************** HPL BENCHMARKING *******************

:- HPL is a High-Performance Linpack benchmark implementation. The code solves a uniformely random system of linear equations and reports time and floating-point execution rate using a standard formula for operation count.

—-- LAB —---

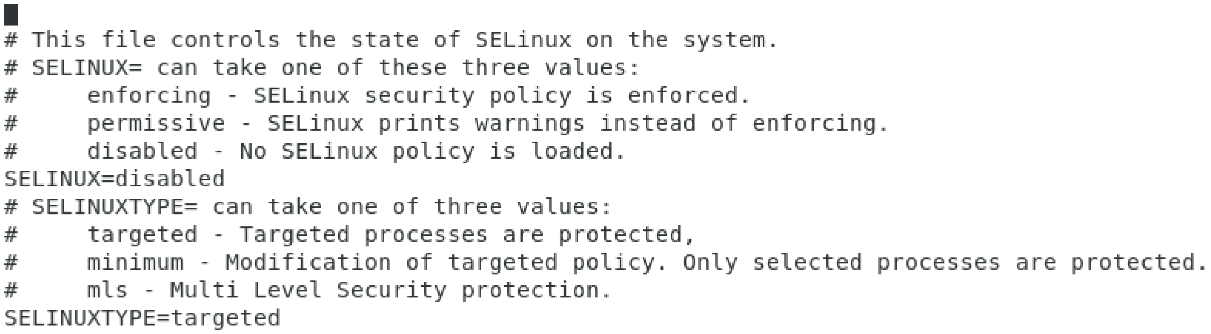
=> Create one machine using nat network

# Turn off the firewall

1. Systemctl disable firewalld

# Turn off selinux

2. vi /etc/selinux/config



```
# This file controls the state of SELinux on the system.
# SELINUX= can take one of these three values:
#     enforcing - SELinux security policy is enforced.
#     permissive - SELinux prints warnings instead of enforcing.
#     disabled - No SELinux policy is loaded.
SELINUX=disabled
# SELINUXTYPE= can take one of three values:
#     targeted - Targeted processes are protected,
#     minimum - Modification of targeted policy. Only selected processes are protected.
#     mls - Multi Level Security protection.
SELINUXTYPE=targeted
```

SELINUX='enable' to 'disabled'

# do restart the system

3. Init 6

# install mathematical library

Yum install blas -y

Or

Yum install atlas -y

# Download HPL tar file

https://netlib.org/benchmark/hpl/hpl-2.3.tar.gz

# untar the HPL tar file

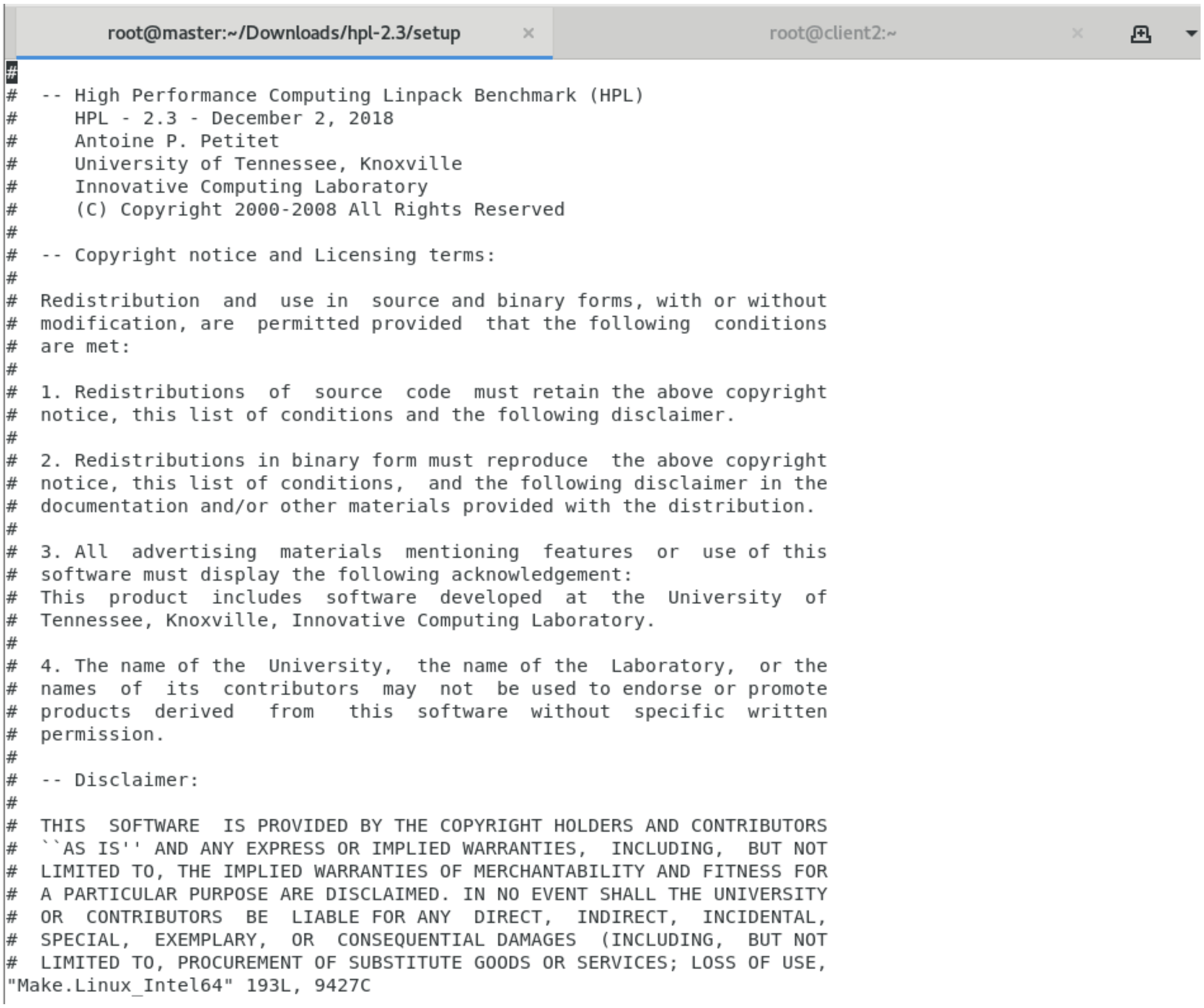
tar -xvf hpl-2.3.tar.gz

# Go to this path

cd hpl-2.3/setup/

# see the file to all information(nothing changes)

vi Make.Linux_Intel64



```
#
#  -- High Performance Computing Linpack Benchmark (HPL)
#     HPL - 2.3 - December 2, 2018
#     Antoine P. Petitet
#     University of Tennessee, Knoxville
#     Innovative Computing Laboratory
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#  SPECIAL,  EXEMPLARY,  OR  CONSEQUENTIAL DAMAGES  (INCLUDING,  BUT NOT
#  LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE,
"Make.Linux_Intel64" 193L, 9427C
```
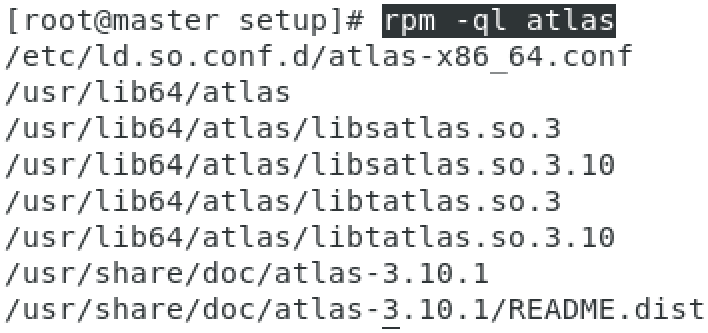

# for see all prebuild library files

```
rpm -ql atlas
```



```
[root@master setup]# rpm -ql atlas
/etc/ld.so.conf.d/atlas-x86_64.conf
/usr/lib64/atlas
/usr/lib64/atlas/libsatlas.so.3
/usr/lib64/atlas/libsatlas.so.3.10
/usr/lib64/atlas/libtatlas.so.3
/usr/lib64/atlas/libtatlas.so.3.10
/usr/share/doc/atlas-3.10.1
/usr/share/doc/atlas-3.10.1/README.dist
```

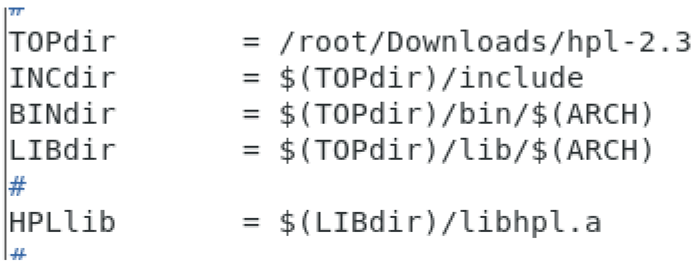
# Download Openmpi tar file from browser

https://download.open-mpi.org/release/open-mpi/v4.1/openmpi-4.1.4.tar.gz

```
# untar openmpi file
        Tar -xvf /root/Downloads/openmpi-4.1.4.tar.gz

# Go to this file
        cd openmpi-4.1.4/

# Configure openmpi
        ./configure --prefix=/opt/openmpi-4.1.4 --enable-orterun-prefix-by-default

# if above command not run then install gcc
        yum -y install gcc gcc-c++

# Configure openmpi
        ./configure --prefix=/opt/openmpi-4.1.4 --enable-orterun-prefix-by-default

# check supporting file
         make -j 8
```

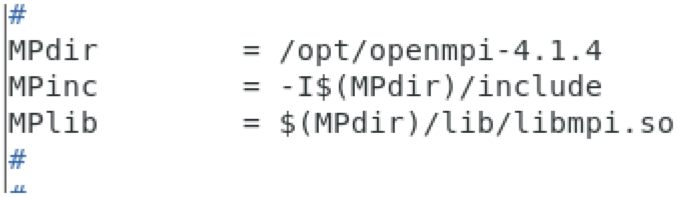
The "-j" option is used with the "make" command to specify the number of jobs (i.e., tasks or processes)

```
# clear all making file
        make clear all

# install make
        make install

# Export openmpi
        export PATH=/opt/openmpi-4.1.4:$PATH

# Export library
        export LD_LIBRARY_PATH=/opt/openmpi-4.1.4:$LD_LIBRARY_PATH

# copy file
        cp /opt/openmpi-4.1.4/setup/hpl-2.3 /root/Download/

# Go to path
        cd /root/Download/

# Edit this file
        vi Make.Linux_PII_CBLAS
```



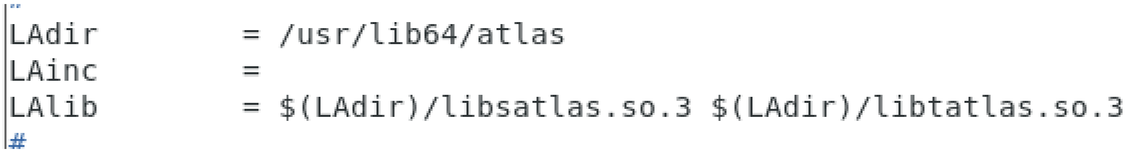
```
#
TOPdir       = /root/Downloads/hpl-2.3
INCdir       = $(TOPdir)/include
BINdir       = $(TOPdir)/bin/$(ARCH)
LIBdir       = $(TOPdir)/lib/$(ARCH)
#
HPLlib       = $(LIBdir)/libhpl.a
#
```

```
TOPdir      = /root/Downloads/hpl-2.3
```



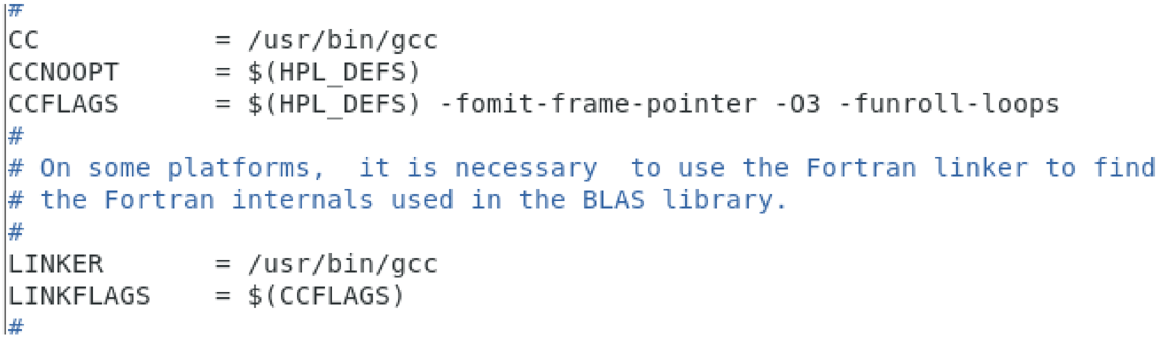
```
#
MPdir        = /opt/openmpi-4.1.4
MPinc        = -I$(MPdir)/include
MPlib        = $(MPdir)/lib/libmpi.so
#
#
```

```
MPdir       = /opt/openmpi-4.1.4
MPlib       = $(MPdir)/lib/libmpi.so
```



```
#
LAdir        = /usr/lib64/atlas
LAinc        =
LAlib        = $(LAdir)/libsatlas.so.3 $(LAdir)/libtatlas.so.3
#
```

```
LAdir       = /usr/lib64/atlas
LAlib       = $(LAdir)/libsatlas.so.3 $(LAdir)/libtatlas.so.3
```



```
#
CC           = /usr/bin/gcc
CCNOOPT      = $(HPL_DEFS)
CCFLAGS      = $(HPL_DEFS) -fomit-frame-pointer -O3 -funroll-loops
#
# On some platforms,  it is necessary  to use the Fortran linker to find
# the Fortran internals used in the BLAS library.
#
LINKER       = /usr/bin/gcc
LINKFLAGS    = $(CCFLAGS)
#
```

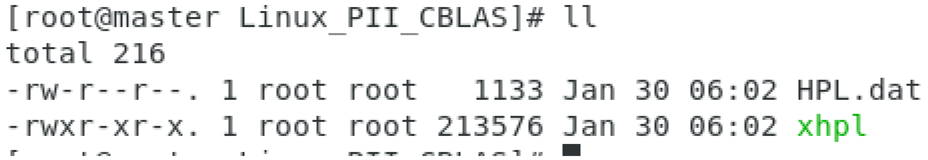
```
CC          = /usr/bin/gcc
LINKER      = /usr/bin/gcc
```

# Go to this path

```
        cd /root/Downloads/hpl-2.3/bin/Linux_PII_CBLAS/
```

# check file

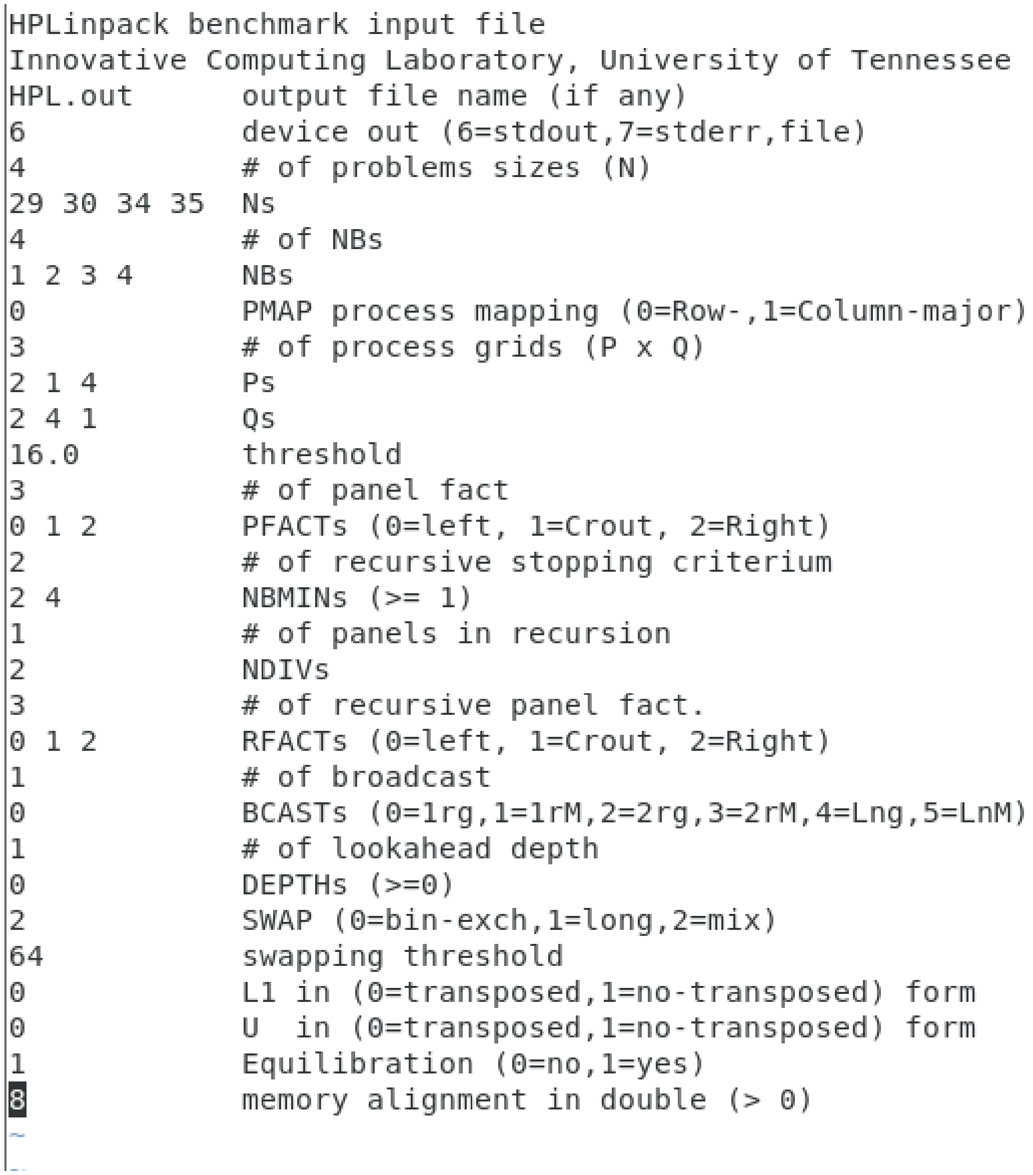
```
        ll
```



```
[root@master Linux_PII_CBLAS]# ll
total 216
-rw-r--r--. 1 root root   1133 Jan 30 06:02 HPL.dat
-rwxr-xr-x. 1 root root 213576 Jan 30 06:02 xhpl
[root@master Linux_PII_CBLAS]# 
```

# check all entry in HPL.dat file

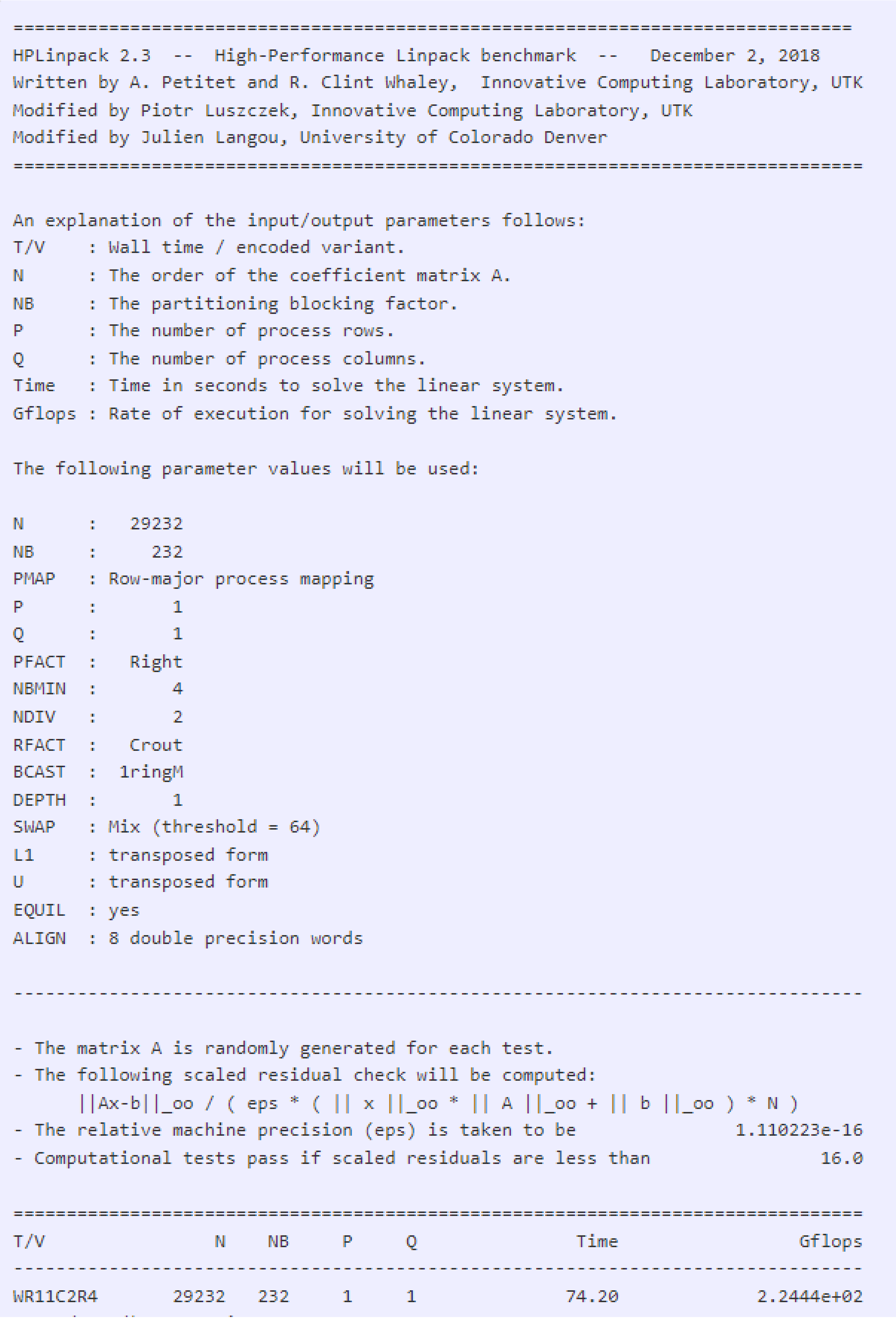
    vi HPL.dat



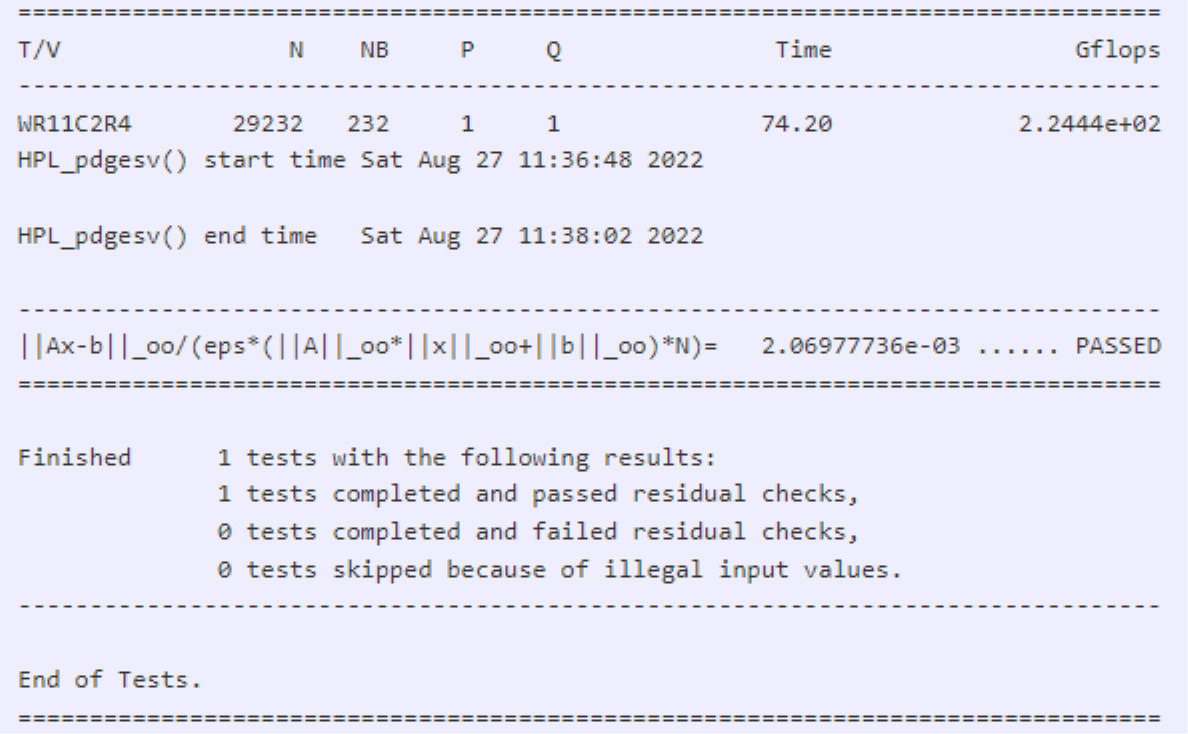
```
HPLinpack benchmark input file
Innovative Computing Laboratory, University of Tennessee
HPL.out      output file name (if any)
6            device out (6=stdout,7=stderr,file)
4            # of problems sizes (N)
29 30 34 35  Ns
4            # of NBs
1 2 3 4      NBs
0            PMAP process mapping (0=Row-,1=Column-major)
3            # of process grids (P x Q)
2 1 4        Ps
2 4 1        Qs
16.0         threshold
3            # of panel fact
0 1 2        PFACTs (0=left, 1=Crout, 2=Right)
2            # of recursive stopping criterium
2 4          NBMINs (>= 1)
1            # of panels in recursion
2            NDIVs
3            # of recursive panel fact.
0 1 2        RFACTs (0=left, 1=Crout, 2=Right)
1            # of broadcast
0            BCASTs (0=1rg,1=1rM,2=2rg,3=2rM,4=Lng,5=LnM)
1            # of lookahead depth
0            DEPTHs (>=0)
2            SWAP (0=bin-exch,1=long,2=mix)
64           swapping threshold
0            L1 in (0=transposed,1=no-transposed) form
0            U  in (0=transposed,1=no-transposed) form
1            Equilibration (0=no,1=yes)
8            memory alignment in double (> 0)
~
~
```

# calculate HPL Benchmarking

    mpirun --allow-run-as-root -np 4 ./xhpl HPL.dat



```
================================================================================
HPLinpack 2.3  --  High-Performance Linpack benchmark  --   December 2, 2018
Written by A. Petitet and R. Clint Whaley,  Innovative Computing Laboratory, UTK
Modified by Piotr Luszczek, Innovative Computing Laboratory, UTK
Modified by Julien Langou, University of Colorado Denver
================================================================================

An explanation of the input/output parameters follows:
T/V    : Wall time / encoded variant.
N      : The order of the coefficient matrix A.
NB     : The partitioning blocking factor.
P      : The number of process rows.
Q      : The number of process columns.
Time   : Time in seconds to solve the linear system.
Gflops : Rate of execution for solving the linear system.

The following parameter values will be used:

N      :   29232
NB     :     232
PMAP   : Row-major process mapping
P      :       1
Q      :       1
PFACT  :   Right
NBMIN  :       4
NDIV   :       2
RFACT  :   Crout
BCAST  :  1ringM
DEPTH  :       1
SWAP   : Mix (threshold = 64)
L1     : transposed form
U      : transposed form
EQUIL  : yes
ALIGN  : 8 double precision words

--------------------------------------------------------------------------------

- The matrix A is randomly generated for each test.
- The following scaled residual check will be computed:
      ||Ax-b||_oo / ( eps * ( || x ||_oo * || A ||_oo + || b ||_oo ) * N )
- The relative machine precision (eps) is taken to be               1.110223e-16
- Computational tests pass if scaled residuals are less than                16.0

================================================================================
T/V                N    NB     P     Q               Time                 Gflops
--------------------------------------------------------------------------------
WR11C2R4       29232   232     1     1              74.20             2.2444e+02
```



```
================================================================================
T/V                N    NB     P     Q               Time                 Gflops
--------------------------------------------------------------------------------
WR11C2R4       29232   232     1     1              74.20             2.2444e+02
HPL_pdgesv() start time Sat Aug 27 11:36:48 2022

HPL_pdgesv() end time   Sat Aug 27 11:38:02 2022

--------------------------------------------------------------------------------
||Ax-b||_oo/(eps*(||A||_oo*||x||_oo+||b||_oo)*N)=   2.06977736e-03 ...... PASSED
================================================================================

Finished      1 tests with the following results:
              1 tests completed and passed residual checks,
              0 tests completed and failed residual checks,
              0 tests skipped because of illegal input values.
--------------------------------------------------------------------------------

End of Tests.
================================================================================
```

Result:--
===

HPLinpack 2.3 -- High-Performance Linpack benchmark --   December 2, 2018Written by A. Petitet and R. Clint Whaley, Innovative Computing Laboratory, UTK

```
Modified by Piotr Luszczek, Innovative Computing Laboratory, UTK

Modified by Julien Langou, University of Colorado Denver

=======================================================================
========


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NB     :     232

PMAP   : Row-major process mapping

P      :       1

Q      :       1

PFACT  :   Right
```

```
NBMIN  :       4
NDIV   :       2
RFACT  :   Crout
BCAST  :  1ringM
DEPTH  :       1
SWAP   : Mix (threshold = 64)
L1     : transposed form
U      : transposed form
EQUIL  : yes
ALIGN  : 8 double precision words


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- The relative machine precision (eps) is taken to be               1.110223e-16
- Computational tests pass if scaled residuals are less than                16.0


========================================================================
========
T/V                N    NB     P     Q               Time                 Gflops
```

```
--------------------------------------------------------------------------------

WR11C2R4       29232   232     1     1             74.20            2.2444e+02

HPL_pdgesv() start time Sat Aug 27 11:36:48 2022


HPL_pdgesv() end time   Sat Aug 27 11:38:02 2022


--------------------------------------------------------------------------------

||Ax-b||_oo/(eps*(||A||_oo*||x||_oo+||b||_oo)*N)=   2.06977736e-03 ...... PASSED

==========================================================================
========


Finished      1 tests with the following results:

             1 tests completed and passed residual checks,

             0 tests completed and failed residual checks,

             0 tests skipped because of illegal input values.

--------------------------------------------------------------------------------


End of Tests.

==========================================================================
========
```