Report on task 1

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Main part:

Step 1: clone Mini-Rt repository

Repository: https://github.com/georgy-schukin/mini-rt

Command:

```
git clone https://github.com/georgy-schukin/mini-rt
```

Step 2: build and install Mini-Rt library

If you are working on our public HPC server: nothing to do, the library is already installed!

If you are working on your own Linux machine:

First, make sure `cmake` and `make` programs are installed. Then go to the directory where Mini-Rt repository was cloned and execute next commands:

```
mkdir build
cd build
cmake ../mini-rt/src
make
sudo make install
```

By default the library will be installed in `/usr/local` directory (include files in `/usr/local/include/minirt` directory, lib files - in `/usr/local/lib` directory).

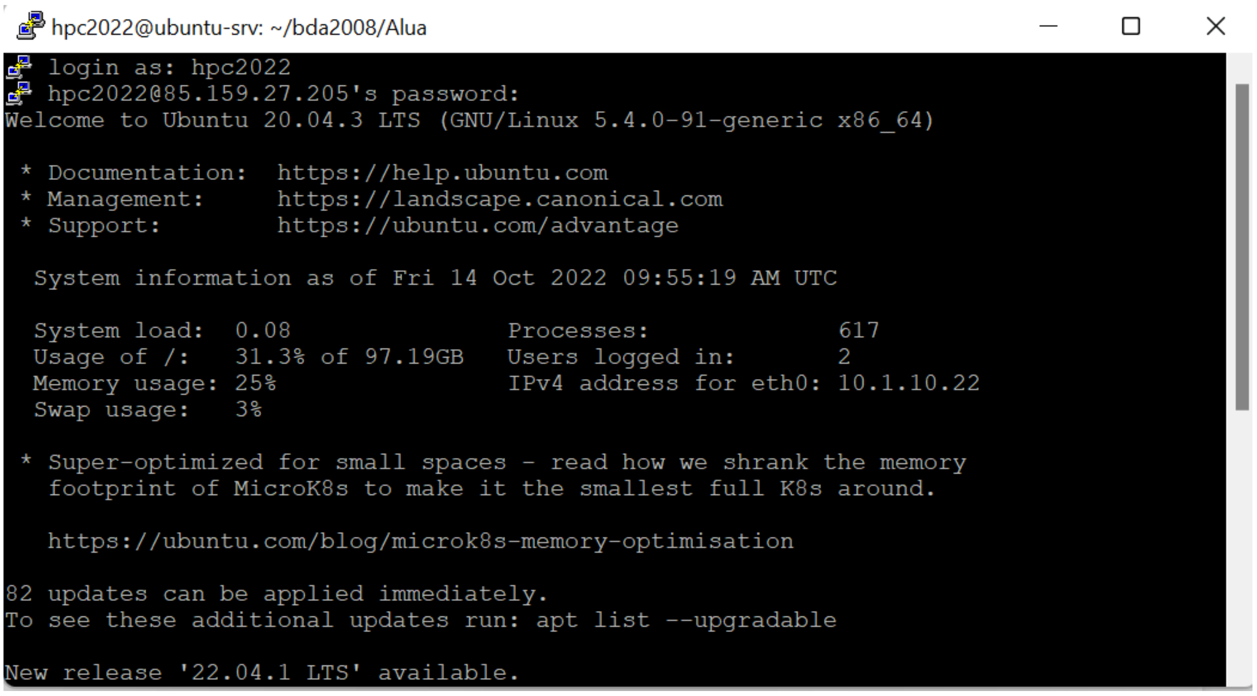
If you are working on Windows machine:

Install `cmake` for Windows and build the library with it (sources are located in `src` folder).

Step 3: build sequential ray tracing application

Create a directory for your project. Copy example application `minirt_test.cpp` from `mini-rt/src/test` directory to your project directory, rename it to `raytracing.cpp`:

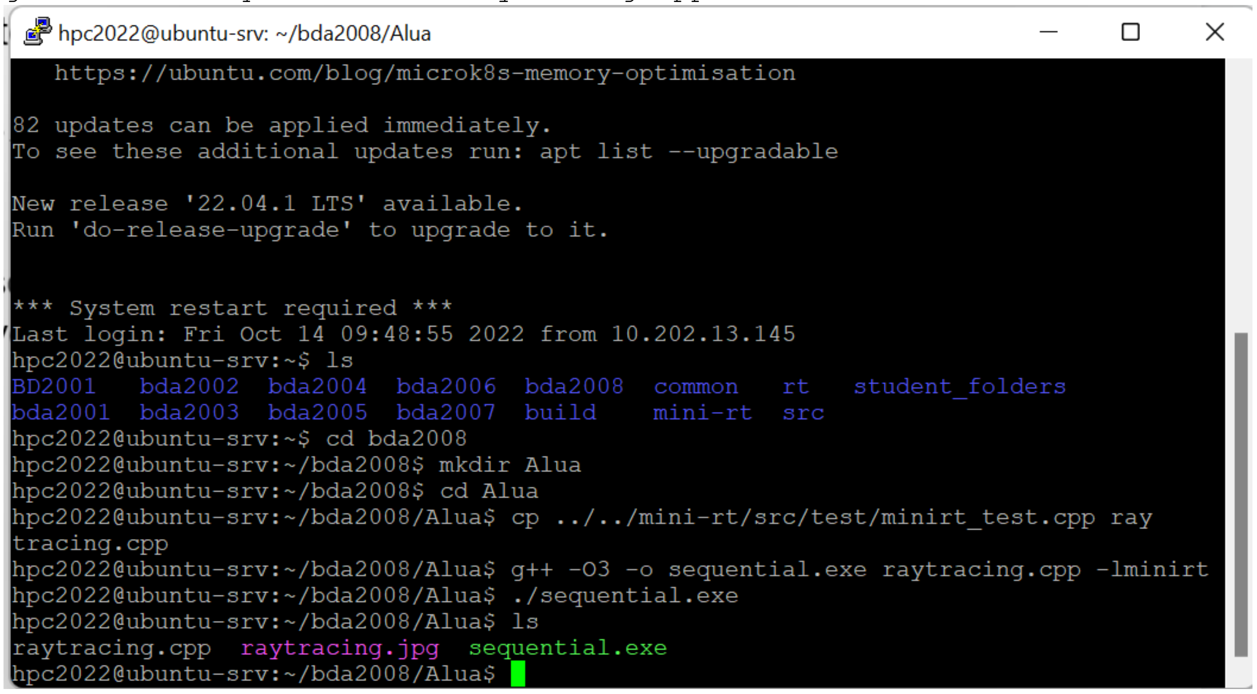
```
cd <your project dir>
cp <mini-rt dir>/src/test/minirt_test.cpp raytracing.cpp
```



```
login as: hpc2022
hpc2022@85.159.27.205's password:
Welcome to Ubuntu 20.04.3 LTS (GNU/Linux 5.4.0-91-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

  System information as of Fri 14 Oct 2022 09:55:19 AM UTC

  System load:  0.08              Processes:             617
  Usage of /:   31.3% of 97.19GB  Users logged in:       2
  Memory usage: 25%               IPv4 address for eth0: 10.1.10.22
  Swap usage:   3%

 * Super-optimized for small spaces - read how we shrank the memory
   footprint of MicroK8s to make it the smallest full K8s around.

   https://ubuntu.com/blog/microk8s-memory-optimisation

82 updates can be applied immediately.
To see these additional updates run: apt list --upgradable

New release '22.04.1 LTS' available.
```

Build the application:

```
g++ -O3 -o sequential.exe raytracing.cpp -lminirt
```

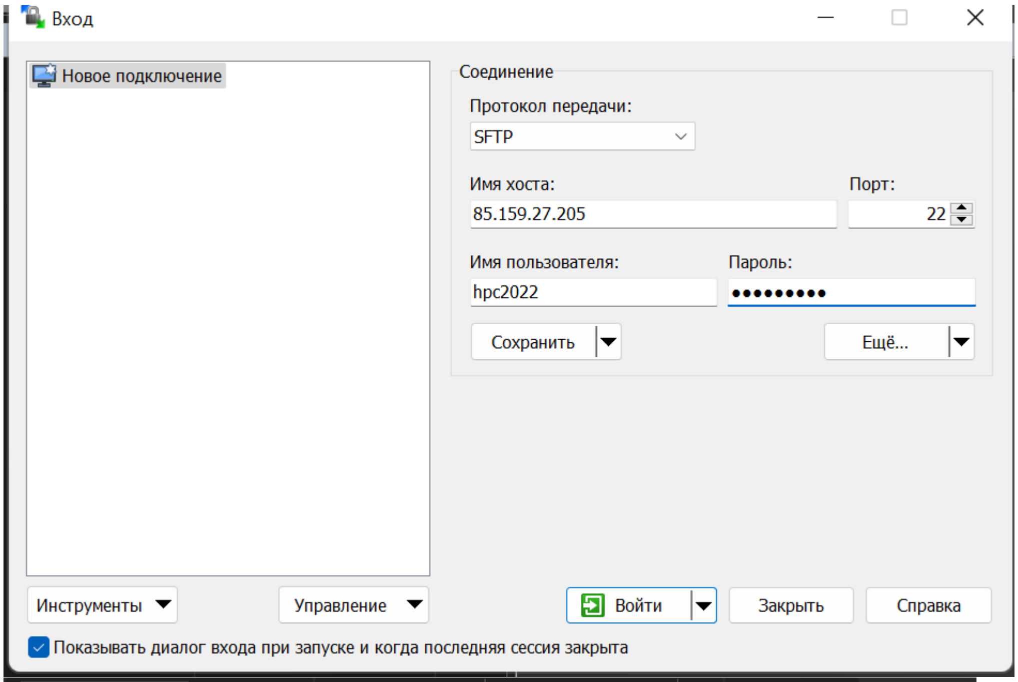


```
   https://ubuntu.com/blog/microk8s-memory-optimisation

82 updates can be applied immediately.
To see these additional updates run: apt list --upgradable

New release '22.04.1 LTS' available.
Run 'do-release-upgrade' to upgrade to it.


*** System restart required ***
Last login: Fri Oct 14 09:48:55 2022 from 10.202.13.145
hpc2022@ubuntu-srv:~$ ls
BD2001   bda2002  bda2004  bda2006  bda2008  common   rt   student_folders
bda2001  bda2003  bda2005  bda2007  build    mini-rt  src
hpc2022@ubuntu-srv:~$ cd bda2008
hpc2022@ubuntu-srv:~/bda2008$ mkdir Alua
hpc2022@ubuntu-srv:~/bda2008$ cd Alua
hpc2022@ubuntu-srv:~/bda2008/Alua$ cp ../../mini-rt/src/test/minirt_test.cpp ray
tracing.cpp
hpc2022@ubuntu-srv:~/bda2008/Alua$ g++ -O3 -o sequential.exe raytracing.cpp -lminirt
hpc2022@ubuntu-srv:~/bda2008/Alua$ ./sequential.exe
hpc2022@ubuntu-srv:~/bda2008/Alua$ ls
raytracing.cpp  raytracing.jpg  sequential.exe
hpc2022@ubuntu-srv:~/bda2008/Alua$
```

Run the application:

```
./sequential.exe
```

If everything is done correctly, the resulting .jpg image file will be created.


Вход

Новое подключение

Соединение

Протокол передачи: SFTP

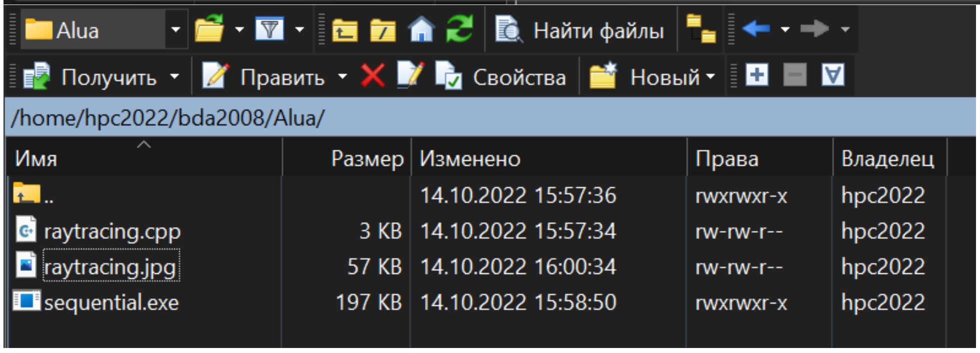
Имя хоста: 85.159.27.205

Порт: 22

Имя пользователя: hpc2022

Пароль: ●●●●●●●●●

☑ Показывать диалог входа при запуске и когда последняя сессия закрыта



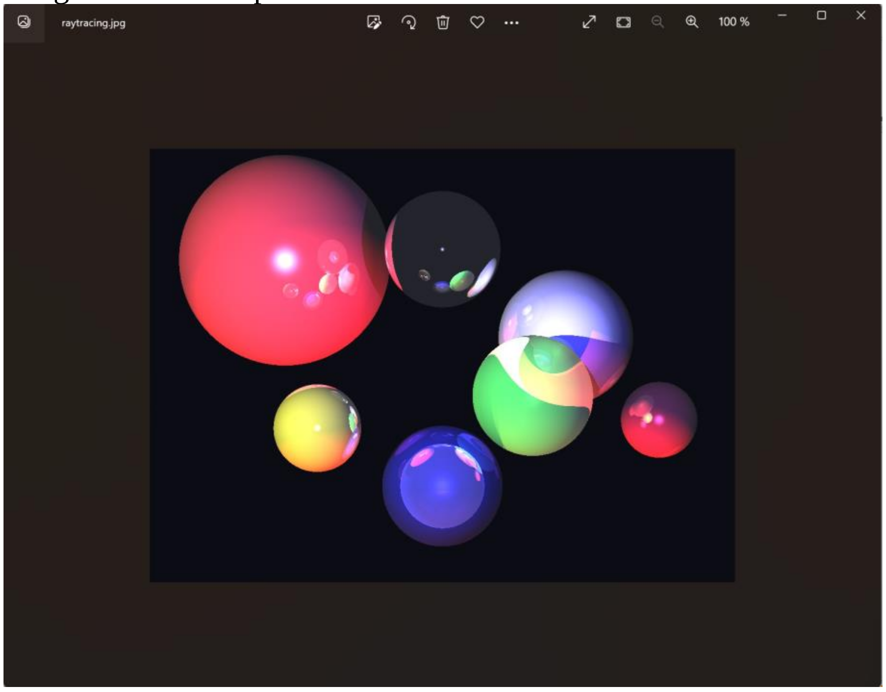
/home/hpc2022/bda2008/Alua/

Имя	Размер	Изменено	Права	Владелец
..		14.10.2022 15:57:36	rwxrwxr-x	hpc2022
raytracing.cpp	3 KB	14.10.2022 15:57:34	rw-rw-r--	hpc2022
raytracing.jpg	57 KB	14.10.2022 16:00:34	rw-rw-r--	hpc2022
sequential.exe	197 KB	14.10.2022 15:58:50	rwxrwxr-x	hpc2022

Step 4: play with the application

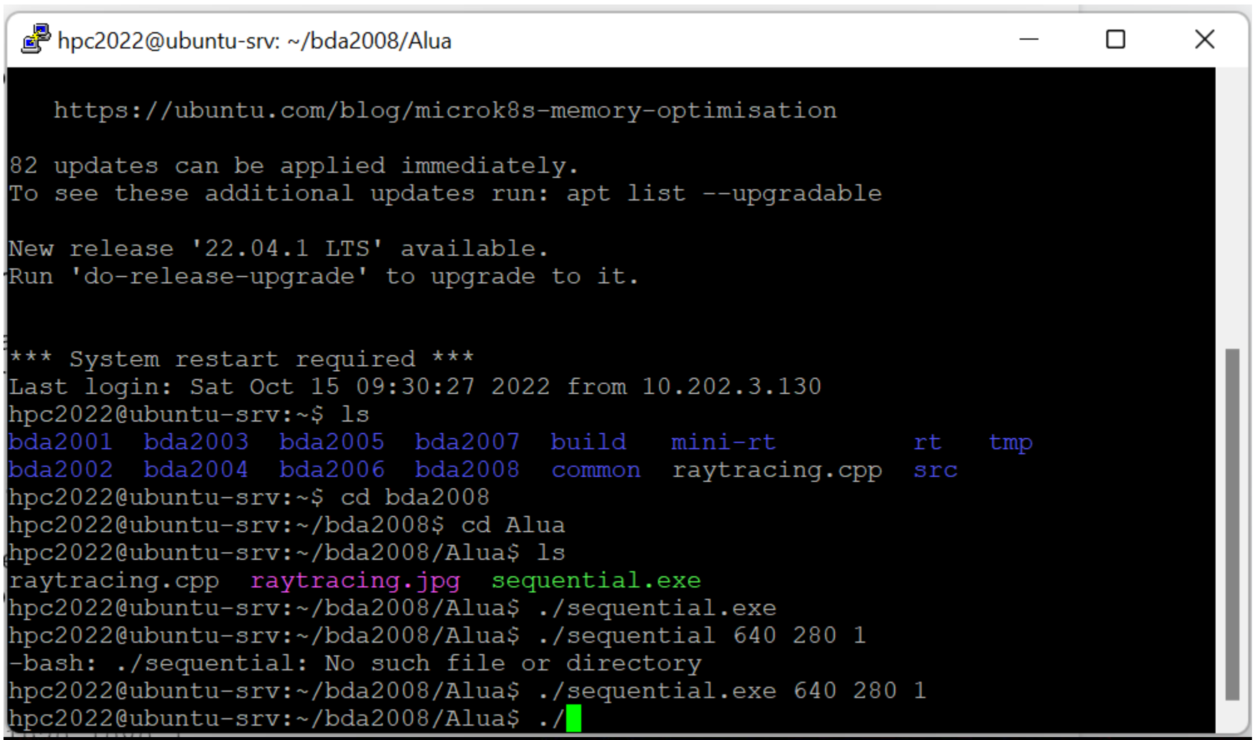
```
./sequential.exe <Image resolution by X> <Image resolution by Y> <Number
of samples>
```

Image with default parameters:

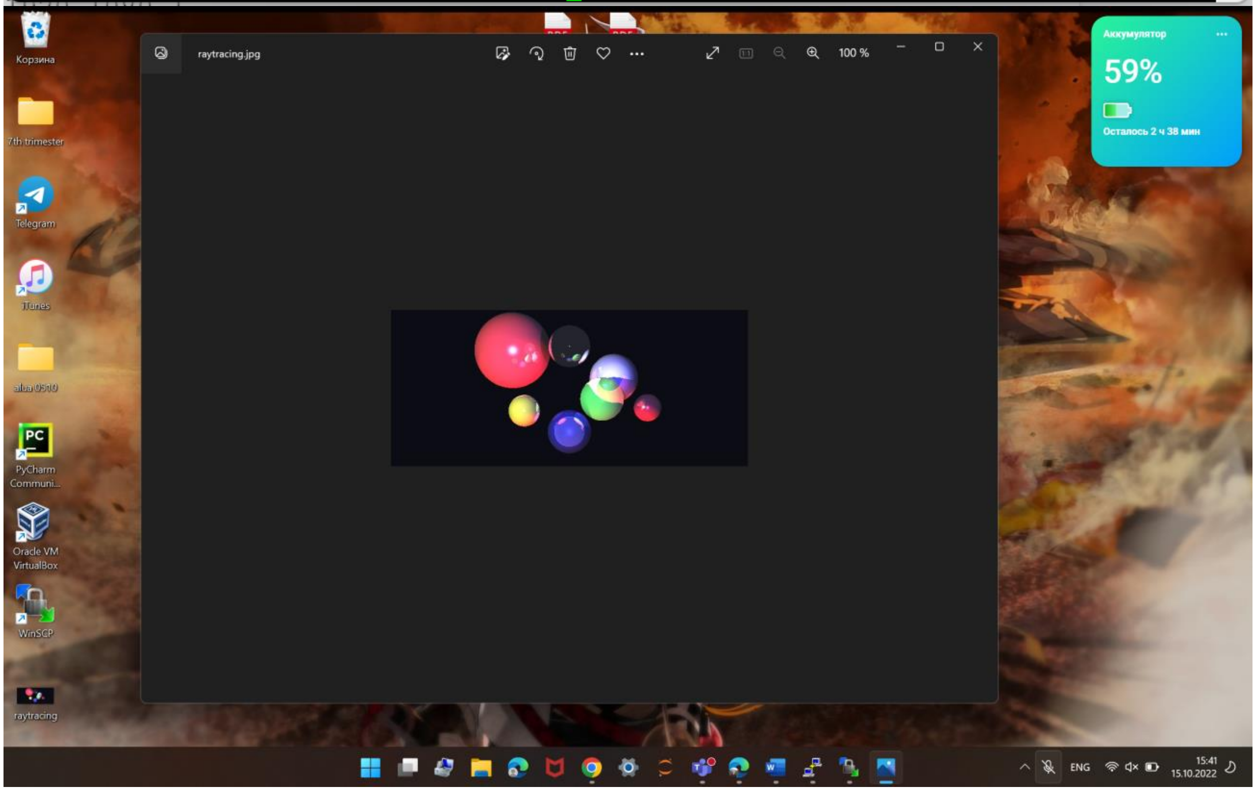


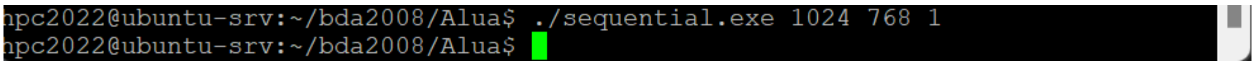
Change such parameters as image resolution or number of samples per pixel (command line arguments 1, 2 and 3 by default), observe the effect on the resulting image:

```
./sequential.exe 640 480 1
./sequential.exe 1024 768 1
./sequential.exe 1920 1080 1
./sequential.exe 1920 1080 2
./sequential.exe 1920 1080 10
```

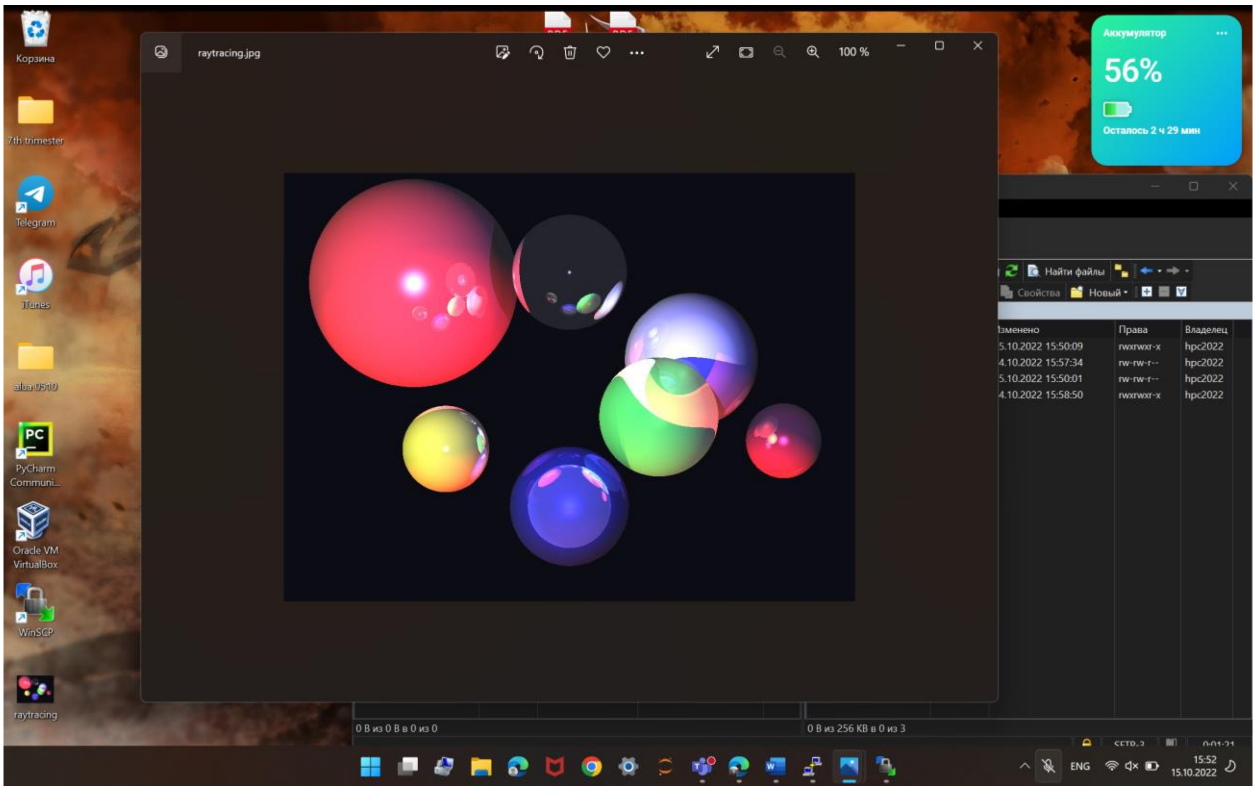


```
  https://ubuntu.com/blog/microk8s-memory-optimisation

82 updates can be applied immediately.
To see these additional updates run: apt list --upgradable

New release '22.04.1 LTS' available.
Run 'do-release-upgrade' to upgrade to it.


*** System restart required ***
Last login: Sat Oct 15 09:30:27 2022 from 10.202.3.130
hpc2022@ubuntu-srv:~$ ls
bda2001  bda2003  bda2005  bda2007  build   mini-rt         rt   tmp
bda2002  bda2004  bda2006  bda2008  common  raytracing.cpp  src
hpc2022@ubuntu-srv:~$ cd bda2008
hpc2022@ubuntu-srv:~/bda2008$ cd Alua
hpc2022@ubuntu-srv:~/bda2008/Alua$ ls
raytracing.cpp  raytracing.jpg  sequential.exe
hpc2022@ubuntu-srv:~/bda2008/Alua$ ./sequential.exe
hpc2022@ubuntu-srv:~/bda2008/Alua$ ./sequential 640 280 1
-bash: ./sequential: No such file or directory
hpc2022@ubuntu-srv:~/bda2008/Alua$ ./sequential.exe 640 280 1
hpc2022@ubuntu-srv:~/bda2008/Alua$ ./
```

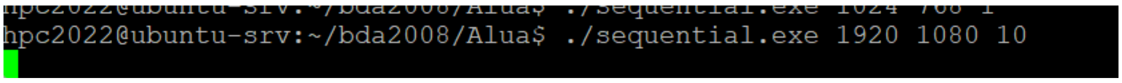




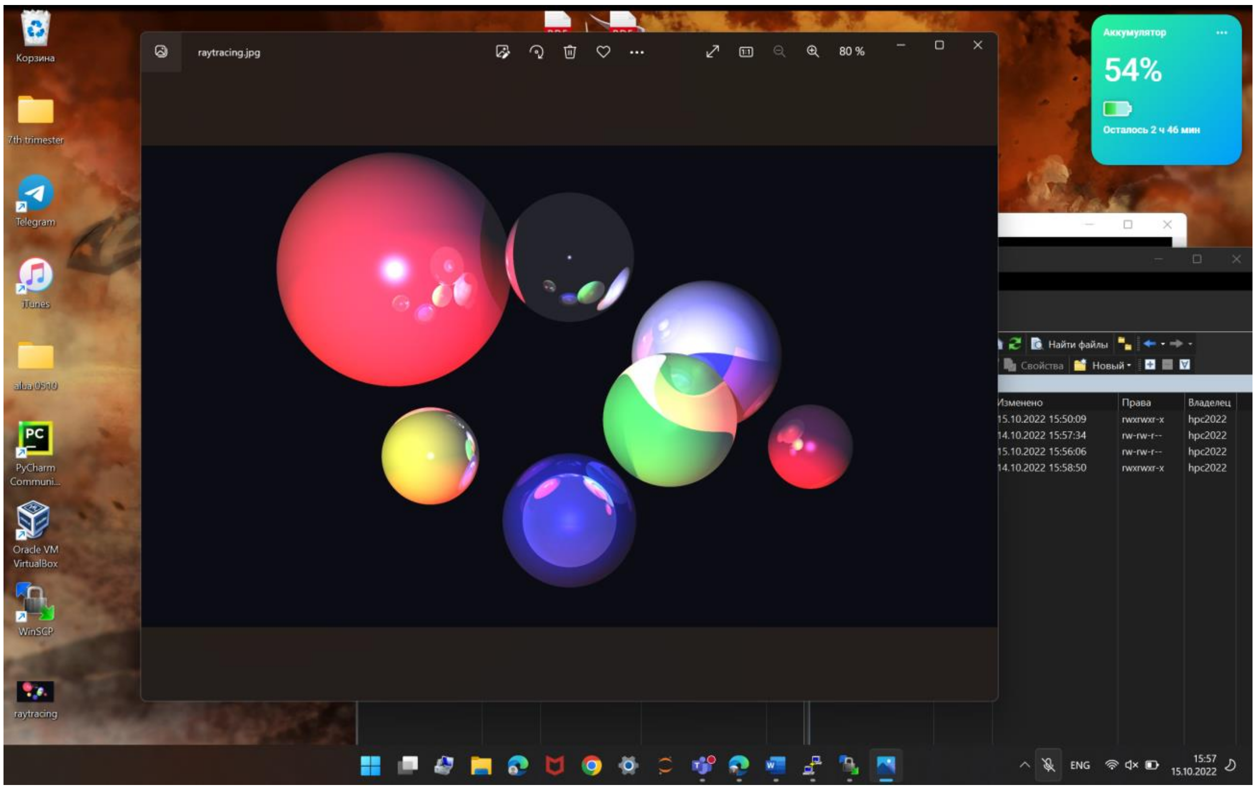
```
hpc2022@ubuntu-srv:~/bda2008/Alua$ ./sequential.exe 1024 768 1
hpc2022@ubuntu-srv:~/bda2008/Alua$ 
```



```
Изменено             Права        Владелец
5.10.2022 15:50:09   rwxrwxr-x    hpc2022
4.10.2022 15:57:34   rw-rw-r--    hpc2022
5.10.2022 15:50:01   rw-rw-r--    hpc2022
4.10.2022 15:58:50   rwxrwxr-x    hpc2022
0 B из 0 B в 0 из 0
0 B из 256 KB в 0 из 3
```

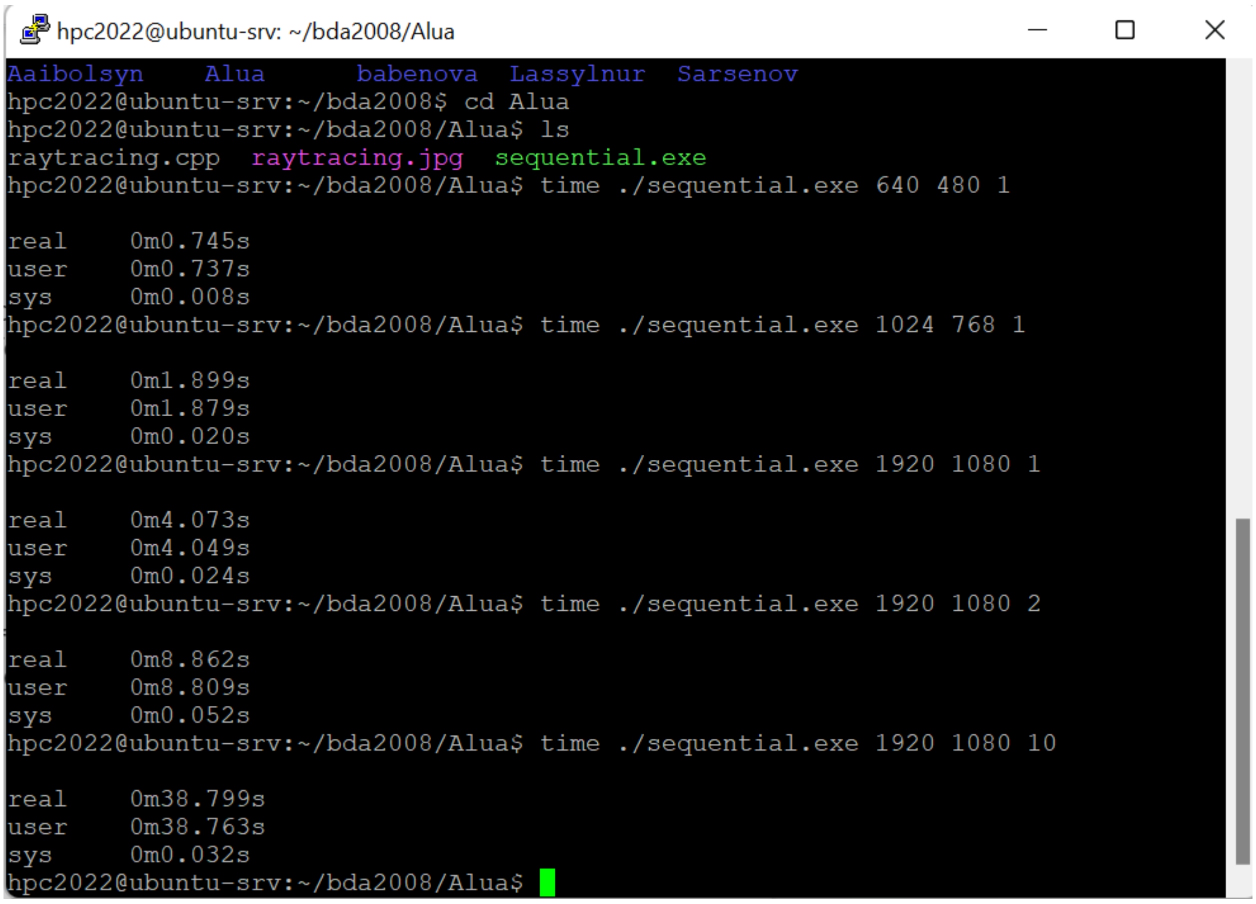


```
hpc2022@ubuntu-srv:~/bda2008/Alua$ ./sequential.exe 1024 768 1
hpc2022@ubuntu-srv:~/bda2008/Alua$ ./sequential.exe 1920 1080 10
```



```
Изменено             Права        Владелец
15.10.2022 15:50:09  rwxrwxr-x    hpc2022
14.10.2022 15:57:34  rw-rw-r--    hpc2022
15.10.2022 15:56:06  rw-rw-r--    hpc2022
14.10.2022 15:58:50  rwxrwxr-x    hpc2022
```

Measure running time of the application with different arguments (image resolution, number of samples, etc). You can use `time` command to measure time:
`time ./sequential.exe <arguments>`



```
Aaibolsyn    Alua       babenova  Lassylnur  Sarsenov
hpc2022@ubuntu-srv:~/bda2008$ cd Alua
hpc2022@ubuntu-srv:~/bda2008/Alua$ ls
raytracing.cpp  raytracing.jpg  sequential.exe
hpc2022@ubuntu-srv:~/bda2008/Alua$ time ./sequential.exe 640 480 1

real    0m0.745s
user    0m0.737s
sys     0m0.008s
hpc2022@ubuntu-srv:~/bda2008/Alua$ time ./sequential.exe 1024 768 1

real    0m1.899s
user    0m1.879s
sys     0m0.020s
hpc2022@ubuntu-srv:~/bda2008/Alua$ time ./sequential.exe 1920 1080 1

real    0m4.073s
user    0m4.049s
sys     0m0.024s
hpc2022@ubuntu-srv:~/bda2008/Alua$ time ./sequential.exe 1920 1080 2

real    0m8.862s
user    0m8.809s
sys     0m0.052s
hpc2022@ubuntu-srv:~/bda2008/Alua$ time ./sequential.exe 1920 1080 10

real    0m38.799s
user    0m38.763s
sys     0m0.032s
hpc2022@ubuntu-srv:~/bda2008/Alua$
```

Step 5: create git repository on Github for this course, upload your project files for Task 1 to it, include a link to the repository in the report

https://github.com/loopiiu/hpc_task1.git