SLURM (basics)

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Quickstart – demo

VIENNA SCIENTIFIC CLUSTER

VSC-4 script: examples/05_submitting_batch_jobs/job_vsc**4**.sh

```
#!/bin/bash                                          # VSC-4

#SBATCH -J test
#SBATCH -N 1
#SBATCH --qos=skylake_0096          # use a qos
#SBATCH --partition=skylake_0096 # use partition (qos)
#SBATCH --tasks-per-node=48         # SLURM_NTASKS_PER_NODE

module purge                                 # recommended
# module load <modules>

echo
echo 'Hello from node: '$HOSTNAME
echo 'Number of nodes: '$SLURM_JOB_NUM_NODES
echo 'Tasks per node:  '$SLURM_TASKS_PER_NODE
echo 'Partition used:  '$SLURM_JOB_PARTITION
echo 'QOS used:        '$SLURM_JOB_QOS
echo 'Using the nodes: '$SLURM_JOB_NODELIST
echo
sleep 30 # <do_my_work>
```

```
# submission:
sbatch job.sh


# check what is going on:
squeue -u $USER      ! sq


# output:
slurm-<job_id>.out


# cancel jobs:
scancel <job_id>
scancel <job_name>
scancel -u $USER
```

Quickstart – demo

VSC-5 script: examples/05_submitting_batch_jobs/job_vsc**5**.sh

```
#!/bin/bash                                          # VSC-5

#SBATCH -J test
#SBATCH -N 1
#SBATCH --qos=zen3_0512              # use a qos
#SBATCH --partition=zen3_0512        # use partition (qos)
#SBATCH --tasks-per-node=128         # SLURM_NTASKS_PER_NODE

module purge                         # recommended
# module load <modules>

echo
echo 'Hello from node: '$HOSTNAME
echo 'Number of nodes: '$SLURM_JOB_NUM_NODES
echo 'Tasks per node:  '$SLURM_TASKS_PER_NODE
echo 'Partition used:  '$SLURM_JOB_PARTITION
echo 'QOS used:        '$SLURM_JOB_QOS
echo 'Using the nodes: '$SLURM_JOB_NODELIST
echo
sleep 30 # <do_my_work>
```

```
# submission:
sbatch job.sh


# check what is going on:
squeue -u $USER      ! sq


# output:
slurm-<job_id>.out


# cancel jobs:
scancel <job_id>
scancel <job_name>
scancel -u $USER
```

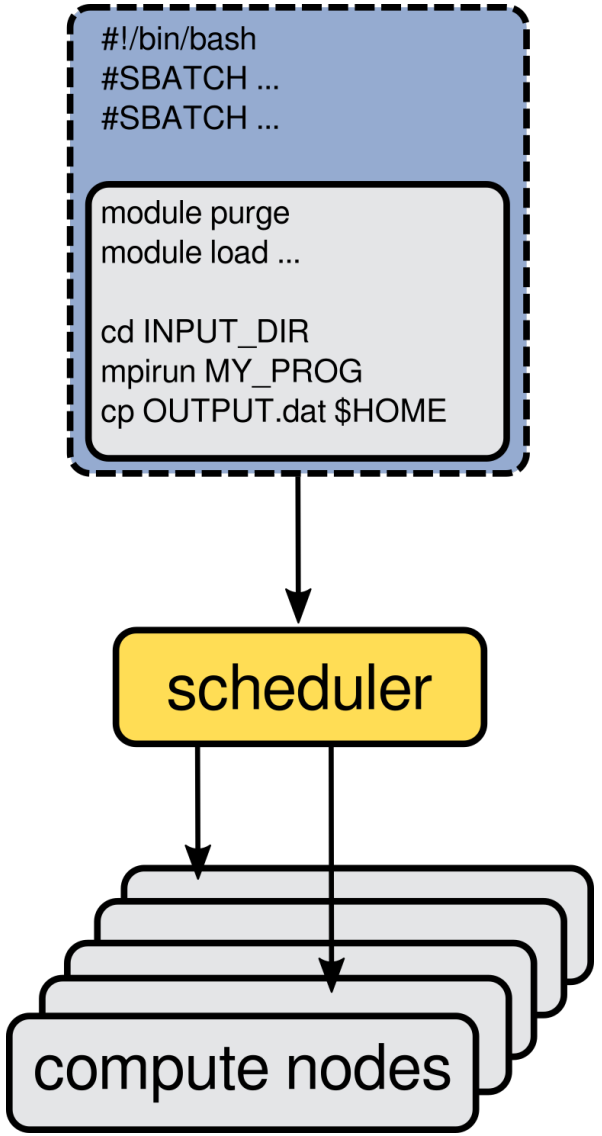
SLURM – basic concepts

Queueing system

- job/batch script
  - ***shell script – #!***
    that does everything needed to run your calculation
  - ***independent of queueing system***
  - ***use simple scripts***
    max 50 lines, i.e., put complicated logic elsewhere
  - ***load modules from scratch***
    purge, then load

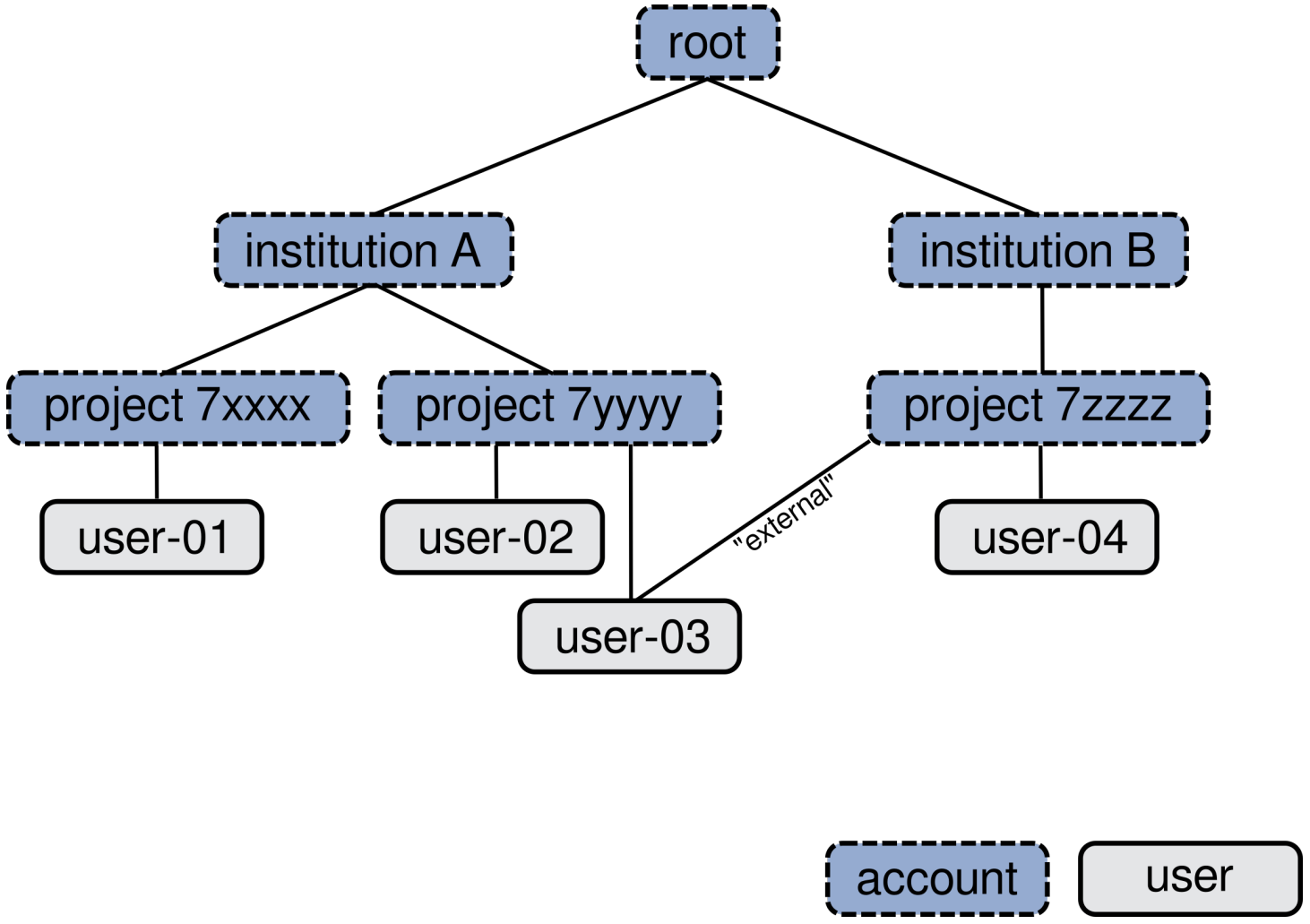
- tell scheduler where/how to run jobs
  - *number of nodes (or cores)*
  - *nodetype (i.e., partition & qos)*
  - *…*

- scheduler manages job allocation to compute nodes



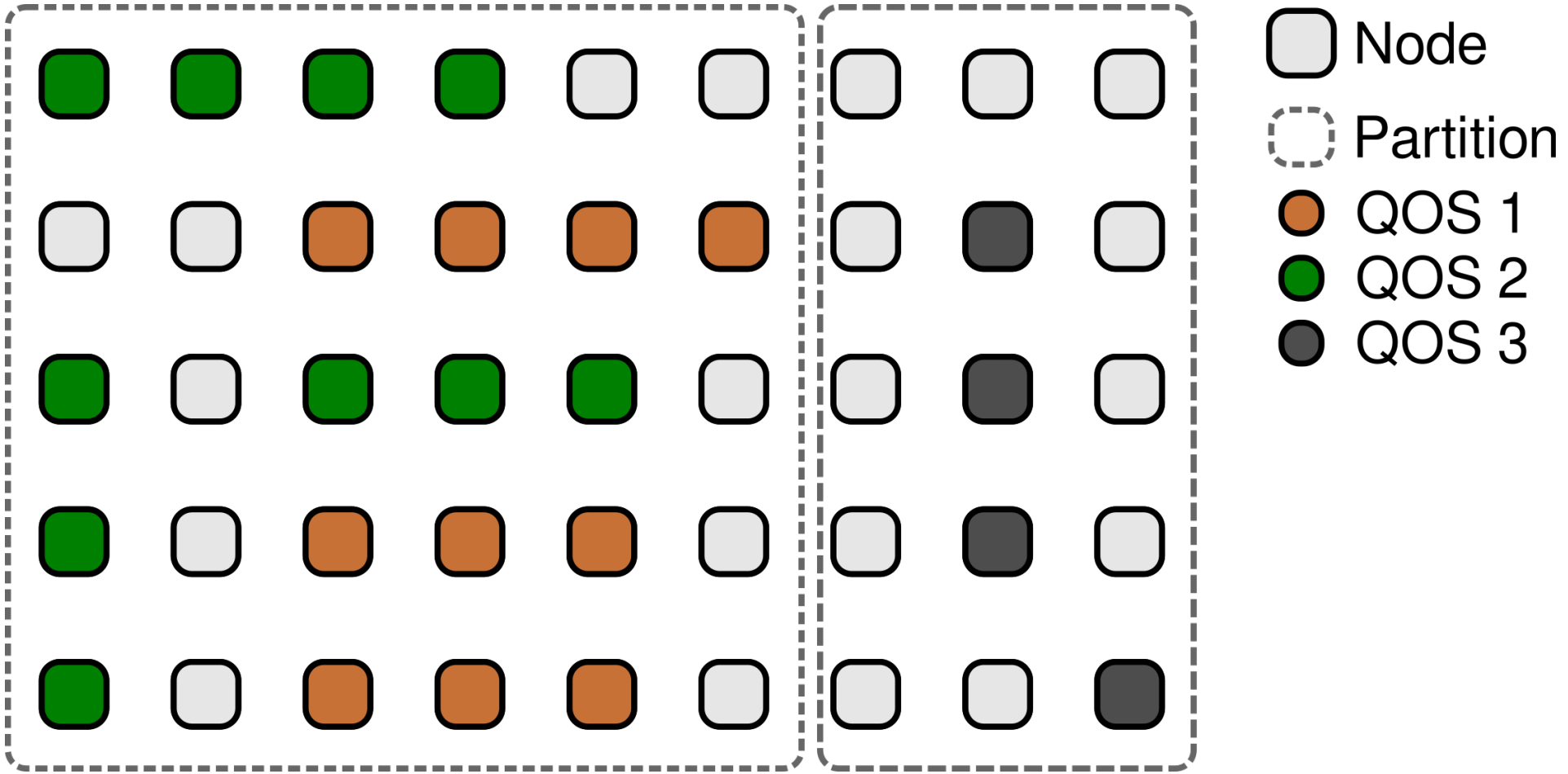
SLURM – account and user

```
#SBATCH --account=<account> ! use a specific account/project p7.... (other than default)
```



SLURM – partition and QOS (quality of service)

```
#SBATCH --qos=<qos>                ! specify quality of service  ! always provide:
#SBATCH --partition=<partition>    ! specify type of hardware    ! qos & partition
```



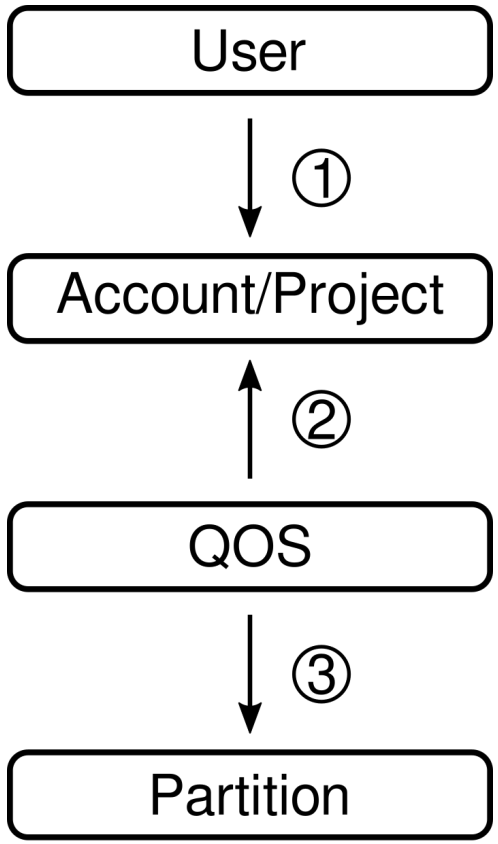
VSC hardware – display information

- Display information about partitions and their nodes:

```
VSC-4> sinfo
VSC-4> sinfo -o %P
VSC-4> scontrol show partition skylake_0096
VSC-4> scontrol show node n4901-001
```

```
VSC-5> sinfo
VSC-5> sinfo -o %P
VSC-5> scontrol show partition zen3_0512
VSC-5> scontrol show node n3501-001
```

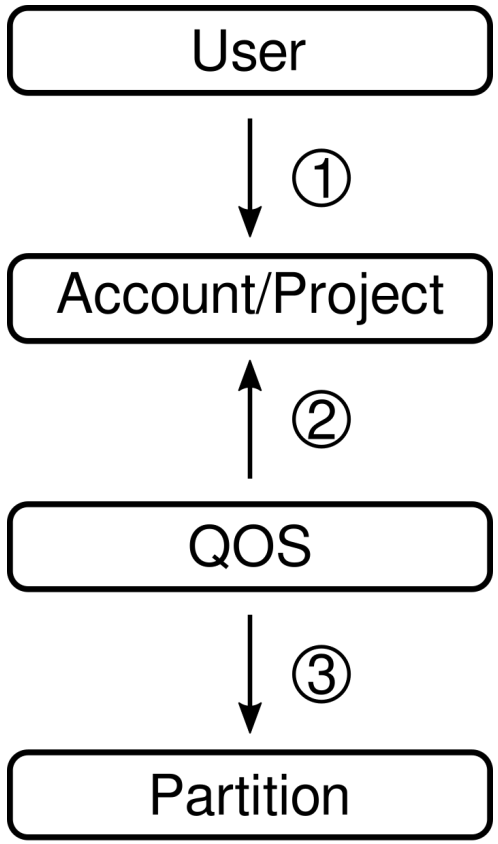
QOS – account/project assignment



→ "is assigned to"

```
VSC-4 login:                                                    # VSC-4

================================================================
Your jobs can run with the following account(s) and ...(QOS):

default_account:                          p70824
        account:                          p70824

    default_qos:                  skylake_0096
            qos:                  skylake_0096
                            skylake_0096_devel
                          skylake_0096_jupyter
                                  skylake_0384
                                  skylake_0768
```

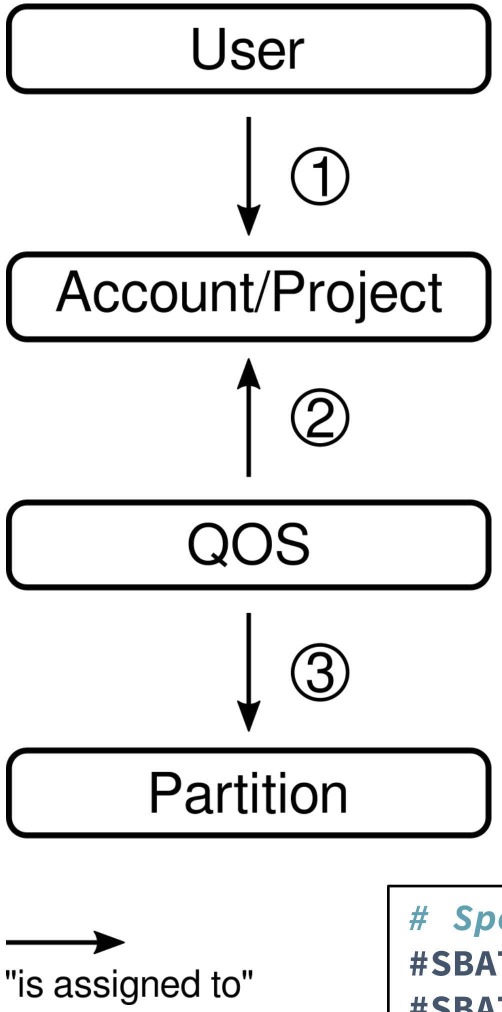
QOS – account/project assignment



→ "is assigned to"

```
VSC-5 login:                                                    # VSC-5

================================================================
Your jobs can run with the following account(s) and ...(QOS):

default_account:                                        p70824
        account:                                        p70824

    default_qos:                                    zen3_0512
            qos:                            cascadelake_0384
                                             zen2_0256_a40x2
                                      zen2_0256_a40x2_jupyter
                                                  zen3_0512
                                             zen3_0512_a100x2
                                      zen3_0512_a100x2_jupyter
                                              zen3_0512_devel
                                            zen3_0512_jupyter
                                                  zen3_1024
                                                  zen3_2048
```

QOS – partition assignment

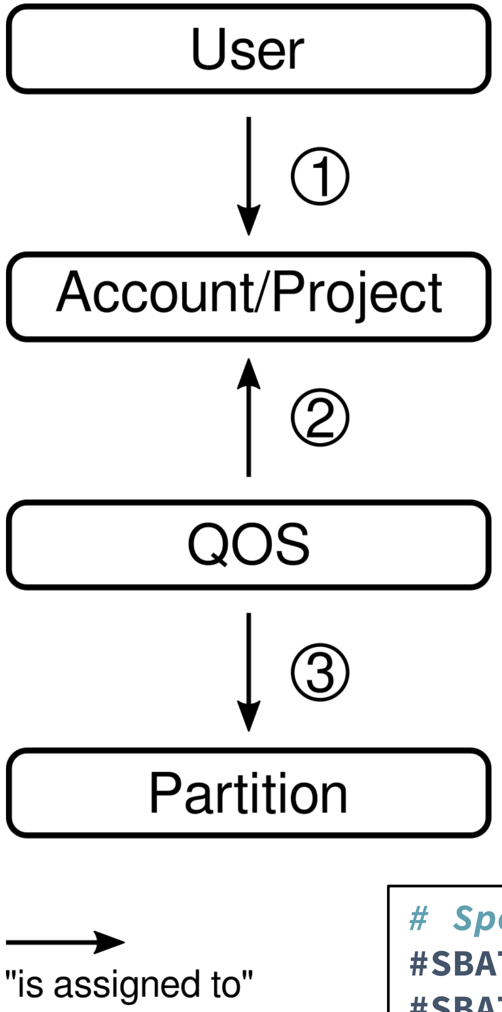



```
VSC-4> sqos                                                      # VSC-4

                qos_name  type   ...     walltime   priority   ...
=================================================================
            skylake_0096   cpu   ...   3-00:00:00       1000   ...
      skylake_0096_devel   cpu   ...     00:10:00    5000000   ...
    skylake_0096_jupyter   cpu   ...   3-00:00:00       1000   ...
            skylake_0384   cpu   ...   3-00:00:00       1000   ...
            skylake_0768   cpu   ...   3-00:00:00       1000   ...
```

```
VSC-4> cat /etc/motd                                             # VSC-4

Available QoS:

partition                   QOS
-----------------------------------
skylake_0096                skylake_0096,skylake_0096_devel
skylake_0384                skylake_0384
skylake_0768                skylake_0768
```

```
# Specification in job script:
#SBATCH --account=<account>     ! specify account/project p7....
#SBATCH --qos=<qos>             ! specify quality of service   ! always provide:
#SBATCH --partition=<partition> ! specify type of hardware     ! qos & partition
```

QOS – partition assignment




```
VSC-5> sqos                                                    # VSC-5

          qos_name  type   ...     walltime   priority   ...
======================================================================
     . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
```

```
VSC-5> cat /etc/motd                                           # VSC-5

Available QoS:

partition                QOS
--------------------------
cascadelake_0384       cascadelake_0384
zen2_0256_a40x2        zen2_0256_a40x2
zen3_0512_a100x2       zen3_0512_a100x2
zen3_0512              zen3_0512,zen3_0512_devel
zen3_1024              zen3_1024
zen3_2048              zen3_2048
```

```
# Specification in job script:
#SBATCH --account=<account>     ! specify account/project p7....
#SBATCH --qos=<qos>             ! specify quality of service   ! always provide:
#SBATCH --partition=<partition> ! specify type of hardware     ! qos & partition
```

Sample batch job

```
#!/bin/bash

#SBATCH -J <jobname>
#SBATCH -N <number_of_nodes>

#SBATCH --account=<account>      # optional, if omitted use default project
#SBATCH --qos=<qos>              # use a qos
#SBATCH --partition=<partition>  # use partition that fits to the qos
#SBATCH --tasks-per-node=<nn>    # SLURM_NTASKS_PER_NODE (mpi procs / node)

module purge                     # recommended to be done in all jobs !!!!!
# module load <modules>          # load only modules actually needed by job

echo 'Hello from node: '$HOSTNAME
echo 'Number of nodes: '$SLURM_JOB_NUM_NODES
echo 'Tasks per node:  '$SLURM_TASKS_PER_NODE
echo 'Partition used:  '$SLURM_JOB_PARTITION
echo 'QOS used:        '$SLURM_JOB_QOS
echo 'Using the nodes: '$SLURM_JOB_NODELIST
# <do_my_work>
```

- must be a shell script – first line – #!
- '#SBATCH' for marking SLURM parameters (for omitted lines corresponding defaults are used)
- environment variables are set by SLURM for use within the script (e.g. SLURM_JOB_NUM_NODES)

Single (few) core(s) jobs – shared compute nodes

```
#!/bin/bash                                                    # VSC-4

#SBATCH -J single
#SBATCH -n 1                          # specify number of cores
#SBATCH --mem=2G                      # memory limit in Gigabytes

###SBATCH --account=<account>         # optional, if omitted use default project
#SBATCH --qos=skylake_0096            # use a qos
#SBATCH --partition=skylake_0096      # use partition that fits to the qos

module purge                          # recommended to be done in all jobs !!!!!
# module load <modules>               # load only modules actually needed by job

echo 'Hello from node: '$HOSTNAME
echo 'Number of nodes: '$SLURM_JOB_NUM_NODES
echo 'Tasks per node:  '$SLURM_TASKS_PER_NODE
echo 'Partition used:  '$SLURM_JOB_PARTITION
echo 'Using the nodes: '$SLURM_JOB_NODELIST
# <do_my_work>
```

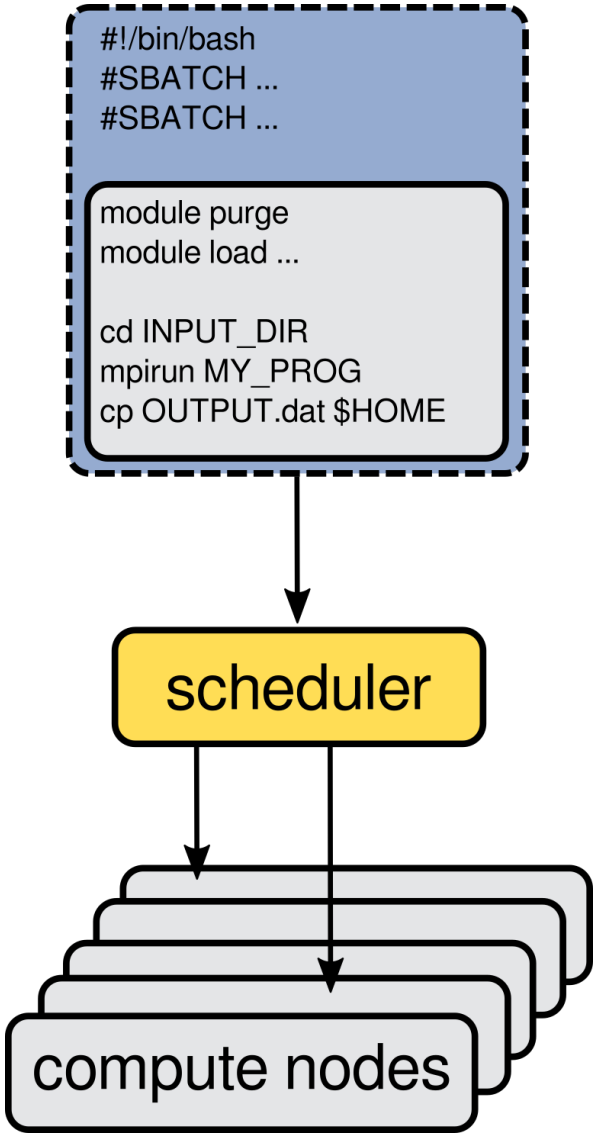
Single (few) core(s) jobs – shared compute nodes

```
#!/bin/bash                                                    # VSC-5

#SBATCH -J single
#SBATCH -n 1                          # specify number of cores
#SBATCH --mem=4G                      # memory limit in Gigabytes

###SBATCH --account=<account>         # optional, if omitted use default project
#SBATCH --qos=zen3_0512               # use a qos
#SBATCH --partition=zen3_0512         # use partition that fits to the qos

module purge                          # recommended to be done in all jobs !!!!!
# module load <modules>               # load only modules actually needed by job

echo 'Hello from node: '$HOSTNAME
echo 'Number of nodes: '$SLURM_JOB_NUM_NODES
echo 'Tasks per node:  '$SLURM_TASKS_PER_NODE
echo 'Partition used:  '$SLURM_JOB_PARTITION
echo 'Using the nodes: '$SLURM_JOB_NODELIST
# <do_my_work>
```

Job submission

```
# submission:

sbatch job.sh

sbatch <SLURM_PARAMETERS> job.sh <JOB_PARAMETERS>
```
parameters are specified as in job script, command-line overrides job-script

```
# check what is going on:

squeue -u $USER          ! alias sq='squeue -u $USER'


# output:

slurm-<job_id>.out


# cancel jobs:

scancel <job_id>
scancel <job_name>
scancel -u $USER
```



Exercises (1/2)

- switch on reservation to avoid queuing time:

```
VSC-4/5> source ~training/start_using_training_vsc4/5     ! during course only
```

- **try all commands explained in SLURM – basics on both VSC-4 and VSC-5:**

examples/05_submitting_batch_jobs/job_vsc**4**.sh # job_vsc**5**.sh

```
sbatch job_vsc4.sh                  #                  sbatch job_vsc5.sh
squeue -u $USER  ! sq
scancel <job_id>
! output in: slurm-<job_id>.out
```

```
sqos
```

```
sinfo
sinfo -o %P
scontrol show partition ...
scontrol show node ...
```

Exercises (2/2)

- switch off the reservation for the next task:

```
VSC-4/5> source ~training/switch_2_default          ! during course only
```

- write & submit to the development queue:

```
hostname                                    (solution = job_devel_vsc4.sh)
free                                        (solution = job_devel_vsc5.sh)
```

- switch on the reservation again:

```
VSC-4> source ~training/start_using_training_vsc4/5        ! during course only
```

submit a single core job:
job_single_core_vsc4.sh
job_single_core_vsc5.sh

look at & submit:
(MIGHT NOT WORK ON JH)
job_mpi_vsc4.sh
job_mpi_vsc5.sh

write & submit a matlab job:
echo "2+2" | matlab
(solution = job_matlab_vsc4.sh)
(solution = job_matlab_vsc5.sh)

Enjoy ☺ ➠ Working on the VSC Clusters

Thank you for your attention!

Please provide an anonymous feedback (at the end of the course)

➠ https://events.vsc.ac.at/event/182/surveys/181