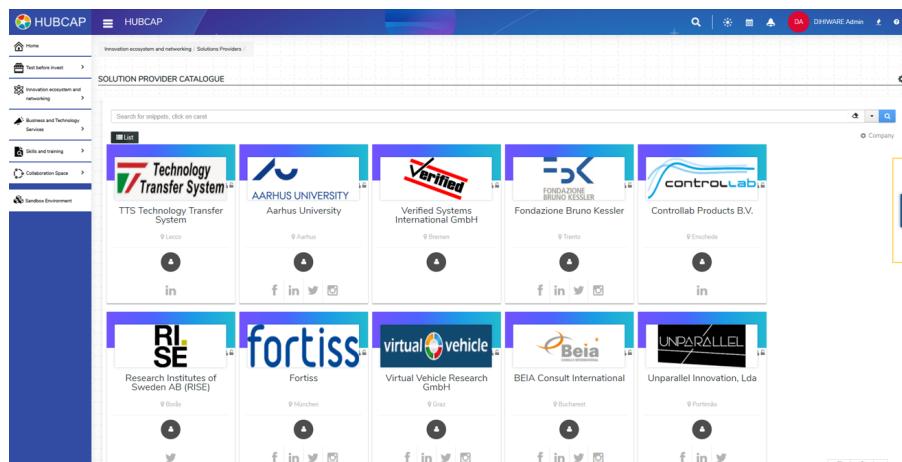


Figure 28 Issues Reporting

The integration of an Issues tracking system allows user to easily report bugs while browsing and using the platform.

All the issues reported is part of the Platform Requirements Engineering Process.

3.3 Chat

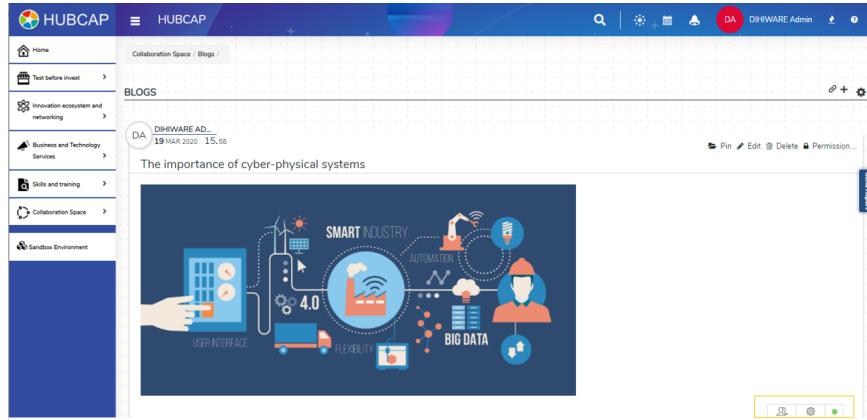


Figure 29 Chat

It is possible to communicate with other users in real time and setting the chat status.

3.4 Main Menu

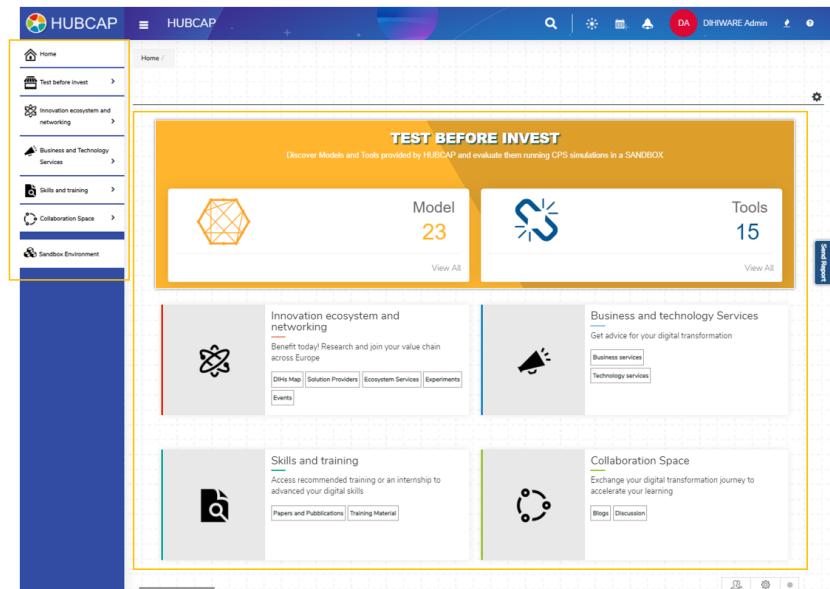


Figure 30 Main Menu

The main menu gives you the entry point to the platform Services.

The navigation of the workspace is possible also thanks to this overview page that the community administrator have been configured in order to direct you to important content and places in the community.

4 HUBCAP Workspace Structure

HUBCAP WS structure



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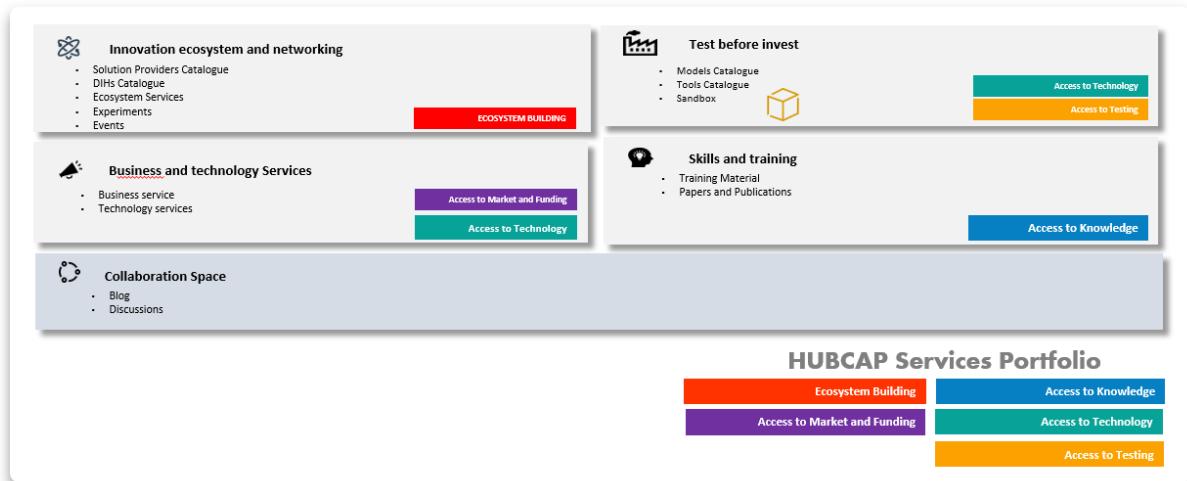


Figure 31 HUBCAP Workspace Structure

The HUBCAP Workspace is made up of different spaces dedicated to:

- **Innovation Ecosystem and Networking** that will help companies to get in contact with other companies of their value chain, with innovators, or early clients that want to test solutions.
- **Business and technology Services** supporting the access facilities, funding opportunities, infrastructures and technological platform etc.
- **Skills and training** that will also provide support in the area of advanced digital skills with the provision of training materials and documents.
- **Collaboration** space that enables the exchange of the different digital transformation journeys among the different beneficiaries.
- **Test before invest** that provide access to, digital transformation expertise, know-how and assets.

The Test before Invest section is made up of:

- a Models catalogue: a structured archiving system to store and retrieve all the information about models provided by HUBCAP network,
- a Tools catalogues: A structured archiving system to store and retrieve all the information about tools provided by HUBCAP network.

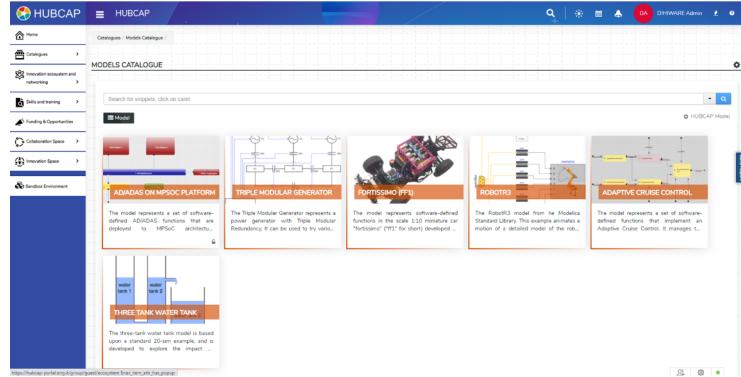


Figure 32 Models Catalogue

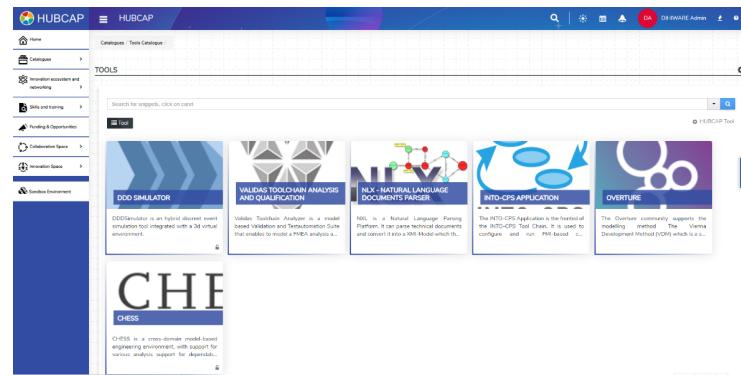


Figure 33 Tools Catalogue

In every catalogue there is possibility to set up specific filters that enable the user to sort through a wide range of items searching for a specific value of one or more field/s within the Data structure.

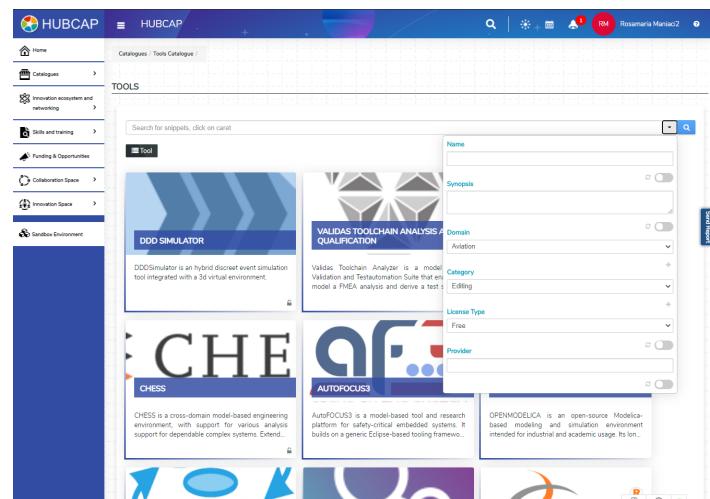


Figure 34 Catalogue Filters

Annex II – Sandboxing Middleware Manager User Guide

HUBCAP

Sandboxing Middleware Manager User Guide

Version 1

Document History

Version	Date	Author(s)	Description
V0.8	2020-07-27	Pietro Greco, Giuseppe Veneziano	
V0.9	2020-08-27	Pietro Greco, Giuseppe Veneziano	Replaced old images, added new images, extended tools provisioning paragraph
v1	2020-09-26	Pietro Greco, Giuseppe Veneziano	Updated §3.3. Feature overview table for Sandbox

1	Purpose of the document	3
2	Glossary	3
3	Introduction.....	3
4	Accessing the Sandboxing Middleware Manager	7
5	Tools and Models Evaluation	9
6	Provisioning.....	21

1 Purpose of the document

The purpose of this document is to describe how to use the functionalities offered by the Sandboxing Middleware.

2 Glossary

Term	Description
Sandboxing Middleware	Provides sandboxes where tools and models can be safely evaluated
Sandbox	Isolated set of virtual machines featuring dedicated local network and storage
Sandbox Local Storage	A folder shared by all the VMs in a Sandbox. Each sandbox has its own storage.
Sandbox Local TCP/IP Network	A TCP/IP Network available to all the VMs in a Sandbox. Each sandbox has its own network.
Sandbox Viewer	Web page containing a Remote Viewer and a Control Panel through which it is possible to interact with the sandbox
Remote Viewer	HTML5 Remote Desktop Client
Collaboration Platform	Platform resulting from the combination of DIHIWARE portal and Sandboxing Middleware
Repository	List of instantiable OSes, Tools or Models
Tool	Software Tool for Model Based Design

3 Introduction

3.1 Sandboxing Middleware Overview

The Sandboxing Middleware provides an environment where several sandboxes can be executed concurrently without interfering with each other.

Each Sandbox (i.e. a secured and isolated set of virtual machines) is instantiated dynamically by a platform user picking up a set of items from the following repositories:

- Operating Systems
- Tools
- Models

Both Operating Systems and Tools are customized Virtual Machines, whereas Models are compressed archives containing an arbitrary set of directories and files.

Whilst an Operating System is a minimal installation on a VM of an official OS (Linux or Windows), a Tool is a customized instance of such Operating System VM in which a provider has installed his own tool.

3.2 User Profiles and Roles

A user is characterized by a profile and one or more roles.

A **Profile** is assigned “statically” to a Collaboration Platform user and determines to which functionalities of the **Sandboxing Middleware** the user can access.

One or more **Roles** can be attached dynamically to a Sandboxing Middleware user and define the relationships between the user and the sandboxes thus determining to which functionalities of a **specific sandbox instance** a user can access.

Profiles

- **Consumer:** can instantiate sandboxes selecting tools and models from the Sandbox Middleware repositories (but cannot insert or destroy items from them).
- **Provider:** in addition to the Consumer’s functionalities, a Provider can also:
 - Instantiate Operating Systems Virtual Machines on which to install his own tools,
 - Save these tools as well as upload models to the Sandboxing Middleware Repositories
 - Destroy the items he has previously added to the repositories.
- **Null:** cannot access to the Sandboxing Middleware.

Roles

- **Owner:** is a Sandboxing Middleware user that instantiates a new sandbox. As owner, he can
 - Destroy his own sandbox,
 - Share it with other Sandboxing Middleware users (who become his guests),
 - Upload or download local archives to/from sandbox.
- **Guest:** is a Sandboxing Middleware user invited to access to one or more sandboxes which he is not the owner of. Owner and Guests of the same sandbox can collaborate with each other sharing the sandbox’s screen, mouse and keyboard. A guest cannot upload or download archives, destroy or share the host sandbox.

So, a Collaboration Platform user

- has one static Sandboxing profile (Consumer, Provider, Null)

and, if he can access the Sandboxing Middleware, he:

- can be Owner of **one only** sandbox instance at the time,
- can be Guest of **many** sandbox' owners.

3.3 Features Overview

The following table outlines the main functionalities made available by the Sandboxing Middleware as well as the combinations of users' profiles and roles for which they are intended.

	Profiles			Roles	
Feature	Provider	Consumer	Null	Owner	Guest
Select Operating System	X				
Select Tool	X	X			
Select Model	X	X			
Upload New Model	X				
Delete Repository Item	X (their own)				

	Sandbox				
	Provider		Consumer		
	Owner	Guest	Owner	Guest	
Access to remote viewer	X	X	X	X	
Upload Archive	X		X		
Download Archive	X		X		
Invite Guests	X		X		
Destroy Sandbox	X		X		
Save Tool	X				

4 Accessing the Sandboxing Middleware Manager

To access the Sandboxing Middleware from the portal, first access the portal at the following URL with your credentials:

<https://hubcap-portal.eng.it/>

then click on the “Sandbox Environment” button available in the sidebar:



Figure 35- Collaboration Portal Main Sidebar Menu

After clicking on the button, a Temporary Password will be sent to the user's email address and the Sandboxing Middleware welcome page will be opened in another browser tab. Use the received credentials to access the Sandboxing Middleware Web Manager.

Note: access to Sandboxing Middleware is available only during predetermined time slots.

Note: some browsers (e.g. Chrome) block the Sandboxing Middleware Welcome page pop-up. Unlock it or click in the alternative link to proceed.

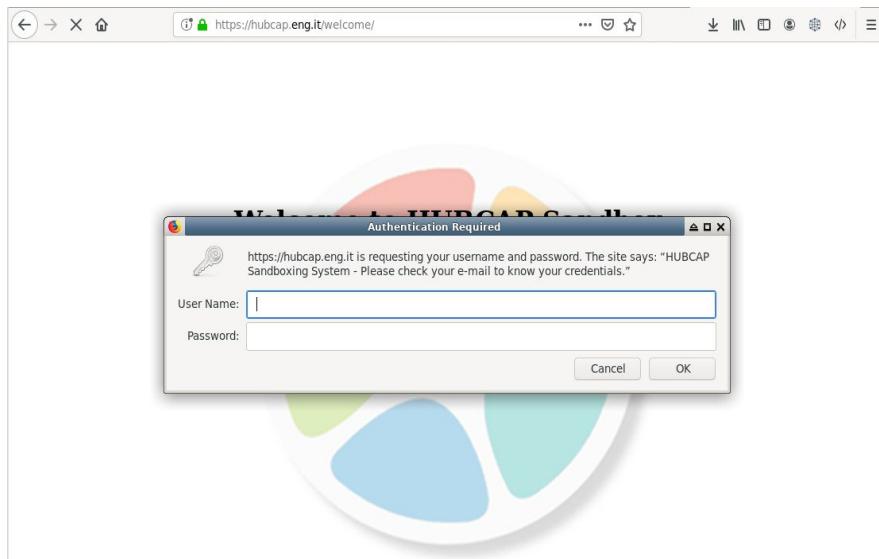


Figure 36 - Sandboxing Middleware Login Page

The Temporary Password is obviously valid only for a predetermined period, after which it will no longer be possible to access the sandbox anymore. Its expiration time is shown in the Sandboxing Middleware home page:



Figure 37- Sandboxing Middleware password expiration shown in the home page

The following sections describe how to take full advantage of the capabilities offered by the middleware.

5 Tools and Models Evaluation

In this section we are going to describe how to carry out evaluation experiments with tools and models from a Consumer user perspective.

Note: The Provider users are required to know the content of this section (5).

Once logged in to the Sandboxing Middleware, the user is prompted with the Sandboxing Middleware home page.

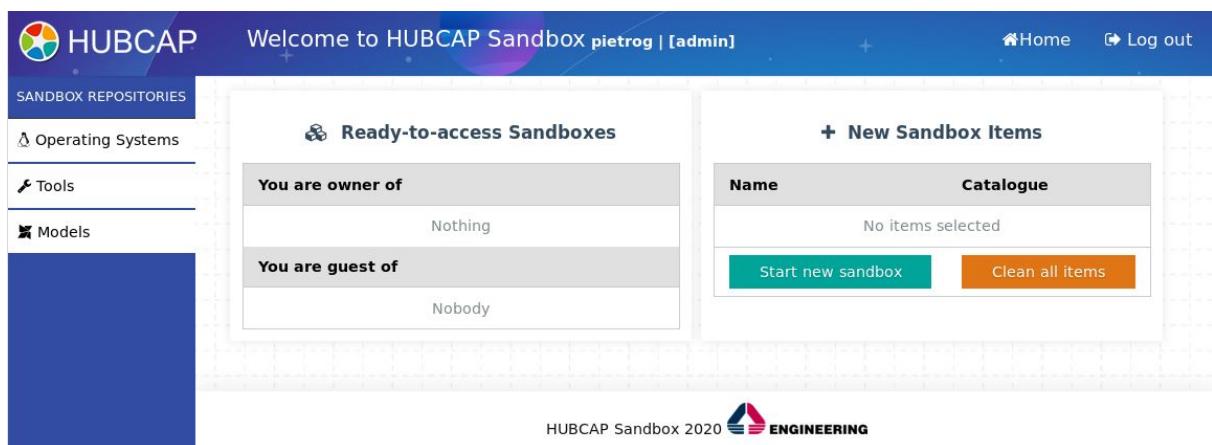


Figure 38- Sandboxing Middleware Home Page

From here the evaluation experiments can be started.

5.1 Selecting Tools and Models

As first step, the user selects one or more Tools and Models from the Sandbox Repositories accessible from the left sidebar in the home page.



Figure 39- Sandbox Repositories on Sandboxing Middleware Sidebar Menu

Once the repository of interest is accessed, the specific item can be selected by clicking on the 'Add to sandbox' button. It is also possible to view item details by clicking on the item name.



Name	Actions
Workcraft	Add to sandbox
IntoCPS_Ubu18_Wine_Empty	Add to sandbox
IntoCPS_Tut1_Win10	Add to sandbox

Figure 40 - Tools Repository

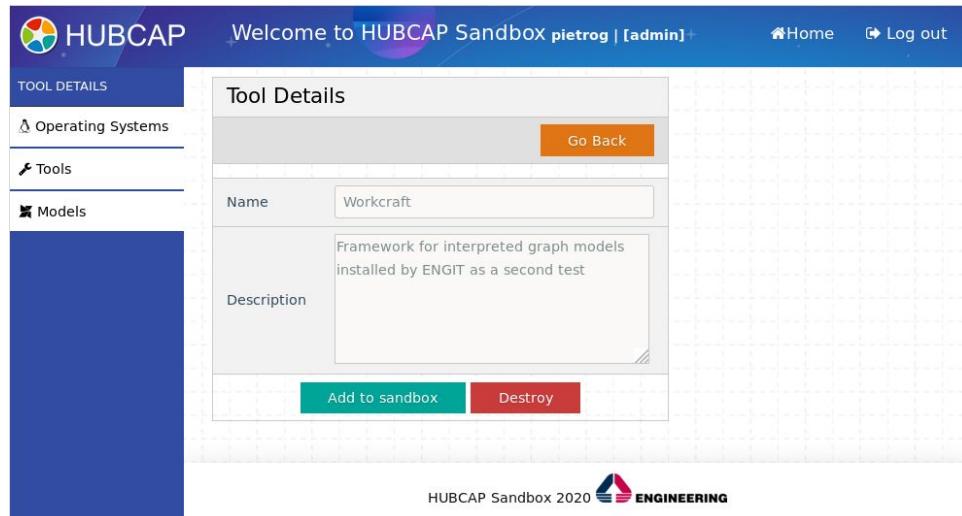


Figure 41 - Tool details page

A recap of the items added to the sandbox is available in the home page under the "New Sandbox Items" section.

Name	Catalogue
Workcraft	Tools
IntoCPS_Ubu18_Wine_Empty	Tools
Workcraft_BasicVendingMachine	Models

Figure 42 - New Sandbox Items section (cart)

In case the user wants to exclude or replace an item from the cart, he clicks on the “Check all items” button to reset the cart.

5.2 Starting the Sandbox

Once the desired items are selected, the user can launch the sandbox by clicking on the ‘Start new sandbox’ button, available in the “New Sandbox Items” section. The Sandboxing Middleware will start instantiating the desired Tools and Models within a Sandbox.

Note: It is possible to instantiate only **one** Sandbox per time. If the “Start new Sandbox” button is disabled, you are Owner of a running sandbox

5.3 Use of the Sandbox

Once the instantiation process is complete, the Sandbox Viewer will be prompted.

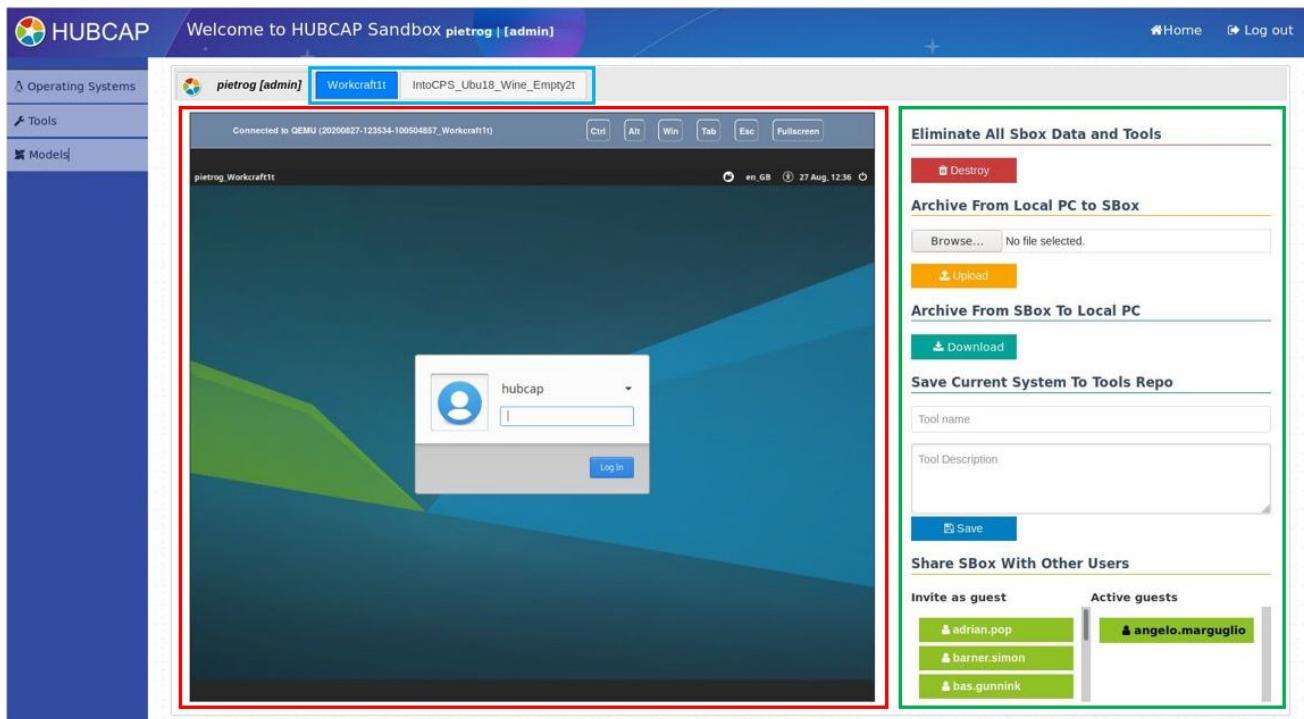


Figure 43 - Sandbox Viewer with three main components highlighted

The **Sandbox Viewer** is composed of three principal areas:

- Remote Viewer (red area)
- Tool selector (blue area)
- Control Panel (green area)

The **Remote Viewer** provides the user with access to the user interface of the operating system on which the tool has been installed and therefore to the tool itself. It also features a set of buttons (Ctrl, Alt, Win, Tab, Esc) - some of which toggle buttons (Ctrl, Alt, Win) - that can be used to send special combinations of keys to the VM. In addition, the Fullscreen button allows to switch to the Fullscreen mode.

Note on Fullscreen mode: once Fullscreen mode is on, for a better user experience, you might want to increase the screen resolution from the virtualized OS

Note on OS/Tool access: the virtualized operating system asks for a password. The default one, if not changed by the Tool Provider, is *hubcap*

From the **Tool selector**



Figure 44 - Tool selector in the top area of Sandbox Viewer

the user can switch from a Tool to another one by clicking on the corresponding tab. The Remote Viewer will be updated accordingly.

Finally, the **Control Panel**:

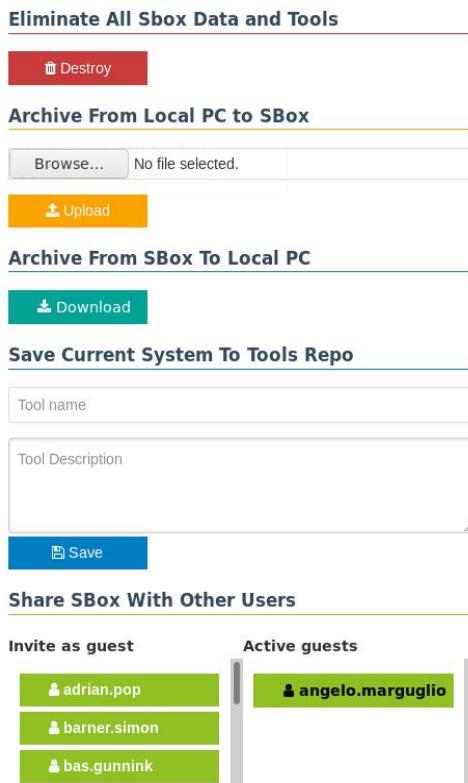


Figure 45 - Control Panel located in the right sidebar of the Sandbox Viewer

gives access to a set of functionalities – described in what follows - available depending on the combination of user role and profile.

Note on Profile and Role: The following paragraphs describe those functionalities relevant for the evaluation experiments and available to users with Owner role (those who have instantiated the sandbox) and Consumer or Provider profile.

5.3.1 Interaction among Tools

Different Tools running within the same Sandbox can interact with each other through the **Sandbox Local Storage** which is a folder they **share**. Files added to this folder are accessible from all the other VMs in the sandbox.

The folder is `/nfs/toolsdata` and can be accessed from any Tool/VM through the default File Manager offered by the virtualized OS.

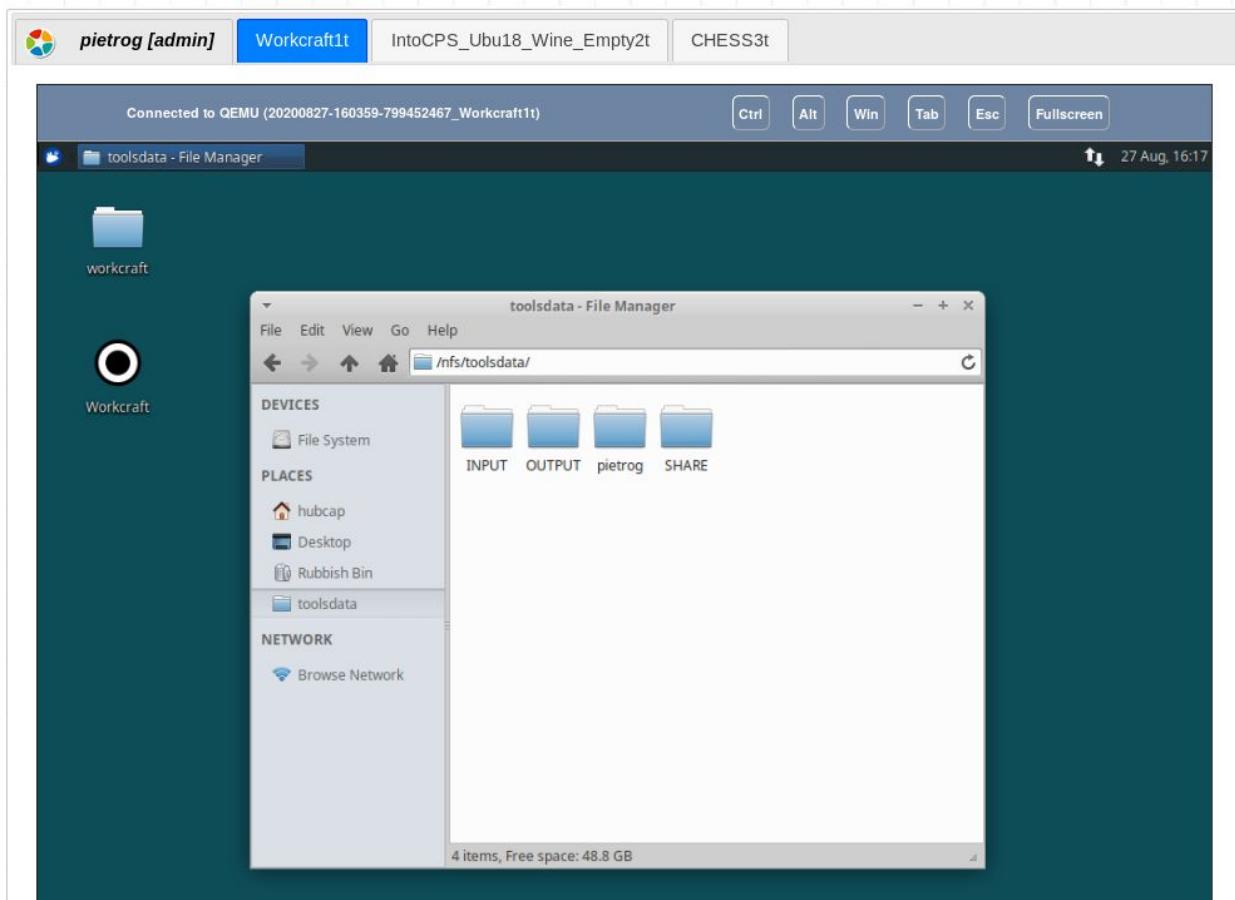


Figure 46 - File manager of Operating System running inside the Sandbox opened on the Sandbox Local Storage (`/nfs/toolsdata`)

In addition, the tools can also interact through the **Sandbox Local TCP/IP Network** referring to each other via their hostnames.

Note: The Sandbox Local Network cannot be accessed from any other sandboxes.

5.3.2 Accessing the selected Models

The models selected and added to the Sandbox are available in the **Sandbox Local Storage** under `/nfs/toolsdata/<username>`. This folder, being under `/nfs/toolsdata` is accessible from any Tool/VM.

5.3.3 External Interaction with the Sandbox Local Storage

To **upload** an archive from his local computer to the Sandbox, the Owner user interacts with the following widget:



Figure 47 - Upload area from which it is possible to upload an archive into the sandbox. The upload content will be available inside the INPUT folder of the Sandbox Local Storage

In particular, he selects the archive from his local computer by using the "Browse ..."/"Choose File" button and then clicks on "Upload".

The uploaded archive is now available in the Sandbox Local Storage under `/nfs/toolsdata/INPUT`, and from there again available to all the Tools/VMs in the Sandbox.

	Note: It is not possible to access files in the Sandbox Local Storage (<code>/nfs/toolsdata</code>) from other sandboxes
	Tip: by uploading an archive you can upload project files, license keys, manuals and in general data you do not want to share with other sandboxes' users.

Furthermore, the Sandbox Owner user can **download** the results of the evaluation experiments by adding them to the `/nfs/toolsdata/OUTPUT` folder and then clicking on "Download"



Figure 48 - Download area in the Sandbox Viewer Control Panel from which is possible to download an archive containing the content of the OUTPUT folder (Sandbox Local Storage)

The user's browser will open a download dialog from which an archive containing the experiment outcomes can be downloaded.

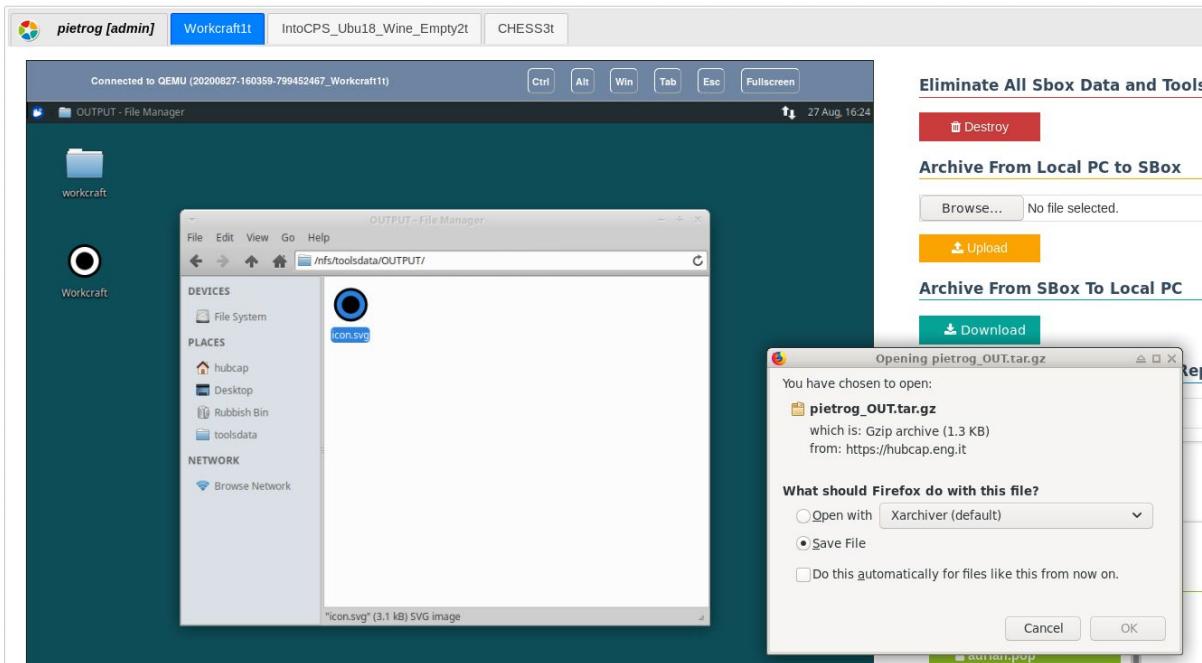


Figure 49 - Download dialog prompted after clicking on Download

5.3.4 Sandbox Sharing

Through the widget depicted below, the Sandbox Owner can choose with whom users (guests) to share his sandbox.

Share SBox With Other Users

Invite as guest

-  adrian.pop
-  barner.simon
-  bas.gunnink

Active guests

-  angelo.marguglio

Figure 50 - Sandbox Sharing Panel from which guests can be invited

To do so, the Sandbox Owner clicks on the button corresponding to the candidate Guest in the “Invite as guest” section.

At that point, the **Guest user** - logged in to the Sandboxing middleware - can access the sandbox by clicking on that button available in the home page - “Ready-to-access Sandbox” section, “You are guest of” subsection - named with the sandbox owner’s name.

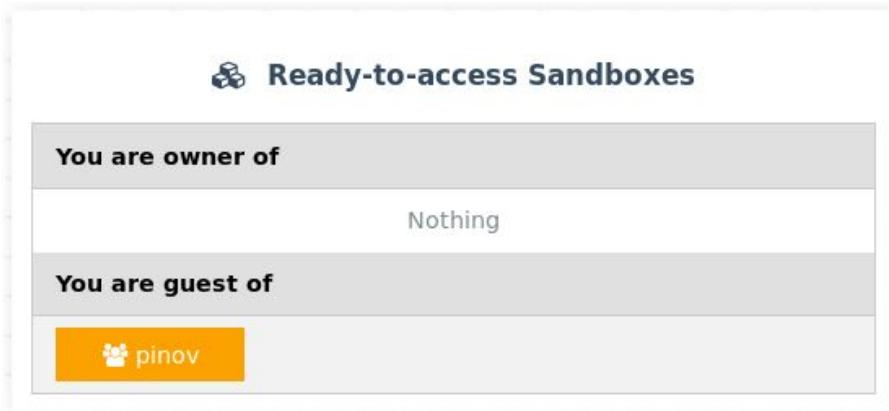


Figure 51 - Ready-to-access Sandboxes section with detail on accessible VM owned by another user

After clicking on that button, the Sandbox Viewer will be prompted to the Guest.

Similarly, to stop sharing the sandbox with a specific user, the sandbox’s owner clicks on the button named with the guest name in the “Active guests” section (Figure 50).

5.3.5 Sandbox Lifetime

Every sandbox has a lifetime determined by the user's resources quota or by other pre-determined policies. However, during this time slot the user is free to leave the sandbox to access it again later.

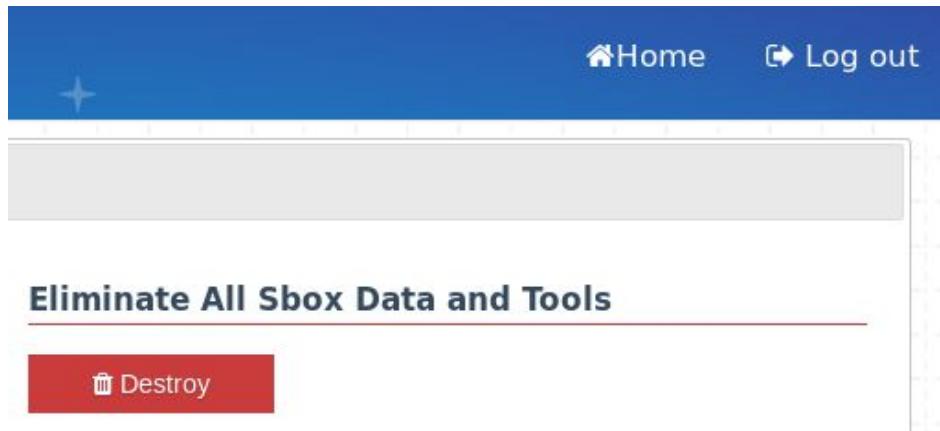


Figure 52 - Top right area of Sandbox Viewer featuring three buttons: Home, Log Out and Destroy

In particular, the user can click on "Home" to get back to the Home page - from where he can access other users' sandboxes - or on "Log out". In both situations he can access his running sandbox again from the "Ready-to-access Sandboxes" section, "You are owner of" subsection, in the home page:



Figure 53- Ready-to-access Sandboxes section with detail on accessible VM owned by logged user

5.3.6 Destroying the Sandbox

Warning: files and any kind of data available in the Sandbox (composing VMs and Local Storage) are deleted with the destruction of the Sandbox and **are not recoverable**. Be careful!

To destroy the Sandbox and all its content click on “Destroy”. Guest users will be disconnected.

Note: users who do not need the sandbox anymore should always destroy it

6 Provisioning

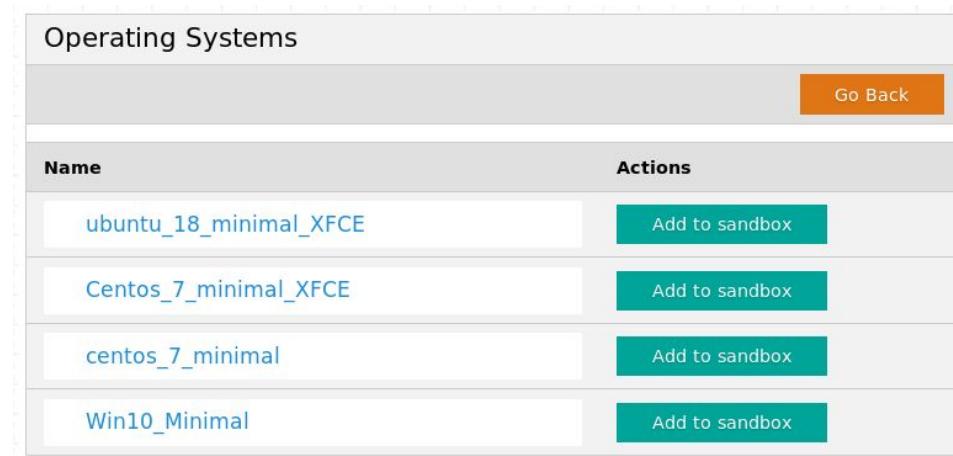
In addition to the basic functionalities illustrated in the section above, a Provider has also access to those intended for provisioning purposes. In particular, a Provider can also bring new tools and models to the Sandboxing Middleware Repositories thus making them available to all the other Sandboxing Middleware users.

Note: The Provider users are required to know the content of section 5 "Tools and Models Evaluation"

6.1 Tools Provisioning

1. To add new tools to the Sandboxing Middleware Tools Repository as first step the Provider selects from the Operating Systems Repository (Home Page -> Left Sidebar -> Operating Systems), as many **Base Operating Systems** as the tools he wants to provision.

Tip: The Provider might also want to select existing Tools or Models so as to test the configuration of the to-be-saved Tools



Operating Systems		Go Back
Name	Actions	
ubuntu_18_minimal_XFCE	Add to sandbox	
Centos_7_minimal_XFCE	Add to sandbox	
centos_7_minimal	Add to sandbox	
Win10_Minimal	Add to sandbox	

Figure 54 - Operating Systems repository

Reminder: A Base Operating System is a VM on which an empty OS has been installed. You can customize this VM by installing on it your own software thus creating the Tool (i.e. a VM with the tool installed)

2. The user then clicks on **Start new sandbox** in the home page to instantiate the sandbox.

Note: If the “Start new sandbox” button is disabled, you have a running sandbox. A user can only have one running sandbox per time and there is no exception for the provisioning phase. Destroy the running sandbox as indicated in the section above.

Once the instantiation process is complete, the resulting Sandbox Viewer will show - in the top area - as many tabs as the selected Base Operating Systems.

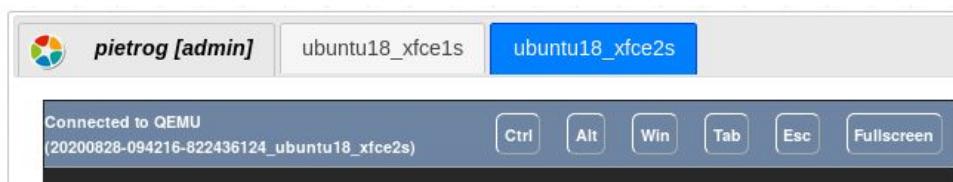


Figure 55 - Sandbox Viewer top area detail showing two tabs, one for each Base Operating System VM running in the Sandbox

3. The Provider, as next step, customises the generic selected Base Operating System (BOS) by installing on it his own software.

For the installation purposes, the provider can leverage all the functionalities described in the “Tools and Models Evaluation” section 5. So, for instance, he might want to use the upload archive functionality to upload installation scripts, license keys or manuals. Or, if needed, obtain the same content by accessing - from the Base Operating System VM - the public internet.

As an example, in the following steps we will show how to install Eclipse and how to add it to the Sandboxing Middleware Tools Repository.

4. The provider clicks on the tab corresponding to the instance of BOS the user wishes to customize and accesses the OS by entering the credentials (default password: hubcap):

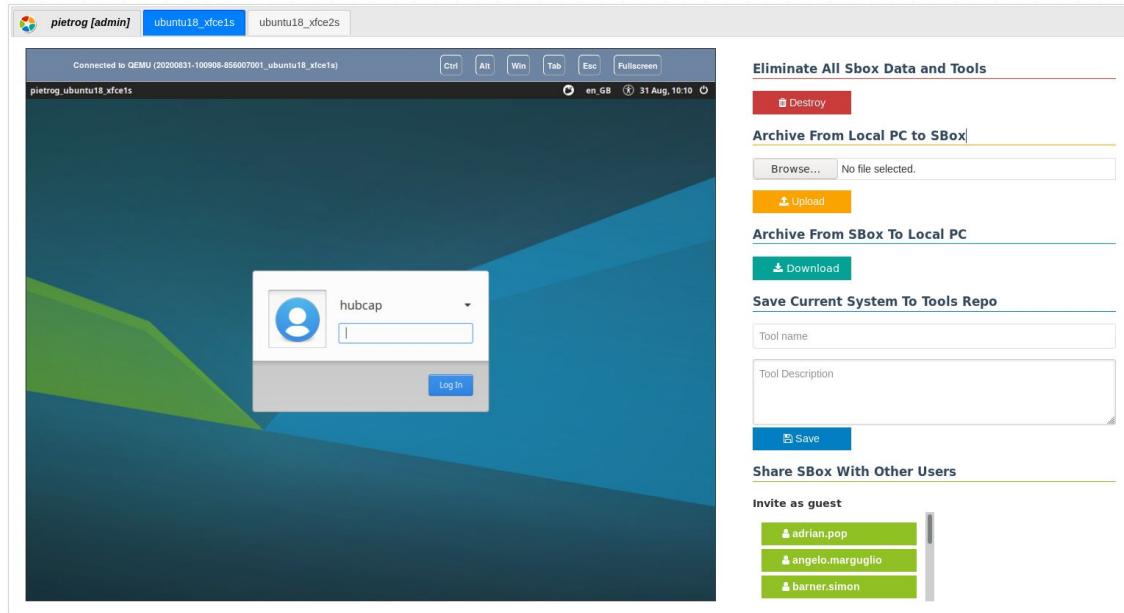


Figure 56- Base Operating System Login Dialog

5. The provider accesses the Internet from within the VM to download the Eclipse installer:

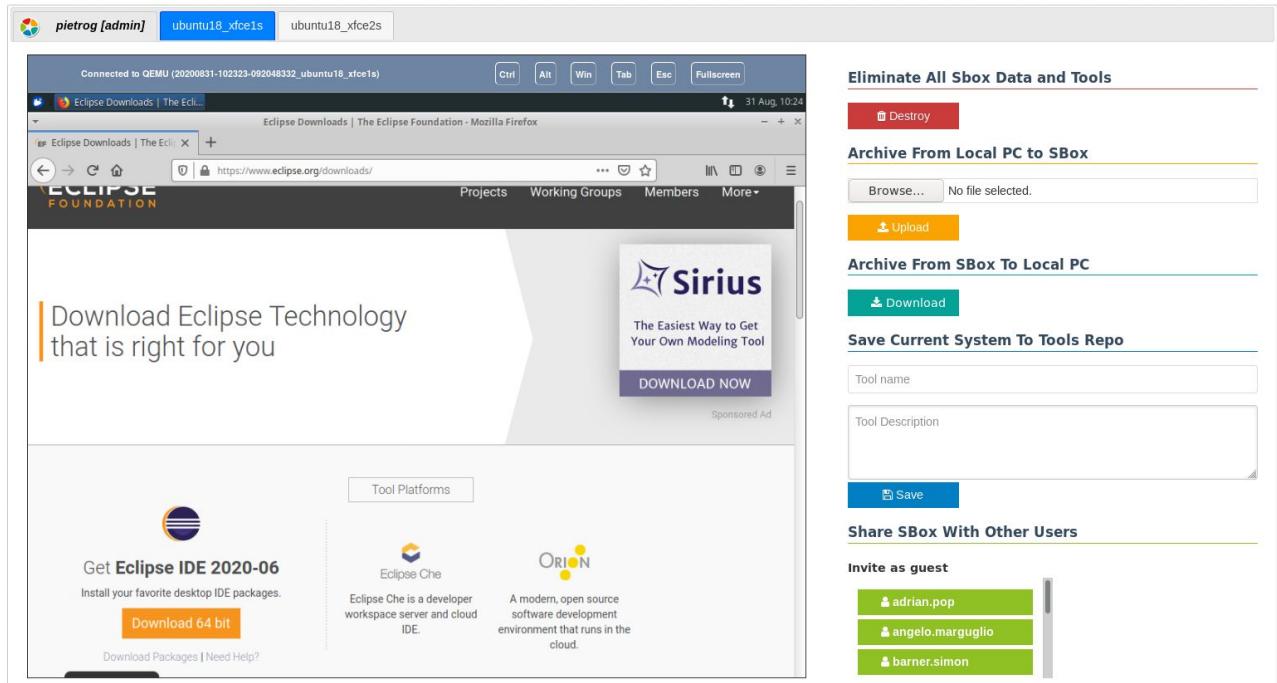


Figure 57 - Browser open on VM running inside sandbox. Eclipse download page is shown

6. The provider also downloads and installs the necessary dependencies. In this case, the Java runtime:

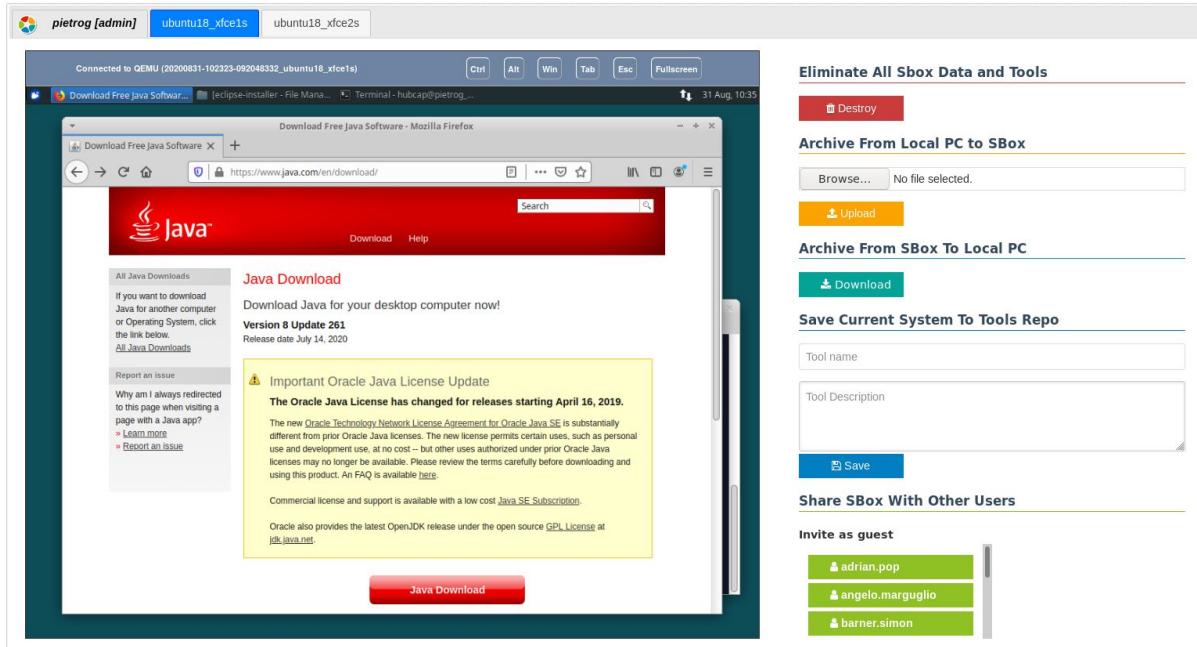


Figure 58 - Downloading dependencies needed by Eclipse

7. The provider installs Eclipse by using its installer:

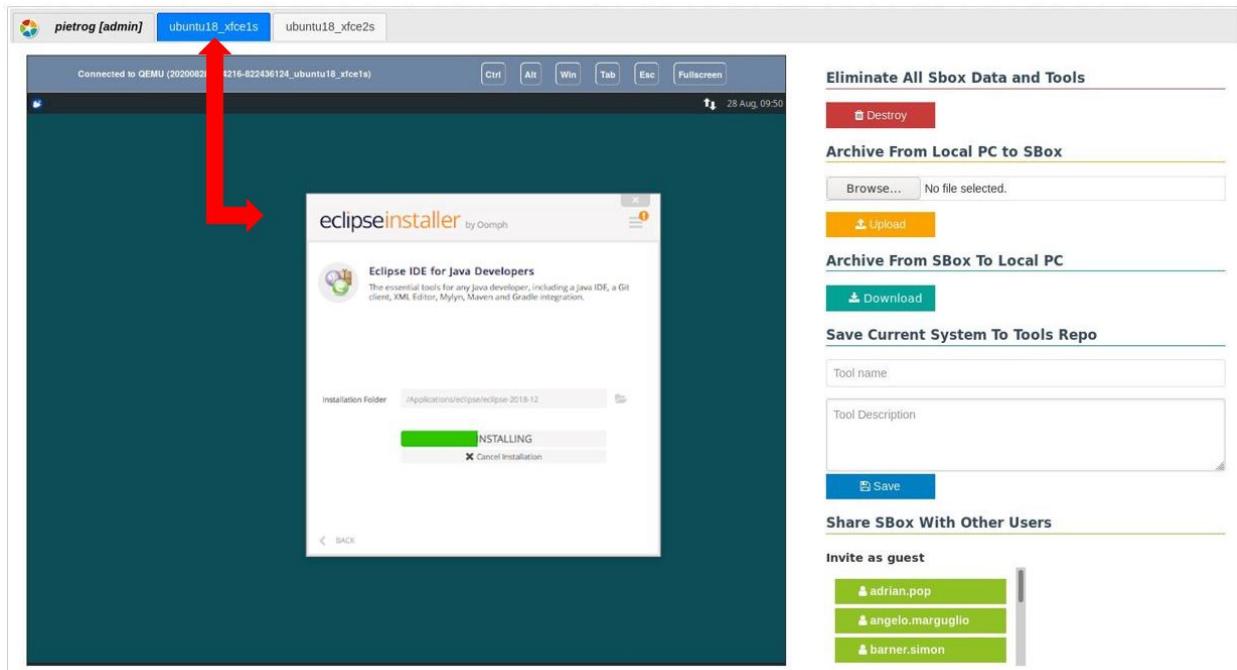


Figure 59- Sample software being installed on selected Base Operating System VM (notice selected tab)

Note: For each Base Operating System you should install only one Tool (I.e.one-to-one relationship between a Tool and a Base Operating System should exist).

8. The provider configures and tests the installed tool:

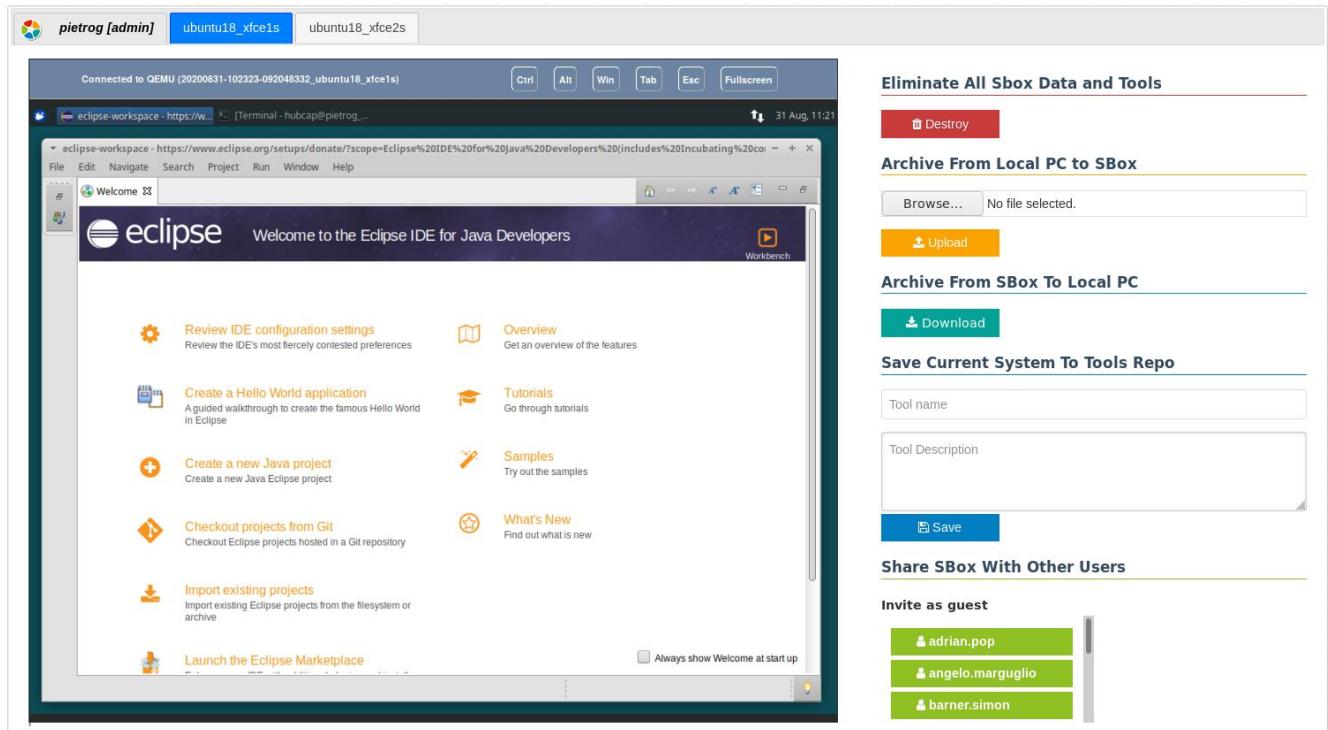


Figure 60 - Eclipse installed and ready to be tested

Once the tool is completely installed, configured and tested, the provider wants to **save it** thus adding it to the Sandboxing Middleware Tools Repository.

Note: The status of the VM at the time of saving is the one that Consumer users will find every time they instantiate the saved tool from the Repo. Therefore, before saving pay attention to UI language, screen resolution, default views and access password and so on. Also, pay attention to eventual sensitive data you might have stored in the virtualized OS during the installation.

Note: In order to save disk space and reduce tool instantiation time, delete any temporary files you have used during the installation, and not needed for the evaluation experiments to be carried out by the Consumer users.

9. The provider clicks on the tab corresponding to the customized OS he wants to save

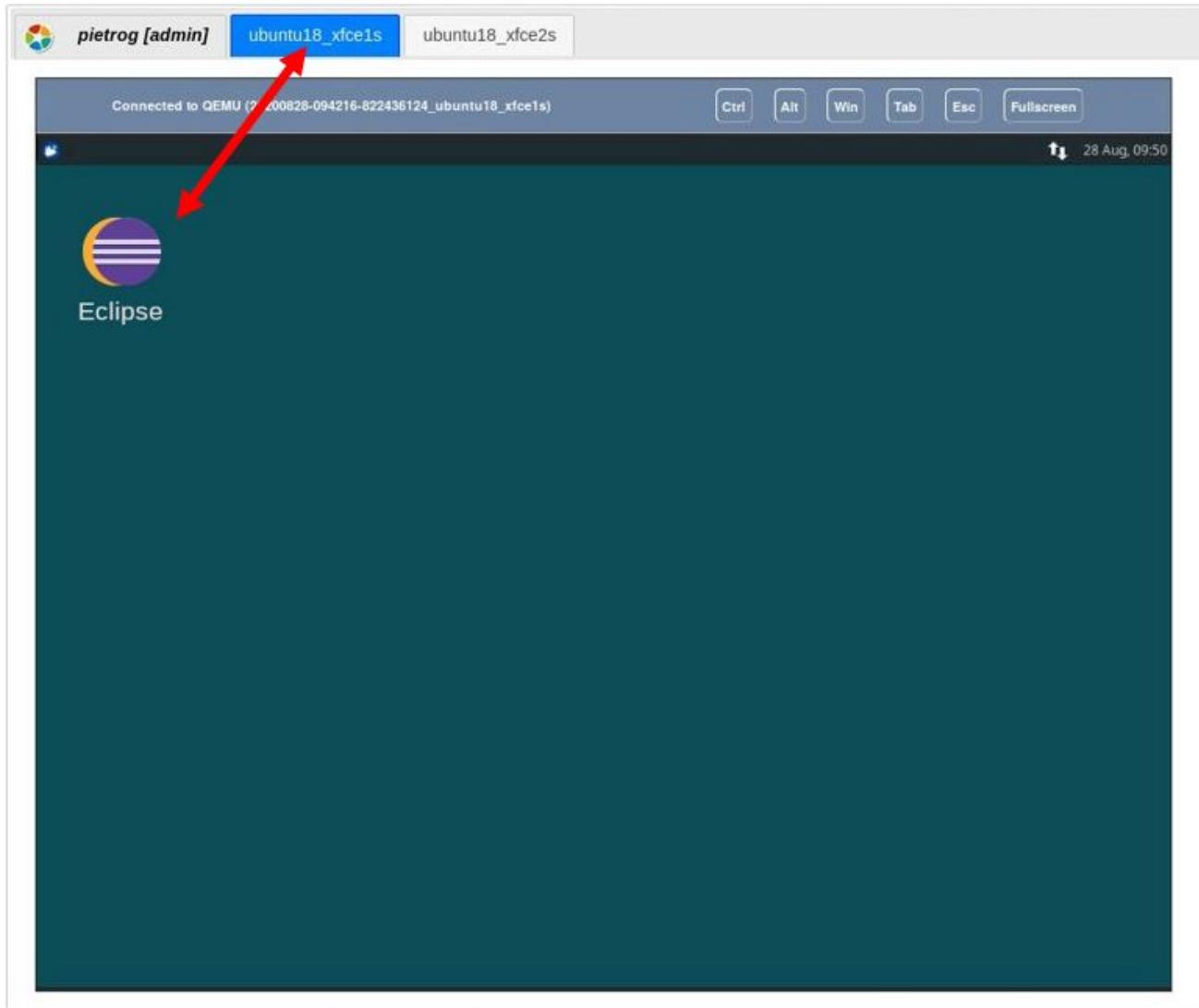


Figure 61 - User has just selected the tab corresponding to the customized Operating System he wants to save

10. The provider enters tool name and description in the following form available on the right in the Control Panel:

Save Current System To Tools Repo

Eclipse_Java_Developers_V2020_06

The Eclipse IDE is famous for our Java Integrated Development Environment (IDE), but we have a number of pretty cool IDEs, including our C/C++ IDE,

 Save

Figure 62 - Save tool form available in the Sandbox Viewer Control Panel

11. The provider clicks on “Save” to save and add the tool to the Tools repository.

Once the saving process is complete, the Sandboxing Middleware reloads the Sandbox. In that way, not only will it be possible to complete the installation of the other tools, but also modify the one just saved in order to create, if needed, different and independent versions of the Tool.

12. In case many tools are being provisioned at the same time, repeat the installation and save procedure (steps 4 to 11) for each other Base Operating System (i.e. for each tool).

13. After having saved all the tools, the user can destroy the sandbox by clicking on “Destroy”.

Warning: Destroying the sandbox without having saved all the tools will result in unrecoverable loss of the unsaved tools.

14. The saved tools are now available in the Sandbox Middleware Tools Repository.

6.2 Models Provisioning

In addition to provision a Tool, a provider can also add a model to the Models Repository. A model is a simple archive (.tar.gz or .zip) containing files (e.g. project files, tutorials, manuals ...) and folders.

To add a new model, the provider accesses the Models Repository from the home page and clicks on "Upload New Model":

Models	
Upload New Model Go Back	
Name	Actions
Workcraft_BasicVendingMachine	Add to sandbox
IntoCPS_Tut_1	Add to sandbox
SenseSpacecraftRate	Add to sandbox

Figure 63- Models repository

then he is prompted with the following form:

Upload New Model	
Go Back	
Model name	<input type="text" value="Model name"/>
Description	<input type="text" value="Description"/>
Select file	<input type="button" value="Browse..."/> No file selected. Choose a .tar.gz or .zip archive
Upload Model	

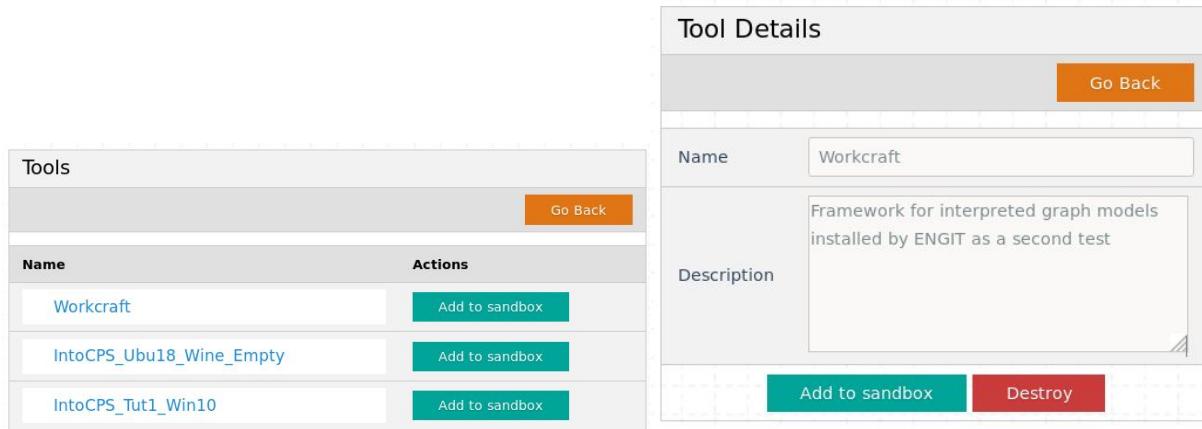
Figure 64 - Upload New Model form

He enters model name, description, selects the archive from his local computer and finally clicks on “Upload Model”. The model is now available in the Models Repository and accessible to the other users.

6.3 Repository Management

6.3.1 Destroying Items

From a repository, the user clicks on the item name to access the details page, then clicks on “Destroy” to destroy the tool. The user can only destroy those tools and models the user has previously provided.



The figure consists of two screenshots of the HUBCAP platform interface. The left screenshot shows the 'Tools' list page with a table of items. The right screenshot shows the 'Tool Details' page for the 'Workcraft' item.

Tools List Page:

Name	Actions
Workcraft	Add to sandbox
IntoCPS_Ubu18_Wine_Empty	Add to sandbox
IntoCPS_Tut1_Win10	Add to sandbox

Tool Details Page (Workcraft):

Name	Workcraft
Description	Framework for interpreted graph models installed by ENGIT as a second test

Buttons at the bottom: Add to sandbox (green), Destroy (red).

Figure 65 - Tools and Tool Details pages

Annex III – Platform Catalogues Templates

In this annex the structure of Platform Catalogues Templates is provided for reference.

Organization (DIHs and Solution Providers) Template				
Field	Field Type	Required [yes/not]	Input field description (tips for the user)	Field searchable [yes/not] (if the field must be a filter)
Organization name	Text Input	Yes	<i>Please provide the name of the company</i>	Yes
Organization website	Url	Yes	<i>Please provide the company web site url</i>	Yes
Organization logo	Image	Yes	<i>Please insert the company logo image file (png, jpg)</i>	Yes
Organization business description	Text Input	Yes	<i>Please describe the organization and the value the organization provides</i>	Yes
Market Sector	Select (Manufacturing, Agriculture, Energy, Healthcare)	Yes	<i>Please specify main domains of interest for the organization and its activities</i>	Yes
Areas of competences	Select Business Competences Education & Training Organic and Large Area Electronics (OLAE) Micro and nano electronics, smart system integration Sensors, actuators, MEMS, NEMS, RF Photonics, electronic and optical functional materials Screens and display technologies	Yes	<i>Please provide information about organization main competences</i>	Yes

	<p>Broadband and other communication networks (e.g. 5G)</p> <p>Cyber physical systems</p> <p>Robotics and autonomous systems</p> <p>Internet of Things</p> <p>Artificial Intelligence and cognitive systems</p> <p>Location based technologies</p> <p>Interaction technologies</p> <p>Cyber security</p> <p>Advanced or High performance computing</p> <p>Data mining, big data, database management</p> <p>Augmented and virtual reality, visualization</p> <p>Simulation and modelling</p> <p>Gamification</p> <p>Cloud computing</p> <p>Software as a service and service architectures</p> <p>Additive manufacturing</p> <p>Laser based manufacturing</p> <p>ICT management, logistics and business systems</p> <p>Internet services (e.g. web development, web production, design, networking, and e-commerce)</p>			
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	New Media technologies Other (Please specify here)			
Services Provided	<p>Select ECOSYSTEM BUILDING Communication, Awareness creation Ecosystem building, scouting, brokerage, networking Technology scouting Trend watching, Visioning and Strategy Development for Businesses</p> <p>TECHNOLOGY PROVISION Ideas Generation, Assessment, Feasibility study Technology Readiness assessment Strategic and Collaborative Researches Technology concept development/ Proof of Concept (PoC) Testing and validation Pre-competitive series production Product Qualification and Certification Provision of experimental facilities, labs, etc.</p>	Yes		Yes

	<p>Provision on technological platforms and infrastructure Incubator/accelerator support Market intelligence Business training and education Project development Product consortia Access to Funding and Investor Readiness Services Access to public funding - Support Access to private funding - Support</p> <p>MATURITY ASSESSMENT & SKILLS Digital Maturity Assessment and Strategy Development Mentoring, Apprenticeship and Secondment</p> <p>DATA AND AI VALUE CHAIN Data acquisition and sensing Data processing & analysis Decision-making Physical-human action & interaction GDPR and Data Sovereignty compliance Data Spaces Data Platforms</p>			
--	--	--	--	--

	Other (Please specify)			
Membership	Text Input	No	<i>Please specify if the organization is member of relevant associations, groups, organizations, etc.</i>	No
Organization legal address Street: Postal code: City: Country Choose an item. Region:	Text Input	Yes	<i>Please provide information about registered address</i>	Yes
Representatives name and surname: email: role in the organization: Responsibilities:	Text Input	No	<i>Please provide contacts to ask for more information</i>	Not
Social Accounts	Text Input Linkedin Twitter Facebook Instagram	No	(insert your Social url)	Not

Experiment	
Basic Information	
Name	Trial title/subtitle
Situation before the trial Please introduce the starting situation in an understandable and realistic manner highlighting the aspects that needed improvement and for which the trial has been implemented.	
Description	
Trial results Please provide a brief summary of the benefits that have been achieved by implementing this trial; show how the product/service has solved business and technical issues (use hard numbers to prove increases in market share, revenues, improved productivity, etc.).	
Trial date start/ stop Please indicate when the trial started and when it stopped.	
Company Which company leads the pilot?	
Project What is the name of the project the pilot belongs to?	
Solution Partner(s) Please identify the partner(s) that supported the company to implement the trial.	
Main actors involved <i>Please identify the actors (by role) involved by the trial scenario.</i>	
Multimedia content Please provide any useful media content such as a video pitch, slides, or images that help to understand very quickly the solution provided by the trial.	
Metrics or KPIs	
Benefits	

TECHNICAL INFORMATION	
Trial technology	Please provide brief reference to the ICT solutions adopted.
Platforms	Write a list with all the platforms used in the pilot
Standards	Write a list with all the standards used in the pilot
Website	Write an URL where some detailed information about the pilot could be found (i.e. online catalogue or pilot official website):
Rough investment	0-10K, 10K-250K, 250K-1M, 1M-10M
<i>Please provide a reasonable approximation of the investment</i>	
Location	
Country	What is the country where the pilot is located?
City	Write the city where the pilot is located
Address	Write the address of the pilot (OPTIONAL, in case this field remains empty the project will appear on the map at the city centre. This data will be used to calculate GPS coordinates and won't be stored):
Contact	
Main contact (name, mail address)	Please provide a contact to ask for more information.

SERVICES (Ecosystem, business and technology) Template					
Field	Field Type	Required [yes/not]	Input field description (tips for the user)	Field searchable [yes/not] (if the field must be a filter)	Repeatable
Provider	Relation (select organization)	yes	<i>Please provide the name of the services provider/s.</i>	yes	yes
Provider Logo	Image	Yes	<i>Please provide the provider representative logo</i>	No	No
Image	Image	Yes	<i>Please provide a representative image of the service</i>	No	No
Category	Select list	yes	<i>Please provide the service category</i>	yes	Yes
Ecosystem Services:					
<ul style="list-style-type: none"> • Technology Scouting • Awareness raising & community building • Trend Watching • collaboration and information exchange • showcases and demonstrations • Industry Accelerator • Hackathon • Visioning and Strategy development • Communication support 					
Business Services:					
<ul style="list-style-type: none"> • Access to Specialised Facilities • Access to Telecommunication Infrastructure and High Powered Computing • access to knowledge and facilities • DIH Establishment • business development - Connection to Funding Sources • Awareness creation 					
Technology Services					
<ul style="list-style-type: none"> • Consulting • Technology Concept Development 					

<ul style="list-style-type: none">• Cloud System selection• Technology Readiness Assessment• Ideas Generation and Assessment• Prototyping• Access to Infrastructure and Technological platforms					
Image	Image	Yes	<i>Please provide a representative image of the service</i>	No	No
Title	Text Input	Yes	<i>Service Title</i>	Yes	No
Description	Image input	not	<i>Please provide a description</i>	not	Yes
Contact:					

Training Template				
Field	Field Type	Required [yes/not]	Input field description (tips for the user)	Field searchable [yes/not] (if the field must be a filter)
TITLE	Text Input	Yes	<i>Title of the education/training</i>	Yes
PROVIDER	Text Input	Yes	<i>CC / DIH that provides the training</i>	Yes
DESCRIPTION	Text Input	Yes	<i>Short description of the education/training and its aim</i>	Yes
TARGET	Select (Directors, Plant Manager, Engineers, Operators, Manager, End User, Software Developers, Technology providers, Others)	Yes	<i>Group(s) of people, identified as the intended recipient of the education/training initiative, and Competence level (e.g., basic/intermediate/advanced...)</i>	Yes
Market Sector	Select (Aerospace Agriculture Chemical Computer – Software Construction Defence Education Energy Manufacturing Research & Development Others)	No	<i>Is the training specific for any sector?</i>	Yes
Channels	Select (face to face Blended MOOC Online Others)	No		Yes

Technology	Select Robotics IoT CPS FIWARE Technology 3D Printing Data analytics Artificial Intelligence Cloud Technologies IDS Reference Architecture Model 2.0 Laser Welding Open-Source Approach Others			
LEARNING OUTCOMES	Text Input	Yes	<i>A learning outcome is a written statement of what the successful student/learner is expected to be able to do at the end of the module/course unit</i>	Yes
LEARNING CONTENT	Text Input	Yes	<i>The subjects or topics covered in the education/training initiative</i>	Yes
APPROACH/METHOD	Select Lecture Workshop Presentation Video Webinar Practical exercises Practical session in lab Others	No	<i>How the content is delivered (e.g., lecture, project work, webinar, game, on the job training, etc.)</i>	Not

DURATION	Text Input	No		Not
ASSESSMENT	Text Input	No	<i>Short description of the final assessment</i>	Not
CERTIFICATION	Text Input	No	<i>Does the training lead to an attendance certification, skill certification, etc.?</i>	Not
COST	Text Input	No	<i>How much does the training cost?</i>	Not
Contact Provider (main contact, mail address)	Text Input	Yes		Not
DATE	Date	No		Not
WEBSITE	Url Input	No	<i>Reference to information and resources available online</i>	Not

Model Template						
Field name	Field Type	Required (yes/no)	Input field description	Field repeatable (yes/no) (if must be possible to add more than one input)	Field searchable (yes/no) (if the field must be a filter)	Field visibility to the final user (yes/no)
Model Name:	Text	Yes	Model Name	No	Yes	Yes
Model-Based Techniques:	Text	Yes	Model-Based Techniques that can be applied to the model	Yes	Yes	Yes
Related Tools:	Select from tools catalogue	No	Related Tools	Yes	Yes	Yes
Related Models:	Select from models catalogue	No	Related Models	Yes	Yes	Yes
Synopsis:	Text	No	Description of the model (describe what the model represents, the modelling features it exemplifies, the tools and techniques can be used with it, a use case scenario) - between approximately 500 and 1500 characters (max 2000).	No	Yes	Yes

Picture:	Picture file or Url	No	A picture to present the model (e.g., the physical system or the system architecture)	Yes	No	Yes
Model Files:	Archive	Yes	Model Files	No	No	No
Model Version:	Text	No	Model Version	No	Yes	Yes
Additional material:	Pdf or Url	No	Additional material (e.g., a more detailed description or the instructions on how to use the tool with the model)	Yes	No	Yes
Related projects:	Url	No	Related projects	Yes	No	Yes
Copyright:	Text	No	Copyright owner	No	Yes	Yes
License:	Text file or Url	Yes	License	Yes	Yes	Yes
Provider	Select from Companies	Yes		No	No	Yes

Support contact:	Select from users list	Yes	Support contact	Yes	Yes	Yes
Purpose:	Select list example to get started, example of advanced features, benchmark	Yes	Purpose of the model	No	Yes	Yes
Target user:	Select list: newbie/experienced	Yes	Is the model suitable for users without experience in the related model-based techniques or only for experienced users?	No	Yes	Yes
Cost	Text Input	No		No	No	Yes
Application domain:	Select list: - industrial automation - aeronautics - space - automotive - railway - power systems - sensors - energy - smart cities - smart farming/ agriculture - healthcare - robotics	Yes	What is the application domain of the model?	Yes	Yes	Yes

	<ul style="list-style-type: none">- consumer technologies/ electronics- other. Please specify _____					
Available in the sandbox:	Select list: Yes/No	Yes	Is the model available in the sandbox?	No	Yes	Yes

Tool Template						
Field Name	Field Type	Required (yes/no)	Input field description	Field repeatable (yes/no) (if must be possible to add more than one input)	Field searchable (yes/no) (if the field must be a filter)	Field visibility to the final user (yes/no)
Tool	Text	Yes	Tool name	No	Yes	Yes
Model-Based Techniques	Text	Yes	What model-based techniques the tool employs	Yes	Yes	Yes
Related Tools	Select list	No	Related tools	Yes	Yes	Yes
Related Models	Select list	No	Related models	Yes	Yes	Yes
Synopsis:	Text	Yes	Description of the tool (describe what model-based techniques it supports, their expected input and output, which libraries or backend tools are internally used for the analysis) – between approximately	No	Yes	Yes

			500 and 1500 characters (max 2000)			
Application domain:	Select list: - industrial automation - aeronautics - space - automotive - railway - power systems - sensors - energy - smart cities - smart farming/ agriculture - healthcare - robotics - consumer technologies/ electronics - other. Please specify <hr/>	Yes	What is the application domain of the model?	Yes	Yes	Yes
Logo Image File URL Insert Image	Picture file or Url	No	Logo of the tool	Yes	No	Yes
Tool download URL reference	Url	No	Url to download the tool	No	No	Yes

Tool version	Text	No	Version of the tool	No	No	Yes
Benefits	Text	No	What are the benefits of the technology for the end-users? How does it differentiate from similar technologies? Max 2000 characters	No	Yes	Yes
Product/technology video	Video	No	Video presenting the tool	No	No	Yes
Maturity level	Text	Yes	Specify the Technology Maturity Level	No	Yes	Yes
Application domains	Text	No	Please provide examples of application domains and current customers. Max 2000 characters	No	Yes	Yes
Price structure	Text	Yes	Please define the price structure for this technology.	No	Yes	Yes
GUI * [Standalone Web]	Select list	Yes	Select which types of GUI are supported	Yes	Yes	Yes
OS	Select list [Win Linux Mac]	Yes	Select which OSs are supported	Yes	Yes	Yes
Execution Type	Select list [Interactive Batch]	Yes	Select type of execution	Yes	Yes	Yes

Collaboration support	Select list [Yes / No]	No		No	Yes	Yes
Quick start Guide	url	No	URL reference			
Manual Reference	url	No	URL reference			
License Type	Select list [Free Commercial Dual] URL to License	Yes		No	Yes	Yes
Provider Information (Support contact) Organization name Main contact (Name, Position in the organization Email address, LinkedIn profile)		Yes		No	No	Yes
Available in the sandbox:	Select list: Yes/No	Yes	Is the tool available in the sandbox?	No	Yes	Yes