PLEASE COMPLETE TASK 1 BEFORE THE BEGINNING OF THE COURSE! Task 1 gives instructions for preparing the cloud environments for the hands-on exercises.

Course Format

The Practical High-Performance Computing System Administration 2022 takes place in an online format utilizing two Big Blue Button rooms.

The main room is called **HPCSA**. In this room the lecturer will present the slides and guide you through the course. HPCSA features a wide set of lecturers from the GWDG and the university, who are experts for the topics they are presenting.

As this course is intended to provide hands-on experience, the lecturers will ask you to complete exercises during the course. These exercises should be completed individually, however, you will form groups to support each other in case you get stuck. To allow for communication within said groups, each group will receive its own breakout room in BBB. The second BBB room called **HPCSA-Support** will be used for this. We will use two BBB rooms as Big Blue Button is limited, and it is currently not possible to be connected to a breakout room while also being able to listen the main room. If you need help from outside your group, feel free to ask for help in the broadcast room where the lecturer and a few helpers will be available. The format will be explained in more detail during the first session.

For the beginning of the course it is enough to join the Broadcast room.

Broadcast Room (HPCSA): https://meet.gwdg.de/b/jul-pfo-7mr-txo

Breakout Room (HPCSA-Support): https://meet.gwdg.de/b/jul-mii-pfh-shu

Please confirm before the course that you can connect to a BBB room and your microphone is working.

https://test.bigbluebutton.org/ can be used for testing your setup.

For the block course, you will use course accounts with access to GWDG cloud resources such that you can roll out your own VMs and follow along with the hands-on exercises. Follow the instructions below to prepare your frontend VM.

During the course you will deploy additional worker VMs.

The course accounts are valid until the 01.03.23.

Task 1: Prepare Cloud Environment (0 min)

Login

- 1. Open the attached file and find your username and password.
- 2. Open https://cloud.gwdg.de in your browser and select Login via AcademicID.
- 3. Use your username and password to login on the AcademicID web page.
- 4. You should be directed back to https://cloud.gwdg.de and see the OpenStack Horizon Dashboard as shown in Figure 1.

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Identity	>						
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		The date should be in YYYY-MM-DD format	te deuge.				
		2023-02-14	to 2023-02-15	Submit			

Figure 1: GWDG OpenStack Horizon Dashboard

If you are already logged in on AcademicID with a different account, you need to switch to the course account. In order to do so, you can clear your browser cache or switch to a different browser.

Instance Launch

- 1. One the left side, under **Compute** tab, select **Key Pairs**. You should see the menu as shown in Figure 2
- 2. Click on **Create Key Pair** and name it **hpcsa-course-vm-key**. See Figure 3 for reference.

This will create a key pair and download the private key to your computer, which will be required later to connect to the machine.

You should see the created key pair as shown in Figure 4

- 3. One the left side, under **Compute** tab, select **Instances**. The instances overview should show no instances as shown in Figure 5
- 4. Click on **Launch Instance**. This will open a dialog as shown in Figure 6
- 5. In the new dialog, name your instance **cluster-manager** and press **Next**.
- 6. Find CentOS Stream 8 Server x86_64 (ssd) in the list and click on the arrow on the right.
- 7. Set **Delete Volume on Instance Delete** to **Yes**. Check that the dialog looks as shown in Figure 7 and press **Next**.
- 8. Find **m1.large** in the list, click on the arrow to the right Verify that the dialog looks as shown in Figure 8 and press **Next**.
- 9. Under **Networks** press the arrow on the right for the **private** but NOT for the **private-pxe** network.

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Figure 2: OpenStack Key Pairs

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Compute 🗸	Key Pairs	hpcsa-course-vm-key 🗸	key pair name you will recognize. Names may only include alphanumeric characters, spaces, or dashes.		
Overview					
Instances	Q Click here for filters.	¥ Cancel	+ Create Key Pair	Create Key Pair	Limport Public Key
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Figure 3: OpenStack Create a Key Pair

This is shown in Figure 9. Confirm that only the **private** network and NOT the **private-pxe** network is added and press **Next**.

- 10. Leave **Network Ports** as they are and press **Next**.
- 11. Confirm that for **Security Groups**, the default security group is set such that it looks as shown in Figure 10 and press **Next**.

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Figure 4: OpenStack Key Pair created

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- In the Key Pair dialog, ensure that your key pair is selected and if it is not, move it up by pressing the arrow on the right. Confirm that it looks as shown in Figure 11.
- 13. Press Launch Instance to launch the instance and it should look like Figure 12.

This will launch a new VM running CentOS 8 with the public key of your key pair already installed.

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Figure 6: OpenStack Launch Instance dialog

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Overview		Flavor *	Select Boot Source Image Volume Size (CB) *	Ves	New Volume	nce Delete		•		Filter	A Launch Instance
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Figure 7: OpenStack Set Source dialog

However, the setup is not complete as an additional network must be attached and a public IP address must be assigned.

Furthermore, the worker nodes need to be prepared.

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	Network >		Configuration	> m1.small	1	2 GB	20 GB	20 GB	0 GB	Yes	•				
	Orchestration >		Server Groups	> c1.medium	4	4 GB	40 GB	40 GB	0 GB	Yes	•				
Identity	>		Scheduler Hints	> m2.small	1	4 GB	20 GB	20 GB	0 GB	Yes	•				
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				> m2.medium	2	8 GB	40 GB	40 GB	0 GB	Yes	•				
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				> m2.large	4	16 GB	80 GB	80 GB	0 GB	Yes	•				
				> m1.xlarge	8	16 GB	160 GB	160 GB	0 GB	Yes	*				
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Figure 8: OpenStack Set Flavor dialog

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Attaching an Additional Network

- 1. Wait for the **cluster-manager** instance to finish provisioning and reach the status **Active**.
- 2. From the Actions drop down menu find the Attach Interface option as shown in Figure 13 and press it.

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Figure 10: OpenStack Set Security Groups dialog

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	API Access		Details	A key pair allows you to SSH into your newly created instance. You may select an existing key pair, import a key pair, or generate a new key pair.		
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	Veluces -		Key Pair	Displaying 1 item		
	volumes >		Configuration	✓ Available		
	Network >		Server Groups	Q Click here for filters.		
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				Displaying 0 items		
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Figure 11: OpenStack Set Key Pair dialog

- 3. In the new Attach Interface dialog, select the private-pxe network in the Network drop-down menu as shown in Figure 14 and confirm by pressing Attach Interface.
- 4. The **cluster-manager** instance should now have two IPs in the **IP** Address column.

Attaching a network after a node was already initialized does not correctly configure the new network inside the node. In order to complete the setup, the new interface must be created and configured on the node itself.

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Figure 12: OpenStack Instances; cluster-manager launching

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Key Pairs	Instance Name Image N	lame IP Address Flavor	Key Pair Sta	us Availability Zone 1	Task Power State Tim	e since created Actions
Server Groups	cluster-manager -	10.254.1.12 m1.large	hpcsa-course-vm-key Acti	ve 🖃 nova. M	None Running 2 mi	inutes Create Snapshot 👻
Volumes > Network > Orchestration > Identity >	Displaying 1 item					Associate Floating IP Attach Interface Edit Instance Attach Interface Detach Interface Detach Volume Detach Volume Udate Metadata Edit Security Groups Edit Port Security Groups Console View Log Pause Instance Suspend Instance Sheke Instance Hard Rebot Instance Hard Rebot Instance Shit Of Instance Build Instance Build Instance Build Instance Build Instance Build Instance Build Instance



The instructions for this can be found on the **Configure Network** sheet and should be completed after this sheet.



Figure 14: OpenStack Attach Interface dialog

Adding a Floating IP Address

1. For your cluster-manager instance, open the drop-down menu in the Actions column and find the Associate Floating IP option as shown in Figure 15 and press it.

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Figure 15: OpenStack Instances; Associate Floating IP option

2. If under IP Address it says No floating IP addresses allocated, press on the plus button next to it

as shown in Figure 16.

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	Ove	rview				Port to be associated *							
		Inces				cluster-manager: 10.254.1.12 -				Filter	Launch Inst	stance 🛙 🗑 Delete Insta	Inces More Actions -
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	Volumes	>	Cluster-manager		private-px	e-11c8a6f79c4541d69a6e2ea26aba8cd3	m1.large hpcsa-course-vm-key Active	💼 nova		None I	Running	3 minutes	Create Snapshot 👻
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Figure 16: OpenStack Managing Floating IP Associations dialog; missing IP

3. In the new Allocate Floating IP dialog press Allocate IP without changing anything as shown in Figure 17.

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Compute	te 🗸	Instances		public •	Description: Allocate a floating IP from a given floating IP pool.				
	Overview Instances			Description	Project Quotas Floating IP 0 of 3 Used		Filter Launch Ir	istance 📋 Delete Insta	Inces More Actions -
	Images Key Pairs	Displaying 1 item	IP Address			vailability Zone	Task Power State	Time since created	Actions
s Volumes Network	Server Groups	cluster-manager -	private-11 10.254.1.12 private-px 10.0.0.17	e-11c8a6f79c4541d69a6e2ea26aba8cd3	Cancel Allocate IP	nova	None Running	3 minutes	Create Snapshot 👻
Orchestrati	tion >	Displaying 1 item							
(dentity	,								

Figure 17: OpenStack Allocate Floating IP dialog

4. Back in the Manage Floating IP Associations dialog, select an IP address in the IP Address dropdown menu and make sure that Port to be associated is set to your cluster-manager as shown in Figure 18.

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.	GWDG•G	WDG_AGC_HPCS			-			_			畠 gkrs48	00@gast.gwdg.de -
Project	~				Manage Floating IP Associations			×				
	API Access	Project / Compute /	Instances		IP Address *	Select the IP address you wi	sh to associate with the					
	Compute 🗸	Instances			141.5.101.14 • +	selected instance or port.						
	Overview				Port to be associated *							
	Instances				cluster-manager: 10.254.1.12 -				Filter	Launch Ir	Balance Delete Inst	ances More Actions -
	Images Key Beiro	Displaying 1 item	Image Name	IP Address			Cancel Associate	vailability Zone	Task	Power State	Time since created	Actions
	Server Groups			private-11	c8a6f79c4541d69a6e2ea26aba8cd3							
	Volumes >	Cluster-manager		10.254.1.12 private-px 10.0.0.17	e-11c8a6f79c4541d69a6e2ea26aba8cd3	m1.large hpcsa-course-v	m-key Active ⊯°	nova	None	Running	3 minutes	Create Snapshot 👻
c	Orchestration >	Displaying 1 item										
Identity	>											

Figure 18: OpenStack Managing Floating IP Associations dialog

 Make a note of the IP address and confirm by pressing Associate. Confirm that the IP address appears for the cluster-manager in the IP Address column as shown in Figure 19

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÷.	🖻 GW	DG•GWI	DG_AGC_HPCSA	_gkrs4800 ·								å gkrs48	00@ga	st.gwd	j.de 🔻
Project		~	Project / Compute / In	istances											
	Compute	API Access	Instances												
		Overview													
		Instances					Instance ID = •			Filter	Launch In	stance f Delete Inst	ances	More Ac	lions 🕶
		Images	Displaying 1 item												
		Key Pairs	Instance Name	Image Name	IP Address	Flavor	Key Pair	Status	Availability Zone	Task	Power State	Time since created	Action	15	
	Ser	ver Groups			private-11c8a6f79c4541d69a6e2ea26aba8cd3										
	Volumes	>			10.254.1.12										
	Network	>	Cluster-manager	-	Hoating IPs: 141.5.101.14	m1.large	hpcsa-course-vm-key	Active iii	nova	None	Running	5 minutes	Crea	te Snapsh	ot 💌
	Orchestration	>			private-pxe-11c8a6f79c4541d69a6e2ea26aba8cd3 10.0.0.17										
Identity		>	Displaying 1 item												

Figure 19: OpenStack Instances; cluster-manager fully set up

The next step is to set up 2 worker instances using the PXE boot volume snapshot.

This does not provide them with a full operating system, instead, their setup will be completed as part of the WareWulf hands-on exercise.

Provisioning Worker Nodes

1. Click on Launch Instance, name the new instances worker and set the Count to 2. Confirm that it looks as shown in Figure 20 and press Next.

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Project 🗸	Project / Compute / Instances	Launch Instance		×			
API Access Compute 🗸	Instances	Details Source *	Please provide the initial hostname for the instance, the availability zone when count. Increase the Count to create multiple instances with the same settings. Instance Name *	e it will be deployed, and the instance Total Instances			
Overview		Flavor *	worker Description	(3 Max)	Filter & Launch I	nstance	ances More Actions +
Images Key Pairs	Displaying 1 item Instance Name Image Nam	Network Ports	Availability Zone	1 Current Usage 2 Added	Task Power State	Time since created	Actions
Server Groups Volumes > Network >	Cluster-manager -	Key Pair Configuration	nova Count*	0 Remaining	None Running	1 hour, 24 minutes	Create Snapshot 👻
Orchestration >	Displaying 1 item	Server Groups Scheduler Hints Metadata					
		× Cancel	< Bac	k Next > A Launch Instance			

Figure 20: OpenStack Launch Instance worker dialog

Under Source select Volume Snapshot as the Boot Source from the drop-down menu, set Delete Volume on Instance Delete to Yes and select the PXE-Boot volume snapshot by clicking on the arrow to the right.

Confirm that it looks as shown in Figure 21 and press **Next**.

- 3. Under **Flavor** select **c1.medium** flavor by pressing the arrow to the right. Confirm that it looks as shown in Figure 22 and press **Next**.
- 4. Under **Networks** select the **private-pxe** network and NOT the other **private** network as shown in Figure 23 and press **Next**.
- 5. Leave **Network Ports** as they are and press **Next**.
- 6. Under **Security Groups** remove the **default** security group by pressing the arrow on the right such that no security groups are set as shown in Figure 24 and press **Next**.
- 7. Under **Key Pair** remove the **hpcsa-course-vm-key** if it is selected by pressing the arrow on the right such that it looks as shown in Figure 25 and press **Launch Instance**.
- 8. Observe that two new instances, **worker-1** and **worker-2** appear and become ready after a short time as shown in Figure 26.

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	horizon/project/instances/					요 8	2 9 E =
GWDG • GWDG_AGC_HPCSA_gkrs480	Launch Instance			×		Langer Section Sectio	gast.gwdg.de -
Project Project / Compute / Instances API Anness	Davida	Instance source is the template used to creat	e an instance. You can use an image, a snaps	hot of an instance (image 👩			
	Source	snapshot), a volume or a volume snapshot (if new volume.	enabled). You can also choose to use persist	ent storage by creating a			
Overview	Flavor *	Select Boot Source Volume Snapshot	Ves No	Delete			
Instances Images Displaying 1 item	Networks *	Allocated			Filter & Laund	Ch Instance	More Actions -
Key Pairs Instance Name Image Nam	Network Ports	Name Description	Size Created	Status	Task Power Sta	te Time since created Ac	tions
Server Groups	Key Pair	> pxe-ooot-1	1 GB 2/15/23 2:34 PM	available			
Volumes > cluster-manager	Configuration	Q Click here for filters.		Select one	None Running	5 minutes	zreate Snapshot 👻
Orchestration >	Server Groups	Name Description	Size Created	Status			
Identity Displaying 1 item	Scheduler Hints		No available items				
	metavata						
	* Cancel		< Back Next >	Launch Instance			

Figure 21: OpenStack Set Source worker dialog

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Project 🗸		Launch Instance								×			
API Access	Project / Compute / Instances	Details	Flavors manage t	he sizing for	the compute,	memory and s	torage capacity	of the instance.		0			
Compute 🗸	Instances	Source	Name	VCPUS	RAM	Total Disk	Root Disk	Ephemeral Disk	Public				
Overview		Flavor	> c1.medium	4	4 GB	40 GB	40 GB	0 GB	Yes	•			Mars Antiana a
Instances	Dicplaying 1 item	Networks *	✓ Available (21						2-1	Filter	E Delete Insta	Aces More Actions +
images Kev Pairs	Instance Name Image Nat	Network Ports	Q Click here	for filters.						×	Task Power State	Time since created	Actions
Server Groups		Security Groups	Name	VCPUS	RAM	Total Disk	Root Disk	Ephemeral Disk	Public				
Volumes >		Key Pair	> c1.small	2	2 GB	20 GB	20 GB	0 GB	Yes	•			
Network >	Cluster-manager -	Configuration	> m1.small	1	2 GB	20 GB	20 GB	0 GB	Yes	1	None Running	2 days, 2 hours	Create Snapshot 👻
Orchestration >		Server Groups	> m2.small	1	4 GB	20 GB	20 GB	0 GB	Yes	•			
Identity >		Scheduler Hints	> m1.medium	2	4 GB	40 GB	40 GB	0 GB	Yes	•			
	Displaying 1 item	Metadata	> c1.large	A 8	8 GB	80 GB	80 GB	0 GB	Yes				
			> m2 medium	2	8 GB	40 GB	40 GB	0.68	Yes				
			> millions	-	8 CB	10 GB	90 CB	0.08					
			> millarge	4	8 GB	80 GB	80 GB	UGB	res	^			
			c1.xlarge	A 16	A 16 GB	160 GB	160 GB	0 GB	Yes	1			
			> m2.large	4	A 16 GB	80 GB	80 GB	0 GB	Yes	1			
			> m1.xlarge	<u>A</u> 8	🔺 16 GB	160 GB	160 GB	0 GB	Yes	*			
			> c1.xxlarge	A 16	🔺 32 GB	160 GB	160 GB	0 GB	Yes	•			
			s of Sularao	00 1	A 32 GB	160 GB	160 CB	0.GR	Vor				

Figure 22: OpenStack Set Flavor worker dialog

Rebooting Instances

When working with VMs, it might be necessary to reboot them via an external command. In the **Instances** view of OpenStack, the **Actions** drop-down menu for each instances reveals the option to **Soft Reboot Instance** and **Hard Reboot Instance** as shown in Figure 27.

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	0.*	≜ gkrs4800@gast.gwdg.de ▼
Project 🗸	Launch Instance	
Project / Compute / Instances API Access	Details Networks provide the communication channels for instances in the cloud.	
Compute J Instances	✓ Allocated ① Select networks from those listed below.	
Overview	Source Network Subnets Associated Shared Status	
Instances	private-pxe-11c8a	Filter Caunch Instance Delete Instances More Actions -
Images Displaying 1 item	t > 6/79c4541d69a6e 2ea26aba8cd3 No Up Active ↓ 11c8a6/79c4541d69a6e2ea26aba8cd3 No Up Active ↓	
Key Pairs 🔲 Instance Name Image Nam	Network Ports	Task Power State Time since created Actions
Server Groups	Security Groups	
Volumes >	Key Pair	
Network > Cluster-manager -	Configuration Network Subnets Associated Shared State	None Running 5 minutes Create Snapshot •
Orchestration	Server Groups private-11c8a6/79c4 > 541d69a6e2ea26aba private-subnet- 11c8a6/79e4541d69a6e2ea26aba No Up Active	
Identity > Displaying 1 item	Scheduler Hints 8cd3	
	Metadata	
	Cancel	

Figure 23: OpenStack Set Networks worker dialog

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₫.	🖻 GWDG • GWI	DG_AGC_HPCSA_gkrs480	0 ~						å gkrs48	
Project	~		Launch Instance				×			
	API Access	Project / Compute / Instances	Details	Select the security groups to launce	h the instance in.		0			
	Compute 🗸 🗸	mstances	Source	Name	Description					
	Overview		Flavor	Select of	ne or more security groups from	n the available groups below.		Cilere Al aunch I	netanca di Distata Inc	More Actions w
	Instances	Displaying 1 item	Networks	✓ Available ①		Sele	ect one or more	Filter		
	Images Key Pairs	 Instance Name Image Name 	Network Ports	Q Click here for filters.			×	Task Power State	Time since created	Actions
	Server Groups		Security Groups	Name	Description					
	Volumes >		Key Pair	> default	Default security group		•			
	Network >	Cluster-manager -	Configuration					None Running	5 minutes	Create Snapshot 👻
Or	chestration >		Server Groups							
Identity	>	Displaying 1 item	Scheduler Hints							
		Displaying I term	Metadata							
			× Cancel			<back next=""> 💁 Laur</back>	nch Instance			
							_			

Figure 24: OpenStack Set Security Groups worker dialog

Connecting with SSH

- 1. Find the **hpcsa-course-vm-key.pem** you downloaded in your **Downloads** folder or where you have saved it and move it into your user folder.
- 2. Open a terminal and confirm that you have **SSH** installed by following the platform specific instructions:

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••		Launch Instance			×		_	_
Project 🗸	Project / Compute / Instances							
API Access	Instances	Details	A key pair allows you to SSH into your newly o or generate a new key pair.	created instance. You may select an existing key pair	r, import a key pair,			
Compute 🗸	Instances	Source	+ Create Key Pair					
Overview		Flavor	Allocated					
Instances		Networks	Displaying 0 items			Filter 🔷 Launch Ir	istance 📋 Delete Instan	ces More Actions -
Images	Displaying 1 item		Name	Fingerprint				
Key Pairs	Instance Name Image Name	Network Ports	Select a ke	y pair from the available key pairs below.		Task Power State	Time since created	Actions
Server Groups		Security Groups	Displaying 0 items					
Volumes >		Key Pair	✓ Available ①		Select one			
Network	Cluster-manager -	Configuration			Concertorie	None Running	5 minutes	Create Snapshot -
		Server Groups	Q Click here for filters.		×			
Orchestration >		Sebeduler Hinte	Displaying 1 item					
Identity >	Displaying 1 item	Scheduler Hints	Name Finge	rprint				
		Metadata	> hpcsa-course-vm-key 56:0c	fc:f9:59:f7:57:6c:63:5b:64:b3:36:45:bb:de	^			
			Displaying 1 item					
		* Cancel		(Back Next)	Launch Instance			

Figure 25: OpenStack Set Key Pair worker dialog

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Project v Project / Compute / Instances API Access Compute v Instances Overview Unstances Develope a term	d)
images Uspraying stems Kow Paire Instance Name Image Name IP Address Flavor Key Pair Status Availability Zone Task Power State Time	me since created Actions
Server Groups vorker-2 - 10.0.0.1 c1.small - Active w ⁰ nova None Running 0 mir	minutes Create Snapshot 💌
Volumes > uvorker-1 - 10.0.0.13 c1.small - Active # nova None Running 3 min	minutes Create Snapshot 💌
Network private-11c8a6f79c4541d69a6e2ea26aba8cd3 Orchestration 0254.12 Identity Pating Price Pating Price Pating Price 115.501.14 m1.large private-price3eaD8cd3 100.0.7	2 minutes Create Snapshot +

Figure 26: OpenStack Instances; cluster-manager and 2 workers

Windows 10/11

- 1. Search for **Powershell**, right click, run as administrator
- 2. Get-WindowsCapability -Online|Where-Object Name -like '*SSH*'
 If SSH client is not installed run the following command:
 Add-WindowsCapability -Online -Name OpenSSH.Client~~~0.0.1.0

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Project	Al Compute Serve Volumes Network Orchestration	API Access O Overview Images Key Pairs Server Groups a > in >	Project / Compute / Instances												
			Ins	stances											
							Instance	e ID = 🗸			Filter 🗅	Launch Ins	tance (Quota exc	eeded) 💼 Delete Ins	tances More Actions -
			Displ	aying 3 items											
			0	Instance Name worker-2	Image Name	IP Address 10.0.0.1	c1.small	Key Pair	Active	L.	Availability Zone	Task None	Power State	0 minutes	Create Snapshot -
			0	worker-1		10.0.0.13	c1.small		Active	e î	nova	None	Running	3 minutes	Create Snapshot 👻
Identity				cluster-manager		private-11c8a6f79c4541d69a6e2ea26aba8cd3 10254.1.12 Floating IPs: 1415.101.14 private-pxe-11c8a6f79c4541d69a6e2ea26aba8cd3 10.0.0.17	m1.large	hpcsa-course-vm-key	Active	L.	nova	None	Running	12 minutes	Associate Floating IP Attach Interface Detach Interface Edit Instance Attach Volume Detach Volume Update Metadata
			Displ	aying 3 items											Eail Section (Souges Console Eait Port Security Groups Console View Log Pause Instance Pause Instance Pause Instance Backs Instance Hard Reboot Instance Hard Reboot Instance Shut Of Instance Backar Instance Delete Instance



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Project	t 🗸		Proj	ect / Compute / I	Instances	_	Rew Tab Displit View V Bookmarks V Achieved 600 hpcsa-course-vm-key.pen		ıy 📄 Paste	Q Find	F
	Compute	~	Ins	stances			✓ ssh -i <u>hpcsa-course-vm-key.pem</u> cloud@141.5.101.14 The authenticity of host '141.5.101.14 (141.5.101.14)' can't be established.				
	Over	view					ED25519 key fingerprint is SHA256:4luVRnkIOHeJVImmHll4hxoqTtYbLr6mUrHcNfR9MOM. This key is not known by any other names.				
	Insta	nces					Are you sure you want to continue connecting (yes/no/[fingerprint])? yes Warning: Permanently added '141.5.101.14' (ED25519) to the list of known hosts.				tions 🕶
	Ima	ages	Displa	aying 3 items			***************************************				
	Key F	Pairs	0	Instance Name	Image Name	IP Address	# The password for the user: cloud # # has been set to: w9fhEet6 #				
	Server Gro	oups		worker-2		10.0.0.1	# ****				pt 💌
	Volumes	>	0	worker-1		10.0.0.13	Please memorize this password, since this message will not be shown again.				pt 👻
	Network	>				private-11c8a6f79c4541d69a6e2ea26aba	g Thank you for using GWDG services.				
(Drchestration	>				10.254.1.12	[cloud@cluster-manager ~]\$				
Identity		>	0	cluster-manager		Floating IPs:					pt 👻
						private-pxe-11c8a6f79c4541d69a6e2ea26					
						10.0.0.17					
			Displa	aying 3 items							

Figure 28: OpenStack Instances; Terminal connected with SSH

3. Confirm that it works by running ssh -V

MacOS/Linux

- 1. Search for **Terminal** and open it
- 2. Check ssh is provided by running the command ssh -V

On MacOS/Linux you need to set the correct permission for the **hpcsa-course-vm-key.pem** key before it can be used with SSH.

Run chmod 600 hpcsa-course-vm-key.pem in the same folder as the key.

Using SSH

- 1. In PowerShell or Terminal type the following command ssh -i hpcsa-course-vm-key.pem -o ServerAliveInterval=60 cloud@YOUR_IP where YOUR_IP is the IP address you got earlier.
- 2. When asked whether you want to continue, type in **yes** . See Figure 28 for comparison.
- 3. Confirm that running hostname returns cluster-manager.novalocal.

After getting a running shell on the cluster-manager, follow the instructions provided in the **Configure Network** sheet to finalize the setup of the cluster-manager.