

# Ansys Remote Solve Manager: Simulations on HPC Clusters

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# Plan

- 1 Introduction: Ansys and Remote Solve Manager (RSM)
- 2 RSM Setup and Usage on Emmy
- 3 Takeaways

# Ansys: Extensive Multiphysics Simulation Suite

## Fluid mechanics

- Ansys Fluent
- Ansys PolyFlow
- Ansys Mechanical
- Ansys LS-DYNA
- **Ansys CFX**
- Ansys FORTE
- Ansys Discovery
- Ansys ICEM-CFD
- Ansys Chemkin

## Electronics

- Ansys HFSS
- Ansys Icepak
- Ansys Maxwell
- Ansys Redhawk
- Ansys SCADE
- Ansys PowerArtist

## Optical

- Ansys Lumerical

## Pre-/Post-processing

- Ansys Spaceclaim
- Ansys DesignModeler
- **Ansys Workbench**
- Ansys DesignXplorer
- **Ansys RSM**
- Ansys CFD-Post
- Ansys Enight
- PyAnsys
- Ansys System Coupling

# Where to Run Ansys Simulations?

## Workstation

- Limited computational resources

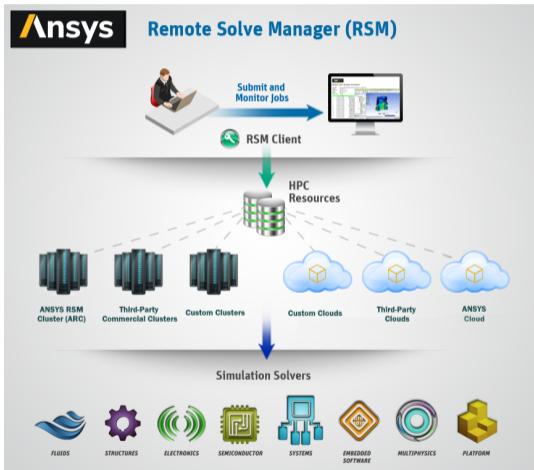
## HPC cluster: Batch script

- Manual transfer of case and custom Slurm batch script
- Flexible: Access to all solver parameters

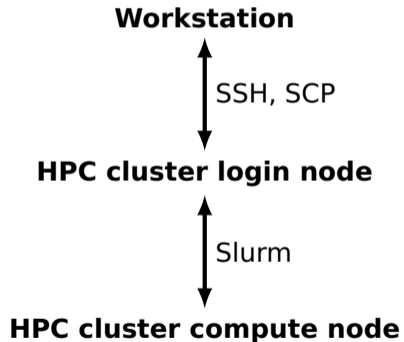
## HPC cluster: RSM

- Control simulations via Workbench on workstation
- Graphical setup and execution of jobs
- Requirement: Ansys including license on workstation and cluster

# RSM: Structural Overview



Source: Image used courtesy of ANSYS, Inc



# Ansys on NHR System Emmy

## Versions

- Available modules

```
$ module avail ansys
```

- We use `ansys/2024.1` on Emmy phase 3 (login nodes and partitions)

## Access

- Installations accessible to Unix group `ansys`
- Request access via [nhr-support@gwdg.de](mailto:nhr-support@gwdg.de)

## Licenses

- Add Slurm option `-L aa_r` to jobs
- Status via Slurm bookkeeping

```
$ scontrol show lic
```

# Outline: From Setup to First Test Job

- 1 Access Emmy via SSH Key and SSH agent
- 2 Preparations on Emmy
- 3 Configuring RSM on workstation
- 4 Submitting jobs via Workbench

## Access Emmy via SSH Key and SSH agent

Needed because password or passphrase cannot be entered in RSM

- Login via SSH key (required anyway on Emmy: <https://s.gwdg.de/EolyEV>)
- Use SSH agent to unlock key with passphrase (next slides)



# Access Emmy via SSH Key and SSH agent

## Linux

Many Linux desktops include an SSH agent by default

- Establish SSH connection to Emmy in terminal

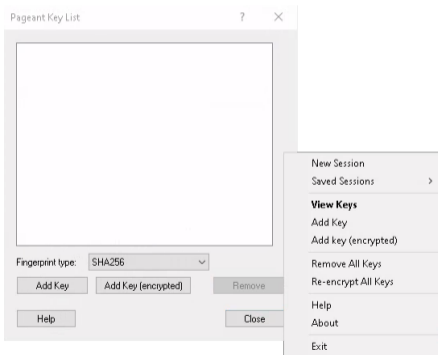
```
workstation:~$ ssh USERNAME@glogin-p3.hpc.gwdg.de
```

- Pop-up opens in which SSH agent requests passphrase to unlock SSH key
- Repeat after starting new desktop session, e.g. reboot

# Access Emmy via SSH Key and SSH agent

## Windows with PuTTY

The MSI installer of PuTTY includes an SSH agent called Pagent



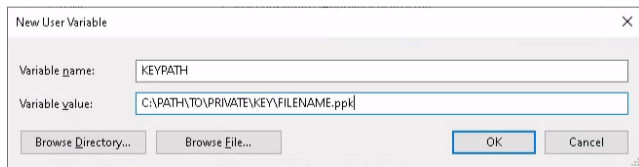
- Start Pagent
- Right-click on the respective system tray icon and choose *View Keys*
- Choose *Add Key*, select your private key (ppk file) and enter passphrase
- Close Pagent window
- Repeat steps after each reboot

# Access Emmy via SSH Key and SSH agent

## Windows with PuTTY

For RSM to find the key, we have to set the `KEYPATH` environment variable

- Open Control Panel and search for Environment Variables
- Open Edit environment variables for your account in results
- In the section User variables, click New
- As Variable name choose `KEYPATH` and use the button Browse File to select your private key (ppk file) including the path as Variable value



## Preparations on Emmy

- Connect to `glogin-p3@hpc.gwdg.de` (Emmy phase 3) via PuTTY/SSH
- Edit `~/ .bashrc` in your Emmy home directory
  - ▶ To ensure that RSM finds the Ansys executables append the line

```
module load ansys/2024.1 &> /dev/null
```

- ▶ For Intel MPI supplied by Ansys to work with Slurm 23.11 or newer append

```
export I_MPI_HYDRA_BOOTSTRAP=ssh
```

- Create a directory for RSM in your scratch directory and show its path

```
gloginXY:~$ mkdir $WORK/ansys-rsm  
gloginXY:~$ ls -d $WORK/ansys-rsm
```

# Configuring RSM on Workstation

## HPC Resource

### ■ Open the Ansys tool

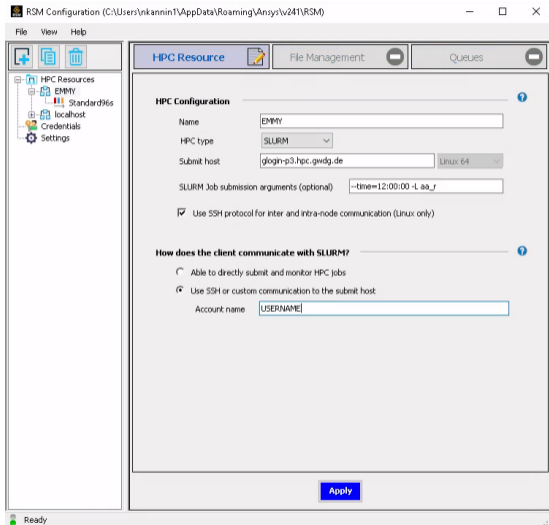
RSM Configuration 2024 R1  
(Windows) or `rsmclusterconfig`  
(Linux terminal)

### ■ Click Add HPC Resource

### ■ Configure resource as in screenshot

- ▶ Provide your USERNAME
- ▶ Note license specification `-L aa_r`

### ■ Click Apply



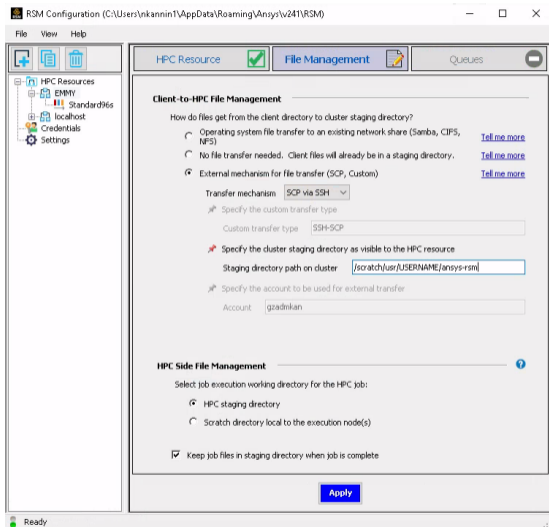
Source: Image used courtesy of ANSYS, Inc

# Configuring RSM on Workstation

## File Management

### ■ Configure as in screenshot

- ▶ Staging directory path on cluster equals `$WORK/ansys-rsm` created before



Source: Image used courtesy of ANSYS, Inc

# Configuring RSM Queues

- Click button  
Import/Refresh HPC Queues
- For queue Standard96s check  
Enabled and click Apply
- Click Submit for queue to start test job
  - ▶ Remark: Job visible on Emmy via

```
$ squeue --me
```
  - ▶ Status changes from question to checkmark after about 15 minutes
- RSM ready to use

RSM Configuration (C:\Users\nkannin1\AppData\Roaming\Ansys\v241\RSM)

File View Help

HPC Resource  File Management  Queues

Queues from SLURM on 'EMMY'

Enabled	RSM Queue	SLURM Queue	Test	Status	Report
<input type="checkbox"/>	Medium96s:test	medium96s:test	submit	?	
<input type="checkbox"/>	React	react	Submit	?	
<input type="checkbox"/>	Standard96	standard96	Submit	?	
<input type="checkbox"/>	Standard96:e17	standard96:e17	Submit	?	
<input type="checkbox"/>	Standard96:e18	standard96:e18	Submit	?	
<input type="checkbox"/>	Standard96:shared	standard96:shared	Submit	?	
<input type="checkbox"/>	Standard96:ssd	standard96:ssd	Submit	?	
<input type="checkbox"/>	Standard96:test	standard96:test	Submit	?	
<input checked="" type="checkbox"/>	Standard96s	standard96s	Submit	✓	
<input type="checkbox"/>	Standard96s:shared	standard96s:shared	Submit	?	
<input type="checkbox"/>	Standard96s:test	standard96s:test	Submit	?	
<input type="checkbox"/>	Vis	vis	Submit	?	

Apply

Ready

Source: Image used courtesy of ANSYS, Inc

# Submitting Jobs via Workbench

## Opening Case in Workbench

We use a CFX test case provided by Ansys, you can use your own case

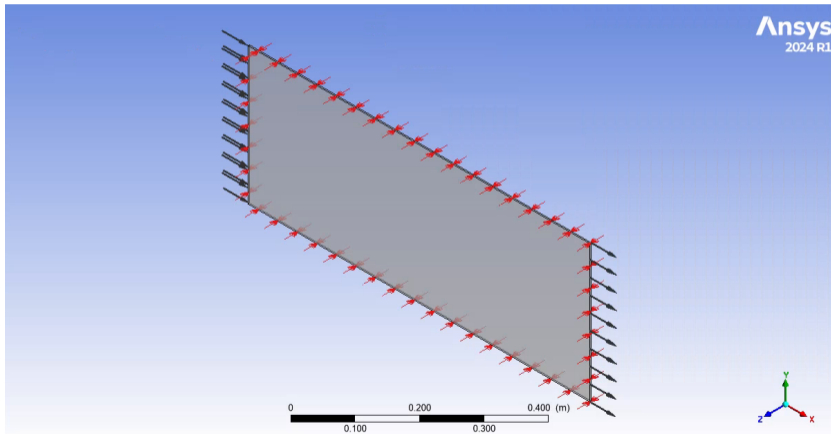
- Start Workbench 2024 R1 (Windows) or runwb2 (Linux terminal)
- Select Help/Ansys Workbench Help to open Ansys portal in browser
- In search field select Search all products, search CFX download test case
- On Fluid Dynamics Verification Manual > 1.6. Downloading the Project Files **download** VM2024R1\_Fluids.zip **and extract**



# Submitting Jobs via Workbench

Test Case VMFL019B

This case describes Transient Flow Near a Wall Set in Motion



Source: Image used courtesy of ANSYS, Inc

# Submitting Jobs via Workbench

## Opening Case in Workbench

- Back in Workbench create a new project with `File/New` and then `File/Save`
- Import via `File/Import` from the extracted zip archive  
`VM2024R1-CFX\VMFL019B_CFX_WB.wbpz`

Now the case would run on the workstation, it remains to reconfigure it to use Emmy via RSM

# Submitting Jobs via Workbench

## Running Case via RSM

The screenshot displays the ANSYS Workbench interface for a project named 'test-case - Workbench'. The 'Project Schematic' on the left shows a hierarchy with 'A' containing 'CFX', 'Setup', 'Solution', and 'Results'. The 'Properties of Schematic A3: Solution' table on the right is configured for RSM. A context menu is open over the 'CFX' component, showing options like 'Edit...', 'Duplicate', and 'Update'. The RSM Queue configuration table is as follows:

	A	B	C
1	Property	Value	Unit
2	General		
3	Component ID	Solution	
4	Directory Name	CFX	
5	Keep Latest Solution Data Only	<input checked="" type="checkbox"/>	
6	Cache Solution Data	<input type="checkbox"/>	
7	Initialization Option	Update from current solution data...	
8	Execution Control Conflict Option	Warn	
9	Notes		
10	Notes		
11	Used Licenses		
12	Last Update Used Licenses	acfx_pre	
13	Multi-configuration Post Processor File Load Options		
14	Load Option	Last Results Only	
15	Solution Process		
16	Update Option	Submit to Remote Solve Manager	
17	RSM Queue	Standard96s	
18	RSM Queue Details		
19	HPC Configuration	EMMY	
20	HPC Queue	standard96s	
21	HPC Type	SLURM	
22	Job Name	Workbench	
23	Download Progress Information	Always Download	
24	Progress Download Interval	120	s
25	Execution Mode	Parallel	
26	Number of Processes	96	

Source: Image used courtesy of ANSYS, Inc

# Submitting Jobs via Workbench

## Running Case via RSM

- In Properties of Schematic A3: Solution adapt the section Solution Process as on the previous slide to use RSM
- In the Project Schematic right click Solution and Clear Generated Data
- In the same menu click Update to start the simulation
- The job takes about 15 minutes, after completion the lightning symbol behind Solution changes into a checkmark

## Key Takeaways

- Speed up Ansys simulations using HPC cluster
- RSM graphical alternative to Slurm batch script
- Control simulations via Workbench on workstation
- Ansys including RSM available on NHR system Emmy