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Project Full Name:	Human Uterus Cell Atlas			
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Topic:	SC1-BHC-31-2019			
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Project Duration	2 years (24 months)			
Document due date:	30/09/2020			
Submission Date	30/09/2020			
Leader of this report:	BAHIA			
Deliverable no:	2.2			
Deliverable name:	Deployment of HUTER cloud infrastructure			
Dissemination level:	Public			

# **Version History**

Version	Date	Details
1.0	30/09/2020	Deliverable completed.



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# **DELIVERABLE 2.2**

# **Deployment of HUTER cloud infrastructure**

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# List of Acronyms

AWS	Amazon Web Services	BAHIA	Bahía Software SLU	DICOM	Digital Imaging and Communication On Medicine
EC	European Commission	eCRF	electronic Case Report Form	HCA	Human Cell Atlas
HCA-DCP	Human Cell Atlas - Data Coordination Platform	HUTER	Human Uterus Cell Atlas	IAM	Identity and Access Management
IT	Information technologies	PACS	Picture archiving and communication system	\$3	Simple Storage Service
SME	Small and medium- sized enterprise	WDL	Worflow description language	WP	Work package





## 1. PURPOSE OF THIS DOCUMENT

The development of the activities regarding Deliverable 2.2 which is defined as "Deployment of HUTER cloud infrastructure" have been successfully completed. The purpose of this document is to provide an overview about the work performed in the framework of this Deliverable as part of the WP2 (entitled "HUTER platform infrastructure") that BAHIA lead. However, the complete technical definition of the HUTER Cloud infrastructure has not been included in this document because is part of the Deliverable 2.1 "Platform architecture design".

This deliverable has been fully developed by BAHIA partner as expert SME in IT solutions considering all the HUTER project requirements.

#### 1.1. Related documents

Documents linked to current actions to be delivered: HUTER\_WP2\_D2.2\_Deployment\_of\_HUTER\_cloud\_infrastructure Documents linked to future actions to be delivered: HUTER\_WP2\_D2.3\_Beta\_version\_of\_data\_access\_tools HUTER\_WP2\_D2.4\_Final\_implementation\_of\_data\_access\_tools\_and\_DICOM\_visualization\_tool HUTER\_WP7\_D7.1\_Final\_design\_ of\_HUTER\_platform\_architecture HUTER\_WP7\_D7.2\_Visual\_System\_implemented\_&\_Digitalisation\_software\_to\_transform\_images\_from\_re search\_equipment\_under\_opensource\_standards Other documents referenced:

HUTER\_WP1\_D1.1\_Ethics\_Plan

HUTER\_WP9\_D9.2\_Data\_Management\_Plan

# 2. STATUS OF DELIVERABLE

The deployment of HUTER cloud infrastructure has been developed, so we considered the deliverable to be completed.

# 3. INTRODUCTION

The HUTER project is focused on creating the molecular reference map of the human uterus. For this purpose, HUTER researchers will generate vast amounts of molecular and imaging data from cell sequencing



#### **Deliverable 2.2**



technologies and uterus cells of women samples. In this line, HUTER will be part of Human Cell Atlas global initiative which aims to create reference cellular maps of whole-body tissues and organs. As a part of HCA global initiative, HUTER must share its generated data openly with the HCA research community with the aim of gathering all the completed cellular maps of the human body in a single platform. Although an open cloud-based Data Coordination Platform (HCA-DCP) is being built to check, share and analyse data to be generated under the different HCA projects, it is not totally finished to allow HUTER partners develop their commitments with the EC. Therefore, BAHIA is leading the development of a cloud-based hosting for HUTER project to guarantee our competence to meet our project deliverables in due time and overcome other unexpected obstacles as a contingency measure. The HUTER cloud-based hosting will be active during all HUTER project and will be turned off once the project ends but the data hosted will be gradually transferred to HCA-DCP when its construction is completed and the data sharing is authorized. Considering the provisional nature of the HUTER cloud because the persistence of data will be done in HCA-DCP servers once the HUTER project ends, the deployment of the HUTER cloud infrastructure has been based on the alignment with HCA guidelines and bearing in mind three key technical aspects: scalability, high availability and storage. Furthermore, the HUTER cloud infrastructure will not only host complex data from cell sequencing technologies but also support data from other relevant specific components such as website for communication and dissemination activities, intranet for project managing, advanced DICOM viewer, etc. These are specific components that are not related to HCA-DCP but they are also needed to fulfil the specific HUTER project objectives and requirements. Thus, all these features and functionalities must be supported by the HUTER cloud infrastructure to a proper development of HUTER project. For this reason, the HUTER cloud infrastructure was customly designed and deployed, integrating and supporting all these required

#### components.

In order to demonstrate that the deployment of the HUTER cloud infrastructure was successfully carried out, we will provide some evidences of different components deployed over the HUTER cloud infrastructure on this document. Some of these evidences will include not only functional descriptions of the components currently deployed but also screenshots related to these components working properly over the HUTER cloud infrastructure. We want to highlight that the first version of the HUTER cloud infrastructure design is fully defined in Deliverable 2.1 (HUTER\_WP2\_D2.1\_Platform\_architecture\_design) and consequently it will not be addressed on this document.

On the other hand, some platform components are currently being designed and developed in close collaboration with partners thus it is not possible to deploy them yet. Nonetheless, the hardware infrastructure required for their deployment is ready to support them once the development is finished.





#### 4. CURRENTLY DEPLOYED COMPONENTS

Herein, components of HUTER platform that have been successfully deployed will be briefly described below, focusing on their functional relevance. Furthermore, we will support our work including several evidences in screenshot format to justify that the committed tasks of this deliverable were properly performed. However, we want to highlight that we must assure confidentiality of data gathered in the HUTER platform complying ethical and data management agreements following European and national legislation in this regard. Therefore, it has not been included any credentials or access instructions to HUTER cloud infrastructure on this document to avoid unauthorized accessions to sensible data due to open/public nature of this document. We considered that we provided enough documented evidences to show that we have accomplished properly with our commitments regarding Deliverable 2.2. Otherwise, EC officers are welcome to contact BAHIA (proyecto.huter@bahiasoftware.es) to request further specific details.

#### 4.1. AWS Nextwork infrastructure

In order to get support for all next listed components, the documented AWS architecture has been deployed in Ireland data center to provide two deployment environments called "production" and "development". The first one is addressed to support the researcher's work, store real data and execute high performance analysis. Meanwhile, development is the environment for the deployment of new tools in order to get them tested before their exploitation.

#### 4.2. LibreClinica

This component is an open source software initially designed for clinical trial studies but now adapted to HUTER project requirements by BAHIA. This component allows to manage electronic case report forms (eCRFs) through a user-friendly web interface that will contain all the biological and clinical variables collected from samples during the project. It has advanced features such as data verifications, audit logs, modification of CRFs, query and discrepancy management, data extraction, etc. At the same time, this module will allow not only the collection, storage and management of clinical data in an electronic and secure way, but also the data export in several formats for subsequent analysis and exploitation by HUTER researchers. Furthermore, this component includes a user role system that is based on the roles typically found in clinical trials and other forms of clinical research to manage the authorized actions of each user.

This application has been improved in two development steps. First version included a Keycloak adapter to be integrated with HUTER Platform IAM. It also provided some features requested by project coordinators in





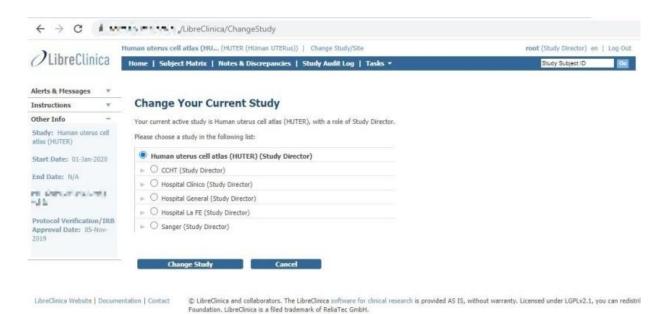
order to facilitate the generation of subject identifiers. Next pictures (from Picture 1 to 5) show the aspect of LibreClinica v.01.01 which includes just functional developments.

Jun	Human uterus cell atlas (HU (HUTER (HUman UTERus))   Change Stu	udy/Site	root (Study Director) en   Log Out
LibreClinica	Home   Subject Matrix   Notes & Discrepancies   Study Audit	Log   Tasks +	Study Subject ID
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other Info -			
itudy: Human uterus cell itlas (HUTER)	* indicates required field.		
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LibreClinica Website   Docun	entation   Contact © LibreClinica and collaborators. The LibreClinica soft warranty, Licensed under LGPLv2.1, you can redistribution		

Picture 1 - HUTER specific generator for subject identifier







Picture 2 - HUTER study sites organization

#### CRF\_INCLIVA\_Whole\_Uterus v\_01\_01\_0001

<ul> <li>CRF Header 3</li> <li>Event:</li> <li>Study:</li> </ul>	() Human uterus cell atía	is (HUTER)	Sex: Age At Enrollme Year of Birth:	ent:	
Site:	N/A				
Interviewer Name: *		60	Interview Date: *		m pe
Discrepancy Notes	on this CRF:				
New	Updated	Resolut	tion Proposed	Closed	Not Applicable

Click the flag icon next to an input to enter/view discrepancy notes. Please note that you can only save the notes if CRF data entry has already started.

Sections			Center(0/2)	I/E_cri(0/13)	Consent(0/3)			
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I/E_criteriaorelegibilitycriteria	1×-	Cent	ter					
Consent_Form	*	1		nong -Select one-	~			
Patient_Status	-	the following collaborator centers:						
Patients_Information	*	Prin	cipal investigator	stigator				
Diagnostic_parameters		z	Please select an	nongSelect one	× *			
Treatment	*	the following research collaborators						
Samples	*		Developed a					
Other outcomes	-							

Picture 3 - LibreClinica CRF data introduction page and early version of new navigation menu





	uman uterus cell	atlas (H	U (HUTER (HUma	n UTERus))   Change Sti	dy/Site			root (Study Dire	ector) en   1
O LibreClinica	Home   Subject	Study Subj	ect ID						
Alerts & Messages – Welcome to LibreClinica, Root User. You last logged in on 21-Sep-			uman uteri icies Assigned	us cell atlas (H 1 to Me: 0	UTER)				
2020.	Subject Enrollment By Site					Subject Enrollment For Study			
	Site	Enrolk	d Expected Enro	llment Percentage	Study	Enrol	led Expected Enrollm	ent Percentage	
	CCHT	0	65	0%	Human	0	105	0%	
Instructions – If needed you may change	Hospital Clínico	0	40	0%	atlas (HUTER)				
the study/site or request access to a new study with a	Hospital General	0	40	0%					
different role.	Hospital La FE	0	105	0%					
Other Info –	Sanger	0	40	0%					
Study: Human uterus cell atlas (HUTER)			Study Progres	is	Subject Status Count				
Start Date: 01-Jan-2020	Event Status	5	# of Events	Percentage	Study Subj	ect Sta	tus # of Study Subje	cts Percentage	
Sec. 31	scheduled		0	0%	available		0	0%	
End Date: N/A	data entry st	arted	0	0%	signed		0	0%	
en sala er mesetar.	completed		0	0%	removed		0	0%	
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Protocol Verification/IRB	locked		0	0%					
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#### Picture 4 - LibreClinica original layout

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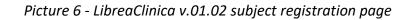
#### Picture 5 - LibreClinica original Subject Matrix

In order to provide a better user experience and add usability to LibreClinica, version v.01.02 includes new aspect that allows LibreClinica to get advantage of current display dimensions. Furthermore, some visual functionalities have been integrated to reach a more intuitive interface (see Pictures from 6 to 10).





LibreClinica Home St	ubject Matrix Notes & Discrepant	ies Study Audit Log	Tasks *	Stud	ly Subject ID	T	Default Study (default-study)
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lefault col Verification/IRB Approval		Save	and Continue Save and Ad	d Next Subject 5a	ve and Finish	Cancel	



CibreClinica Home S	ubject Matrix Notes & Discrepancies Study Audit Log Tasks *
~	Change Your Current Study Your current active study is Human uterus cell atlas (HUTER), with a role of Study Director.
≅ Alerts & Messages	Please choose a study in the following list:
Instructions	Human uterus cell atlas (HUTER) (Study Director)     O      Q COHT (Study Director)
i Other Info —	Hospital Olínico (Study Director)     Hospital General (Study Director)
Study: Human uterus cell atlas (HUTER)	Hospital La FE (Study Director)     III Sanger (Study Director)
Start Date: 01-Jan-2020	
End Date: N/A	Change Study Cancel
PI: Carlos Antonio Simón Vallés	
Protocol Verification/IRB Approval Date: 05-Nov-2019	

Picture 7 - LibreClinica v.01.02 List of Study Sites





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Previous pregnancy c		1 Have the patient been pregnant before?	Yes	• •
Complication descrip	Pending	2. Any complication?	Yes	v <b>=</b>
Female age		3 Complication description		
Normal Karyotype	œ	3 Completation description		•
Negative serological	•			
Pemale BMI				al and a second s
Regular menstrual fo	œ	4 Female age: 18-42 years (both included)	Yes	
Previous pregnancy s	•		165	
Tumour diagnosed	8	5 Normal Karyotype	Yes	V Note: Please select unknown option if patient's karyotype is unknown
Previous multiple pr				
1.0	œ	6 Negative serological tests for HIV, HBV, HCV, RPR	Yes	× •
Uterine_malformation	(00)	7 Female BMI: 18-30 Kg/m2 (both included)	Yes	v <b>*</b>
bacterial_interfere_				
Immunological_treatm	œ	8 Regular menstrual formula (21-35 days)	Yes	V PNote: Please select unknown if menstrual formula is not available
nsent_form	00*	9 Patients with a previous pregnancy with severe preeclampsia	Yes	V 🏴 Note: This criteria is CNLY applicable for patients with severe preedampsia. If this criteria does not ap
itents_Information	00~	(sPE), being characterized by a hypertension greater than or equal to 160/90 (systolic / diastolic blood pressure), and/or proteinuria and / or other symptoms such as edema, HELP		please mark NA.
mecological_Obstetric_Data	00~	syndrome, liver failure, renal failure and eclampsia among others		
vy of endometrial sample collection	00~	Exclusion Criteria		

Picture 8 - LibreClinica v.01.02 Data introduction page and new navigation menu

LibreClinica Home Sut	oject Matrix N	lotes & Discr	epancies Sh	ady Audit Log	Tasks *		Study Subject ID	т	Default Study (default-s	tudy) =			O root (Study Director) en	
			ault Study											
i Alerts & Messages					Subject Enrollment By Site	e				Su	bject Enrollment For Study			
Instructions –	Site	:	Enrolled	1	Expected Enrollment	1	Percentage	I	Study I Enrolled	1	Expected Enrollment	:	Percentage	1
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ferent role. Other Info —	SANGER	C		40			0%							
	site1	2		50			<b>\$%</b>							
tudy: Default Study tart Date: 23-Oct-2006					Study Progress						Subject Status Count			
nd Date: 23-Oct-2006		Event Sta	hur	1	# of Events	1	Percentage	1	Study Subject Status	ı	# of Study Subjects	:	Percentage	1
: default		LTCH 50			e or crons	5	rerenninge		Study Subject Status		a or story surjects	•	- crossing -	
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tatuses	completed			8		<b>8</b> %			removed	0			0%	
Not Started	signed			0		0%								
Scheduled	locked			1		(1%)								
Data Entry Started	skipped			1		11.96								
Stopped	stopped			1		1%								
Skipped														
Completed														
signed														
Locked														
Invalid														
ctions														

Picture 9 - LibreClinica v.01.02 layout





LibreClinica <sup>Home Sub</sup>	iject Matrix Notes & Discrepa	ancies Study Au	udit Log Tasks *		Study Subject ID	т	Default Study (default-study) *		😝 root (St	udy Director) en 💌
	Subject Matrix fo	r Default Stu	udy							
Alerts & Messages	« « » »	Records 15	5 • Show More	Add New Subject Eve	ts Select An Event •	•				
Instructions	Study Subject ID 1	evento1	evento2 eventRep	La FE Whole Uterus (1-G1)	eventDouble	sdvTest	CCHT Endometrial Biopsy (5-G2-G3)	evento3	SANGER Whole Uterus (4-G1)	Actions
Other Info 🗸	ESP-1-001-G1			et l	2		2	0	2	Q U 🛪
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atuses	ESP-1-003-G1	_		_	_	_	_	_	_	
Not Started						2	0	B	B	Q (U) 🛪
Scheduled	ESP-1-020-G2/B5		<b>2</b>		0	B		B	<b>B</b>	Q (U 🛪
Data Entry Started	ESP-1-052-G2				0	6	E .	B	<b>B</b>	Q (U) 🛪
Skipped	ESP-1-054-G2				0	в	6			۹ ७ 🛪
Completed	ESP-2-020-G1	_		_	_			_	_	
signed	137202001				0	B	B	B	E	Q (U) 🛪
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Invalid	ESP-2-024-G1	0	B B	B	B	B	B		B	Q (U) 🛪
tions	EST-5-010-G2/B5		0	B		6				۵.۵ ×
Edt	EST-5-012-G3			_					_	Q U ×
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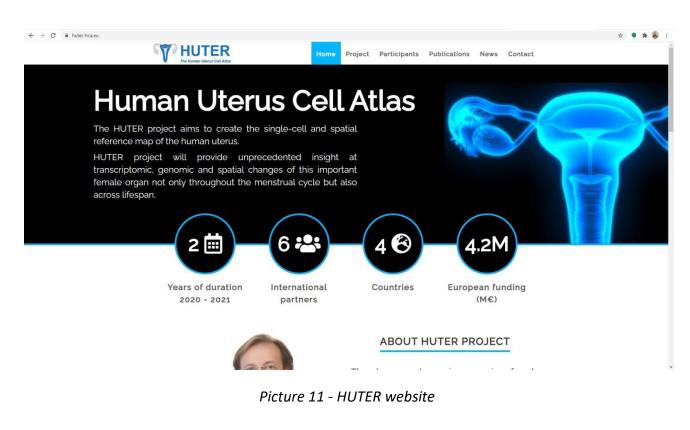
Picture 10 - LibreClinica v.01.02 Subject Matriz layout

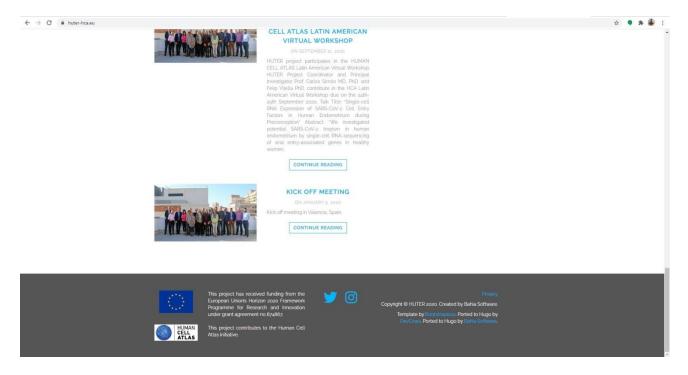
## 4.3. Website

This component contains the public HUTER official website (https://huter-hca.eu/). It will become in the core of digital communication and dissemination activities of research results throughout the lifetime of the HUTER project. It will also contain a point of access to the different private modules through securely authentication with exclusive user credentials for HUTER users. The public website portal will not host personal or sensible data and it is totally public. See related pictures from 11 to 14.





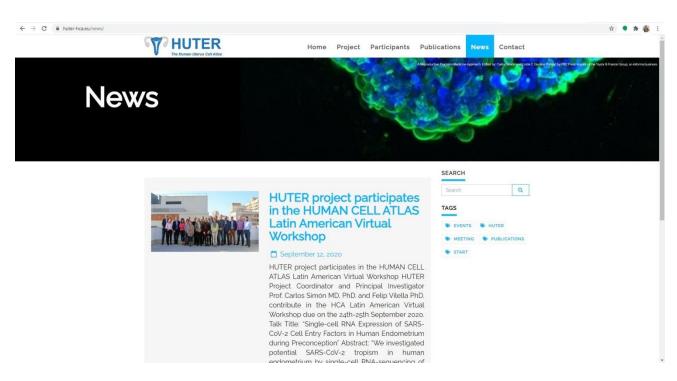




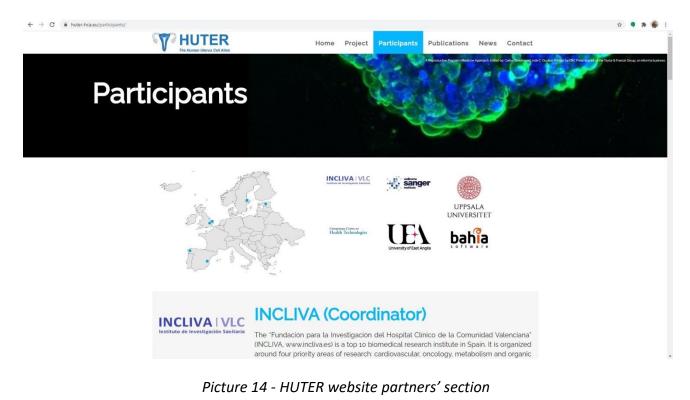
Picture 12 - HUTER website european project reference







## Picture 13 - HUTER website news section





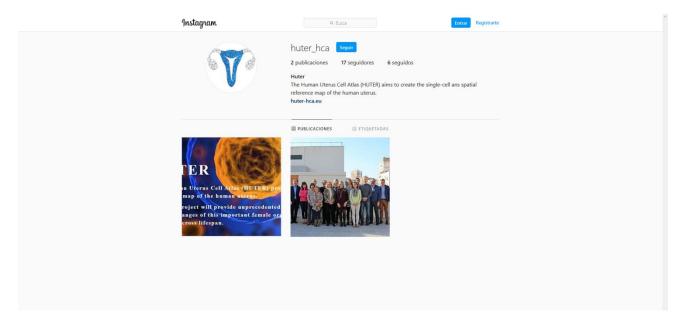


#### 4.4. Social network

Even though this is not a component deployed under the HUTER Platform, social media accounts are required as tool for HUTER dissemination aim. Accounts in two well-known social networks, Twitter and Instagram were created with the aim of improve the communication activities related to the project. Our website infrastructure is ready to support not only links to these social networks, but also specific widgets to show the last communications of HUTER on these networks. In addition, this component is open to incorporate new social networks if the project requires it (see related pictures from 15 to 17).



Picture 15 - HUTER Twitter



Picture 16 - HUTER Instagram



huter-hca.eu



#### LASTEST NEWS ABOUT HUTER PROJECT



Picture 17 - Twitter feed in HUTER website

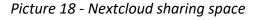
# 4.5. NextCloud + Plugins

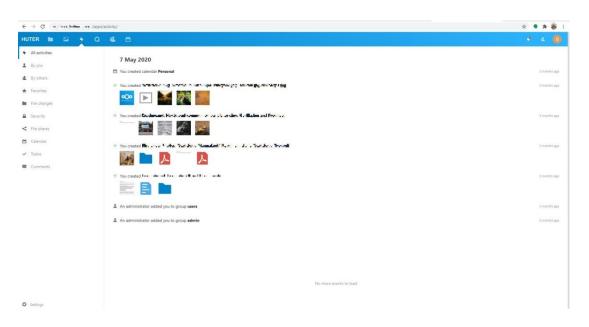
NextCloud and their plugins constitute the "intranet" component. It aims to improve the HUTER project managing tasks between partners located in different countries. For this purpose, NextCloud gathers a useful suit of open source tools, designed with a user-friendly interface for collaborative work, data sharing, videoconference, shared calendars, office tools, etc. This solution offers low adaptation period to learn to use this platform because the similarity with other popular private tools, such as Google Drive, Dropbox or Microsoft OneDrive. The data and information gathered in this module will be related to coordination tasks and documents repository (see related Pictures from 18 to 24).





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	< ··· 6.5 MB S months age
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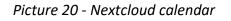


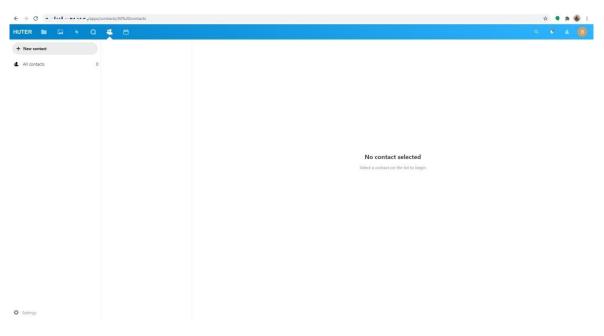
Picture 19 - Nextcloud activity dashboard





JTER 🖿 🖼 🥠								
September 2020	>	San	30	Mon 31	Tue 1	Wed 2	Thu 3	Fri Sat
New event     Today	ш							
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			13	14	15	16	17.	18
			20	21	22	23	0	25
			27	28	29	30		
			4		6			

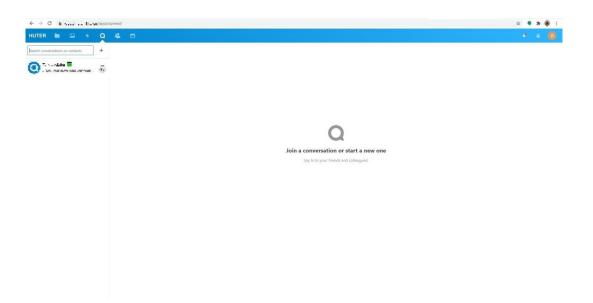


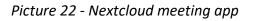


Picture 21 - Nextcloud contact list









	eetings/spps	2 <b>4</b> 9 2
	Q 46 🗂	۹ ا ا ا
Your apps	10 apps have an update available Update all	
Active apps	Brute-force settings     1.5.0     If the settings	Update to 2.0.1 Disab
Disabled apps	10 Calendar 2.0.2 V Featured	Update to 2.0.4 Disab
Updates App bundles	Community Document Server 0.1.5	Update to 0.1.7 Disabl
	Contacts 32.0 Featured	Update to 3.3.0 Disabl
Customization	Group folders 6.0.1  Featured	Update to 5.0.7 Disabl
Dashboard Files	Notifications for calendar event updates	Update to 1.0.2 Disab
Games	ONLYOFFICE     4.1.4      Featured	Update to 6.0.0 Disab
Integration	Shelderice     Ansonware protection	
Monitoring		Update to 1.6.1 Disab
Multimedia	Social Login 2.4.4	Update to 3.3.0 Disab
Office & text	Q Talk 80.5 Featured	Update to 8.0.11 Disab
Organization	★ Accessibility 1.4.0 ✓ Featured	Disab
Search	4 Activity 2.11.0 V Featured	Disab
Security	Collaborative tags 1.8.0 Featured	Disab
Social & communication	Comments 1.8.0 Featured	Disab
Flow	To Deleted files	Disab
Developer documentation >	External storage support 19.0 Featured	Disab

Picture 23 - Nextcloud plugin list 1





UTER 🖿 🖾 😽	a 4 8	۹. ۴ ۴ 🖪
Your apps	✓ Federation 1.8.0 ✓ Featured	Disabi
Active apps		
Disabled apps	File sharing 1.10.1 Featured	Disabi
Updates	10 E Log Reader 2.3.0 Featured	Disabi
App bundles	Ar Monitoring 1.8.0	Disabl
Customization	Notifications 2.6.0	Disab
Dashboard	Password policy 1.8.0 Featured	Disab
Files	DF viewer 1.7.0 🗸 Featured	Disab
Games	Photos 1.0.0 🗸 Featured	Disat
Integration	of Privacy 1.2.0 V Featured	Disab
Monitoring Multimedia	Right dick     0.15.2     ✓ Featured	Disab
Office & text	< Share by mail 1.8.0  Featured	Disab
Organization	New Support 1.1.0	Disabl
Search	Text 2.0.0 V Featured	Disab
Security		Disab
Social & communication	Update notification     1.8.0     Featured	Disab
Flow	E Versions 1.11.0 Featured	Disab
Developer documentation #	Video player 1.7.0 Veatured	Disat

Picture 24 - Nextcloud plugins list 2

# 4.6. Pipeline Manager (Cromwell) + Scalable processing backend (AWS Batch)

HUTER Platform contains an area to execute pipelines over cell sequencing data in order to analyze them or generate new results in form of new data files. HUTER platform is aligned with HCA-DCP in this regard deploying a Pipeline Manager based on Cromwell. Cromwell is one of the workflow management systems recommended by HCA that allows scientists to run pipelines written in WDL (Workflow Description Language) over data. Additionally, a scalable processing backend is enabled to handle these executions. In this case, AWS batch service was configured to dynamically provision the optimal quantity and type of computing resources (e.g., CPU or memory optimized instances) based on the volume and specific resource requirements of the batch jobs submitted.

Pipeline execution infrastructure is already deployed and working integrated with a pure AWS S3 storage. Thus, WDL can be run over training data in order to ensure analysis process workflow. The API of the deployed Cromwell is shown as evidence in Swagger format, so test executions can be done from any website. However, additional AWS S3 access is required in order to provide input data. In regards of WDL, even when git repositories are ready to store WDL files, they can be provided to Cromwell through the Swagger interface (see Picture 25).





← → C ▲ ***** ↓	🖦 🗈 👘 🗤/swagger/index.html?u	=/swagger/cromwell.yaml#/			¢ ۹	<b>* 6</b> E
	Swagger.	/swagger/cromwell.yaml		Explore		
	01-1026-05101-1-061*					
	Cromwell Serve	r REST API				
	Describes the REST API provided by a Cro	nwell server				
	BSD					
	Workflows			~		
	POST /api/workflows/{ver	ion} Submit a workflow for execution				
	POST /api/workflows/{ver	ion}/batch Submit a batch of workflows for execution				
	GET /api/workflows/{ver	ion}/{id}/labels Retrieves the current labels for a wo	rkflow			
	PATCH /api/workflows/{ver	ion}/{id}/labels Update labels for a workflow				
	POST /api/workflows/{ver	<pre>ion}/{id}/abort Abort a running workflow</pre>				
	POST /api/workflows/{ver	ion}/{id}/releaseHold Switch a workflow from 'On i	fold to 'Submitted' status			
	GET /api/workflows/{ver	ion}/{id}/status Retrieves the current state for a wor	diow			
	GET /api/workflows/{ver	ion}/{id}/outputs Get the outputs for a workflow				
	GET /api/workflows/{ver	ion}/{id}/logs Get the logs for a workflow				
	GET /api/workflows/{ver	ion}/query Get workflows matching some criteria				
	POST /api/workflows/{ver	ion}/query Get workflows matching some criteria				
		· · · · · · · · · · · · · · · · · · ·				

Picture 25 - Cromwell API in Swagger format

# 4.7. Identity and access management component

The HUTER platform will use KeyCloak software as advanced open source identity and access management system. It allows not only to configure permissions for each component and user profile but also to create an access record that ensures the accesses traceability (see Picture 26).

🗧 🔶 C 📲 🔤 🐇 🖿 ma/auth/realms/master/protocol/openid-connect/auth?client_id=security-admin-	console&redirect.uri: 💷 🕸 🕮 🚛 💷 🗤 & 2Fauth%2Fadmin%2Fmaster%2Fconsole%2F&state=96f1149b-6de6-4f2d-a494-175bc81861eb&res 🕁 🦣 🐐 👼 🗄
	Log In
	Username or email
	Password
	Log In

Picture 26 - Keycloak for HUTER SSO login page





## 4.8. S3 (infrastructure)

Amazon Simple Storage Service (S3) is an object storage service that offers industry-leading scalability, data availability and security. The infrastructure required to support S3 is ready and deployed to be used by HUTER platform. This means that HUTER platform can use it to store and protect any amount of data. Furthermore, it provides easy-to-use management features so data can be configured with finely-tuned access controls to meet HUTER specific requirements. S3 automatically creates and stores copies of all S3 objects across multiple systems so that data is available when needed and protected against failures, errors, and threats.

Some AWS S3 buckets have been created to accomplish specific functionalities like website storage or Cromwell related space for input and output files (see Picture 27).

Nombre	Tamaño Modificación
Manager and	Desconocido
📕 cf-templates-14ulohjvrnr3l-eu-west-1	Desconocido
🚨 dev.huter-hca.eu	Desconocido
🚨 huter-dev-cromwell	Desconocido
🚨 huter-dev-nextcloud	Desconocido
🚨 huter-dev-nextcloud-transfer-acceleration	Desconocido
🖳 huter-hca.eu	Desconocido
🛚 🚨 huter-prd-nextcloud	Desconocido
🖳 huter-share-files	Desconocido
Maxww.huter-hca.eu	Desconocido

Picture 27 - AWS S3 current buckets

#### 4.9. DICOM PACS

A picture archiving and communication system (PACS) is a medical imaging technology which provides economical storage and convenient access to images from multiple sources. This component is deployed over the HUTER infrastructure with the aim of storing and managing the DICOM images that comes from different advanced research microscopes of HUTER researchers (see Picture 28).





Studies Patients	MWL UWL DIFFs				-	-		
Patient name	Fuzzy Matching	Study description	Modaliity	Sending AET of Series	Study Instance UID	Order By	Web App Service	
Patient ID	Issuer of patient	20	all 🗸	Study date	Study time	SUBMIT		
Accession number	Issuer of accession numbe	Referring physician name	Institutional Department Na	Study Received			🗘 SIZE	
More	2	-			F	-		1
			1		0		17	
			4				12	

Picture 28 - dcm4chee Archive 5 web portal

# 4.10. DICOM viewer (infrastructure)

A custom infrastructure to support the state-of-art DICOM viewer compatible with advanced images to be generated by the latest single cell sequencing and microscopy techniques used by HUTER project researchers has been deployed. However, the DICOM viewer is currently under development and the final version is expected to be provided as part of Deliverable D2.4. (HUTER\_WP2\_D2.4\_Final\_implementation\_of\_data\_access\_tools\_and\_DICOM\_visualization\_tool) during month 21 of the project.

# 4.11. Monitoring & Log Management

CloudWatch is a service provided by AWS to collect monitoring and operational data in the form of logs, metrics, and events of the AWS' services and modules installed in HUTER platform. This component has been deployed and it will provide security and traceability of user actions and data in the platform (see Picture 29).





Services 🔻		β ∎urte libite s
ch	CloudWatch > CloudWatch Logs > Log g	oups > /prd/nextcloud.log > i-Occ2af9/bf0f6a5f0 Switch to the original inter
	Try CloudWatch Logs Insights CloudWatch Logs insights allows you	to search and analyze your logs using a new, purpose-built query language. To learn more, read the AWS blog 🕑 or visit our documentation 🕑.
0	Log events	C Actions V Create Metric Filter
ps	Q. Filter events	2020-02-14 (12:00:00) > 2020-02-14 (13:05:59)
	▶ Timestamp	Message
		There are older events to load. Load more.
	2020-02-14T12:59:14.246+01:00	("regid: "uSVSA649/PREEx70", "Level"), "time": "2020-02-14T11:59:08-00:00", "remoteAddr":
ies	2020-02-14T12:59:31.246+01:00	("reald":"555joaYbd0yfu0InIJS","level":3,"time":"2020-02-14TII:59:25-00:00","remoteAddr":
ns	2020-02-14T13:00:11.246+01:00	("reald": "WJ3TKrLkcE4Hf9HY9#", "level":3, time": 2020-02-14T12:00:05-00:00", "remoteAddr":
ap	2020-02-14713:04:13,246+01:00	("reald": "XS1va0dbgX0etDlffk!", "level":3, "time": "2020-02-14T12:04:07-00:00", "remoteAddr": 🐁 🖛 ", "user": ',
	2020-02-14T13:09:12.246+01:00	('reald':'%X4Fw4Pikus6xb80psf7','level':3,'time':'2020-02-14Tl2:09:07-09:00'', remoteAddr': *
Insights New	2020-02-14T13:14:12.246+01:00	("reald": "myd6/h06H7H462paU804", "level":3, "time": 2020-02-14712:14:07-00:00", "remoteAddr":
5	2020-02-14T13:19:12,246+01:00	. ("reald":"S98ta12zAP1fbNSeos6","level":3,"time":"2020-02-14T12:19:07-00:00","remoteAddr": ","user":
nce Monitoring	2020-02-14T13:24:13.246+01:00	(reald': "asr55055FRurYSHscia9", "lavel':3, "time": "2020-02-14T12:24:07+00:00", "remoteAddr": " " "user": " Juser": " Juser: "
NEW	2020-02-14T13:29:12.246+01:00	("reald":"GggY976warkiF38tilx","level":3,"time":"2020-02-14112:29:07-00:00","remoteAddr":
	2020-02-14T13:34:13.246+01:00	("reald": "Poly@spTcxsIg5TCms0", "level":3, "time": "2020-02-14T12:34:07+00:00", "remoteAddr":
or Insights	2020-02-14T13:39:12.246+01:00	("req[d":"YEFRugh494THiAdetfqi","level":3,"time":"2020-02-14T12:39:07-00:00", "remoteAddr": 🔥 🚛 ","user": • • • • • • • • • • • • • • • • • • •
n maigina	2020-02-14T13:44:12.246+01:00	("reald":"gdCBDeCline8Pi1kADUF","level':3,"time":"2020-02-14T12:44:07+00:00","remoteAddr':" 👝 🖛 ","user":' 🕳 🚛 🗰 🗰 🗰 🚛 ","app":"no app in context","method":"GET","unl':"/ocs/v2.p.
	2828-82-14T13:49:12.246+81:88	("req[d": "FDFB6570EawkF6JtHchr","level":3,"time": "2020-02-14T12:49:07+00:00", "remoteAddr": 🔥 📲 ,"user": • • • • • • • • • • • • • • • • • • •
	2020-02-14T13:54:13.246+01:00	("redd":"5f5jCvM0VlacdBw5M00","level":3,"time":"2020-02-14T12:54:07-00:00","remoteAddr": 🥠 🐨 ',"user":' • • • • • • • • • • • • • • • • • • •
shboard	2020-02-14T13:59:13.246+01:00	("reqld":"lc97srHEpxPFEpx0F11","level":3,"time":"2020-02-14T12:59:07+00:00","remoteAddr": ,"user": ,"user": ,"app":"no app in context", "method":"GET","url":"/ocs/v2.p.
Ishboard	2020-02-14T14:04:13.246+01:00	{"regId":"b0e8o&D01D0LHj4nfIS","level":3,"time":"2020-02-14T13:04:07-00:00","remoteAdd":" ","user":
	2020-02-14714:09:12.246+01:00	("reqId":"EKRdPa7IzmMInZeLEkw6","level":3,"time":"2020-02-14T13:09:07+00:00","remoteAddr": 🔹 👘 ","user": • • • • • • • • • • • • • • • • • • •
	▶ 2020-02-14T14:14:12.246+01:00	("redid":"s9WeqA6UlaEj83JUtKCt","level":3,"time":"2010-02-14T13:14:07-00:00","remoteAddr": 🔸 📲 ","user": • • • • • • • • • • • • • • • • • • •
	2020-02-14T14:19:13.246+01:00	{"reqId":"zmno1v7ja5PLRHJUtCA","level":3,"time":"2020-02-14T13:19:07-00:00","renoteAddr": 💦 ,"user": 🗰 🚛 ","user": 🗰 👘 ","sep":"no app in context","method":"GET","url":"/ocs/v2.p.
	2020-02-14T14:24:13.246+01:00	("reld":"@KU266YCFAEhIkepFA41","level"13,"time":"2010-02-14113:24:07+00:00","remoteAddr": 🧀 📲 ","user": • • • • • • • • • • • • • • • • • • •
	2020-02-14714:29:13.246+01:00	{"reald":"@v@wmloAFD0008/MGFx44","level":3,"time":"2020-02-14T13:29:07-00:00","renoteAdd":"
	2020-02-14T14:34:13.246+01:00	("reald":"lavGst8geXwEJlaFtn9r","level":3,"time":"2020-02-14113:34:07-00:00","remoteAddr": 🦾 📲 ","user": • • • • • • • • • • • • • • • • • • •
	2020-02-14T14:39:12,246+01:00	("reeld":"Xf3Eiapoq866760kAxT","level":3,"time":"2820-02-14T13:39:07-00:08","remoteAddr":

Picture 29 - Amazon Cloudwatch for HUTER Platform

# 5. NON-DEPLOYED COMPONENTS

According to the Project Plan, some tools are not deployed yet because they are in an early development stage or they are in a designing process. However, the architecture to support these tools has been fully defined in Deliverable 2.1 and it is ready to support all these tools when their development process ends. In this section these tools will be listed in order to clarify dimension of the complete HUTER Platform.

Components	Description
LibreClinica webservice layer	Service that allows the integration with LibreClinica
	registered information.
Ingestion manager	Service layer for submission managing. It allows
	broker to request access to the HUTER storage.
Broker-uploader	Client application for file uploading to HUTER
	Platform. Ensures data integrity and subject
	tracking.
Storage Manager	Service layer for file consolidation in the HUTER
	Platform.
Git repository	Storage for WDL and dockerfiles for pipeline
	definition and execution.
Docker repository	Docker repository for pipelines execution.





	Autobuild from dockerfiles.
Pipeline Web Manager	Web portal to manage Cromwell execution
	requests integration S3 storage, git WDL, metadata
	and Cromwell.
Dicom Viewer	The purpose of this viewer is to allow researchers
	to examine uterus tissues and cells with very high
	resolution from these advanced images in their
	laptops. It will allow not only the rapid
	identification of areas of interest but also
	collaborative studies of very specific cell shapes and
	arrangements that are usually associated with the
	disease. Furthermore, the DICOM viewer will have
	the capability to integrate data from very complex
	analysis that HUTER scientists will carry out with
	the proprietary software installed in their imaging
	equipment and to provide basic features for Virtual
	Microscopy approaches such as identification of
	abnormalities, addition of comments, image
	segmentation, etc. Additionally, this component
	will enable synchronisation with corresponding
	PACS component. These features will ensure an
	optimal user experience during access, visualization
	and manipulation of the digitized samples,
	simulating as far as possible the interaction with
	current visualization tools broadly used in research,
	thus the system will be intuitive, and the learning
	curve will be low.
Data Web Browser	Web application for data querying in the HUTER
	Platform. It provides the capability of download
	index files for raw data download.
Downloader	Client application for raw-data downloading from
	HUTER Platform to a device by an authorized user.
HCA Mapping Process	Support application for HCA metadata building
	based on the HUTER stores data.





Intranet access	Private area under the website for registered users
	in HUTER platform. It allows users to have a
	personal view of the platform and facilitates their
	access to application according to their profile.
Configuration Server	Service for managing application variables per
	environment. It offers a centralized point for every
	application an environment under the HUTER
	Platform. It is also needed for microservices
	scalability.
Registration and Discovery Server	These components provide a unique point to know
	microservices running instances. In works
	synchronously to Gateway and configuration server
	in order to get microservices balancing and
	scalability.
Microservices Gateway	Service that provides service load balancing and is
	integrated with Discovery service to query available
	service instances.