NETWORK AND STORAGE FAILURE TOLERANCE ON HIGH PERFORMANCE COMPUTING SYSTEM USING APPLICATION MIGRATION APPROACH

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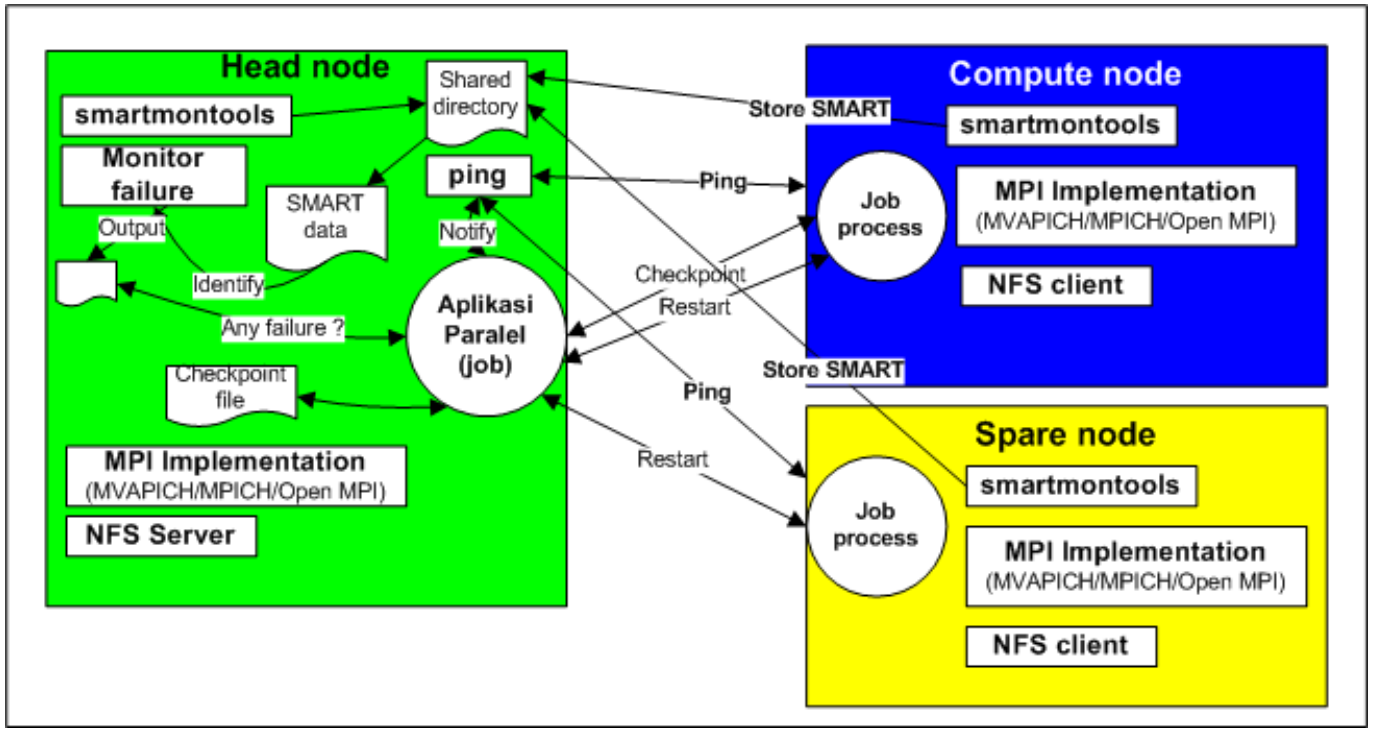
Problems to solve

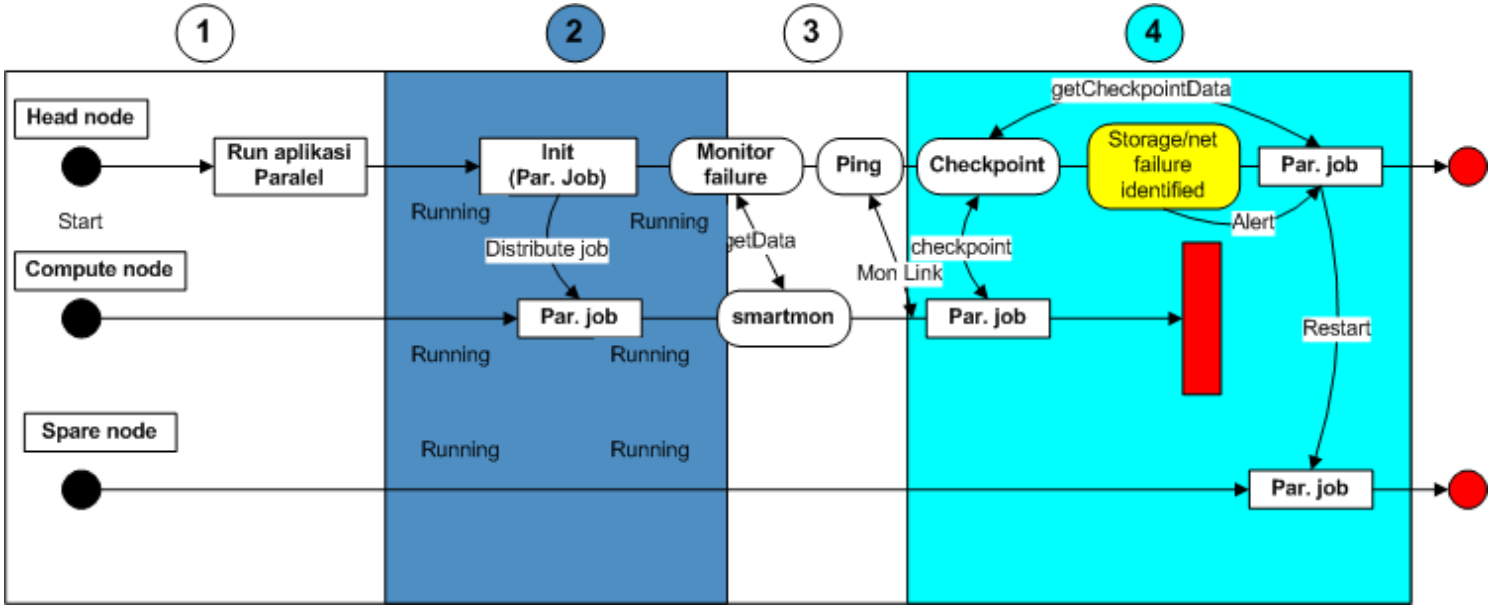
storage failure/network failure identification

application process migration from node identified to have *storage failure/network failure* *to available node*

Arsitektur Cluster



Contoh Skenario Failure



The cluster specs


head-node


compute-node


spare-node

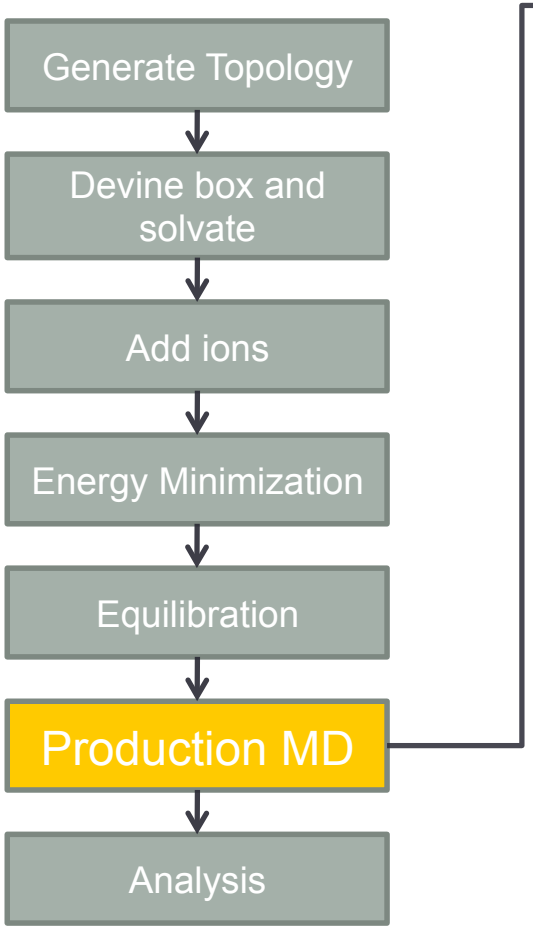
OS	Ubuntu 14.04 LTS Trusty	Ubuntu 14.04 LTS Trusty	Ubuntu 14.04 LTS Trusty
Processor	Intel core i7-2600 3.40 GHz	Intel core i7-2600 3.40 GHz	Intel core i7-2600 3.40 GHz
#core	4	4	4
#Thread	8	8	8
RAM	6 GB	6 GB	6 GB
Hard Disk	1 TB	1 TB	1 TB
Software	• Gromacs 5.1.2 • Slurm-15.08.10 • MVAPICH2-2.2b • NFS • DMTCP-2.4.4 • SSH client&server • Mysql server 5.5.49 • WEKA3-7-13 • smartmontools	• Gromacs 5.1.2 • Slurm-15.08.10 • MVAPICH2-2.2b • NFS • DMTCP-2.4.4 • SSH client&server • smartmontools	• Gromacs 5.1.2 • Slurm-15.08.10 • MVAPICH2-2.2b • NFS • DMTCP-2.4.4 • SSH client&server • smartmontools

Network Failure Identification

```
checkNode_Network(){
  NODES="compute-node spare-node"
  COUNT=1
  TIMEOUT=3

  for node in $NODES
  do
    received=$(ping -c $COUNT -W $TIMEOUT $node | grep 'received' | awk -F',' '{ print $2 }' | awk '{ print $1 }')
    if [ $received -eq 0 ]; then
      sed -i -e 's/'$node' 0/'$node' 1/g' classifyresult.txt
    fi
  done
}
```

Gromacs Simulation

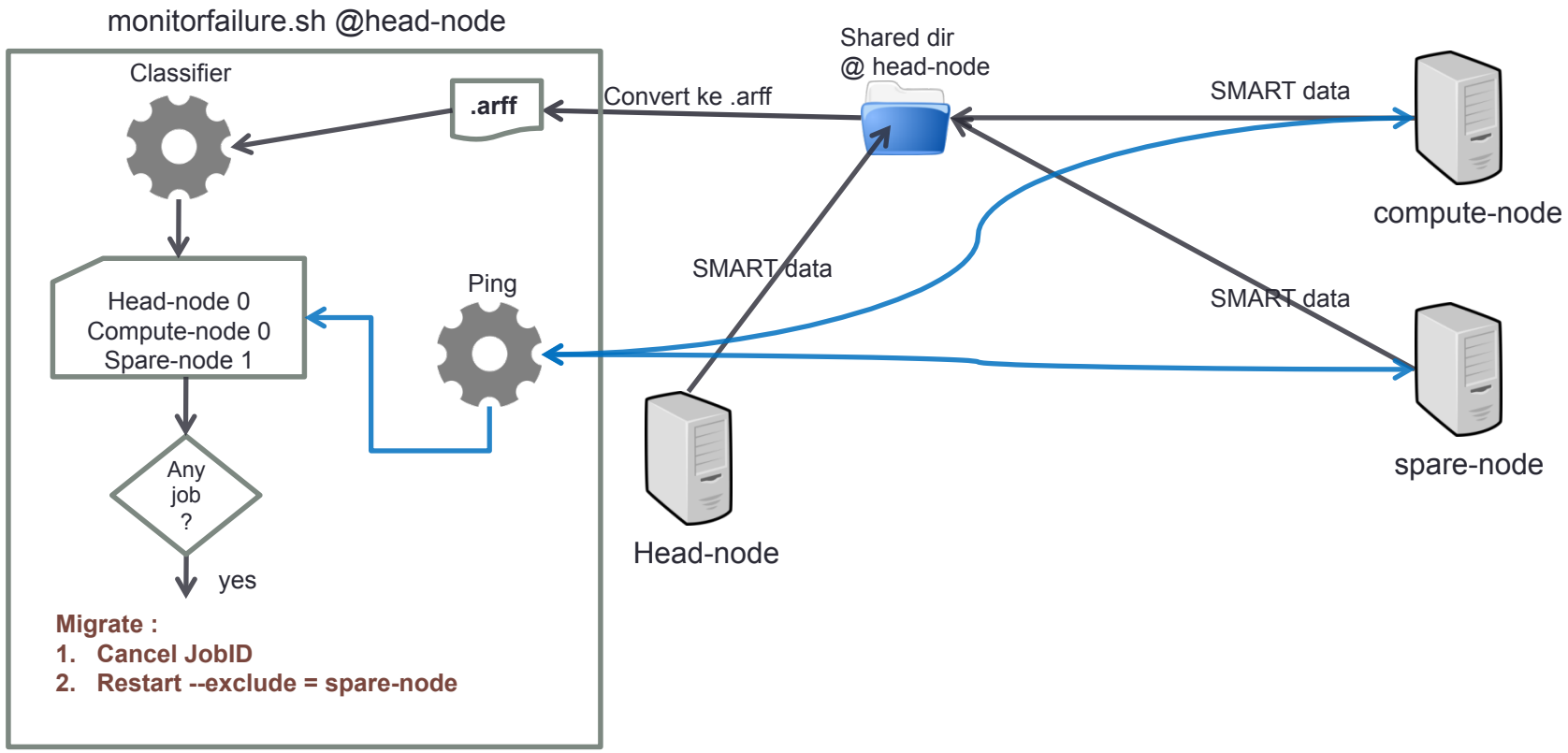


gmx mdrun -deffnm md_gmx

```
#!/bin/bash
#SBATCH -J mdrun01
#SBATCH -o md%j.out
#SBATCH -A necis
#SBATCH -N 2
#SBATCH -n 16
#SBATCH –exclude=[nodename]
#SBATCH --time=10:00:00
#SBATCH --mail-user=hus3nr@gmail.com
#SBATCH --mail-type=begin
#SBATCH --mail-type=end

mpirun gmx_mpi mdrun -deffnm md_gmx (submit job)
mpirun gmx_mpi mdrun –cpi md_gmx.cpt –deffnm md_gmx (restart)
```

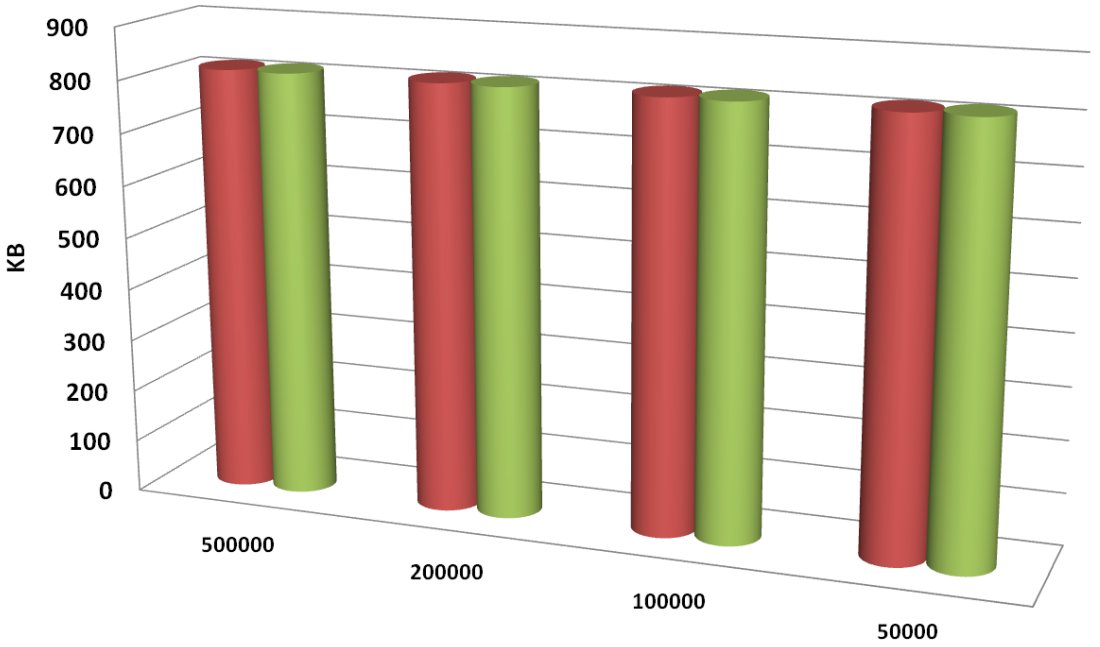
How the system works?



Testing scenarios

No	Scenario	Initial condition	Failure Simulation
1	Scenario 1	The application runs on 3 nodes (N=3) using 24 procecessors (np=24)	One of a node is simulated having storage/ network failure. Application is terminated then restarted based on checkpoint file using 2 nodes and 16 processors.
2	Scenario 2	The application runs on 2 nodes (N=2) using 16 processors (np=16)	As above but using 2 nodes and 16 processors

Gromacs Simulation Checkpoint)



	500000	200000	100000	50000
N=3,n=24	815.2	815.2	815.2	815.2
N=2,n=16	815.2	815.2	815.2	815.2

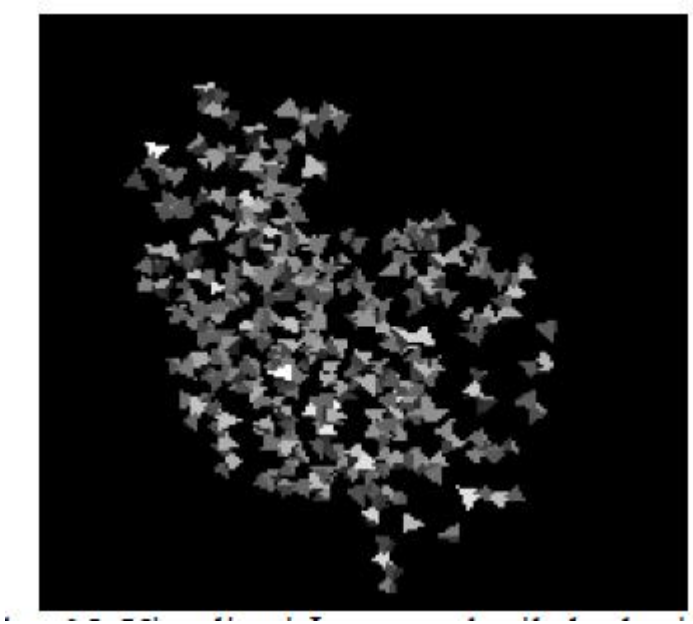
Testing results

Scenario	The expected responds	Sto failure	Net Failure
Scenario 1	The simulation stopped then restarted based on the checkpoint using 3 nodes	V	V
Scenario 2	The simulation stopped then restarted based on the checkpoint using 2 nodes	V	V

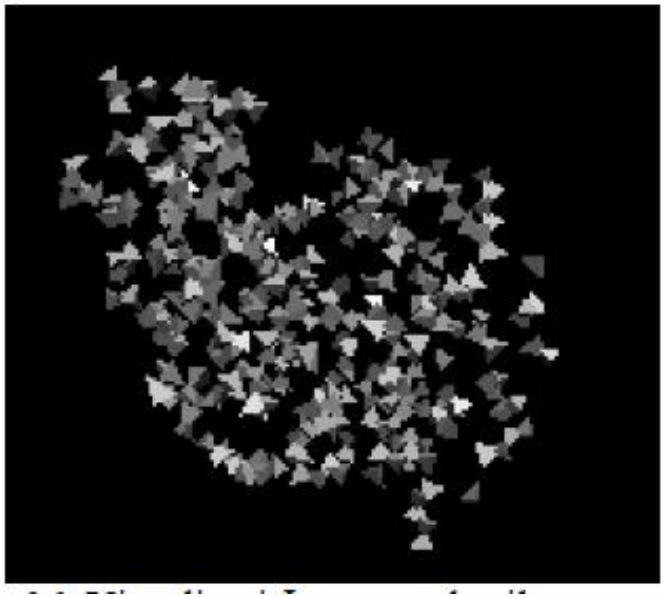
Results of Gromacs simulation

Scenario	nsteps	Continuation	Elapsed time
Skenario 1	50000	Step 6540	29 minutes , 48 seconds
Skenario 2	50000	Step 37160	8 minutes , 47 seconds

Gromac Results



Visualized *Lysozyme in normal execution*



Visualized Lysozyme with migration process

Thank You