

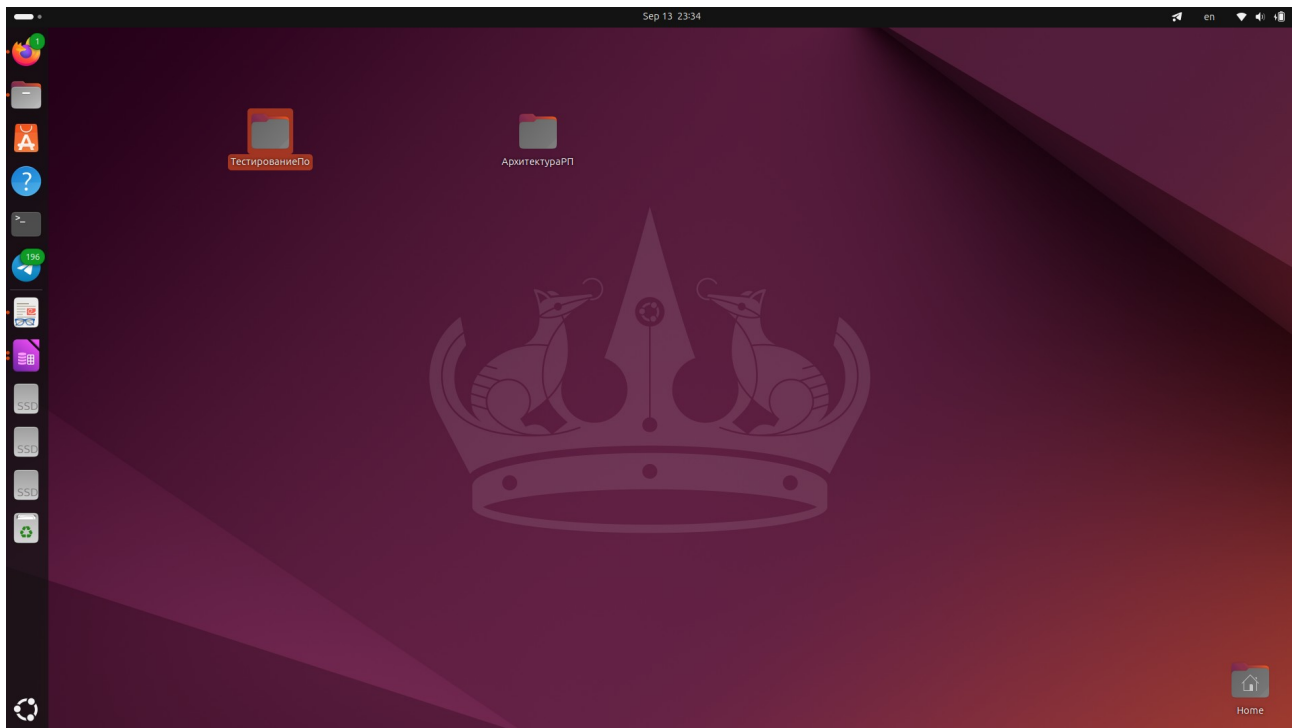
# Тестирование программного обеспечения

## Лабораторная работа 1

### Запуск OpenVMС с использованием QEMU

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1. С помощью загрузочной флешки установили Ubuntu.



## 2. Запуск образа OpenBMC.

Перед этим нужен `sudo apt update`, иначе некоторые пакеты он не найдёт.

```
gastello123@gastello123:~$ sudo apt install qemu-system-arm
```

```
gastello123@gastello123:~$ sudo apt update
Get:1 file:/cdrom/noble InRelease
Ign:1 file:/cdrom/noble InRelease
Get:2 file:/cdrom/noble Release
Err:2 file:/cdrom/noble Release
   File not found - /cdrom/dists/noble/Release (2: No such file or directory)
Hit:3 http://ru.archive.ubuntu.com/ubuntu noble InRelease
Get:4 http://ru.archive.ubuntu.com/ubuntu noble-updates InRelease [126 kB]
Get:5 http://security.ubuntu.com/ubuntu noble-security InRelease [126 kB]
Get:6 http://ru.archive.ubuntu.com/ubuntu noble-backports InRelease [126 kB]
Get:7 http://security.ubuntu.com/ubuntu noble-security/main amd64 Packages [1118 kB]
Get:8 http://ru.archive.ubuntu.com/ubuntu noble/main Translation-en [513 kB]
Get:9 http://ru.archive.ubuntu.com/ubuntu noble/restricted Translation-en [18.7 kB]
Get:10 http://ru.archive.ubuntu.com/ubuntu noble/universe Translation-en [5982 kB]
Get:11 http://security.ubuntu.com/ubuntu noble-security/main Translation-en [191 kB]
Get:12 http://security.ubuntu.com/ubuntu noble-security/main amd64 Components [21.6 kB]
Get:13 http://security.ubuntu.com/ubuntu noble-security/main amd64 c-n-f Metadata [8712 B]
Get:14 http://security.ubuntu.com/ubuntu noble-security/restricted Translation-en [382 kB]
Get:15 http://security.ubuntu.com/ubuntu noble-security/restricted amd64 Components [212 B]
```

```
gastello123@gastello123:~$ wget https://jenkins.openbmc.org/job/ci-openbmc/lastSuccessfulBuild/distro=ubuntu,label=docker-builder,target=romulus/artifact/openbmc/build/tmp/deploy/image
s/romulus/*zip*/romulus.zip
Warning: wildcards not supported in HTTP.
--2025-09-13 23:44:55-- https://jenkins.openbmc.org/job/ci-openbmc/lastSuccessfulBuild/distro=ubuntu,label=docker-builder,target=romulus/artifact/openbmc/build/tmp/deploy/images/romul
us/*zip*/romulus.zip
Resolving jenkins.openbmc.org (jenkins.openbmc.org)... 169.60.228.181
Connecting to jenkins.openbmc.org (jenkins.openbmc.org)|169.60.228.181|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: unspecified [application/zip]
Saving to: 'romulus.zip'

romulus.zip                               [      <=>                               ] 141.64M  2.84MB/s   in 38s

2025-09-13 23:45:40 (3.73 MB/s) - 'romulus.zip' saved [148523056]
```

```
gastello123@gastello123:~$ unzip romulus.zip
Archive:  romulus.zip
  inflating: romulus/aspeed-bmc-opp-romulus.dtb
  inflating: romulus/fitImage--6.12.43+git0+050998469a-r0-romulus-20250912220446.bin
  inflating: romulus/fitImage-its--6.12.43+git0+050998469a-r0-romulus-20250912220446.its
  inflating: romulus/fitImage-its-obmc-phosphor-initramfs-romulus--6.12.43+git0+050998469a-r0-romulus-20250912220446.its
  inflating: romulus/fitImage-linux.bin--6.12.43+git0+050998469a-r0-romulus-20250912220446.bin
  inflating: romulus/fitImage-obmc-phosphor-initramfs-romulus--6.12.43+git0+050998469a-r0-romulus-20250912220446.bin
  inflating: romulus/image-u-boot
  inflating: romulus/obmc-phosphor-debug-tarball-romulus-20250912220446.manifest
  inflating: romulus/obmc-phosphor-debug-tarball-romulus-20250912220446.qemuboot.conf
  inflating: romulus/obmc-phosphor-debug-tarball-romulus-20250912220446.spxd.json
  inflating: romulus/obmc-phosphor-debug-tarball-romulus-20250912220446.tar.xz
  inflating: romulus/obmc-phosphor-debug-tarball-romulus-20250912220446.testdata.json
  inflating: romulus/obmc-phosphor-image-romulus-20250912220446.manifest
  inflating: romulus/obmc-phosphor-image-romulus-20250912220446.qemuboot.conf
  inflating: romulus/obmc-phosphor-image-romulus-20250912220446.spxd.json
  inflating: romulus/obmc-phosphor-image-romulus-20250912220446.squashfs.xz
  inflating: romulus/obmc-phosphor-image-romulus-20250912220446.static.mtd
  inflating: romulus/obmc-phosphor-image-romulus-20250912220446.static.mtd.all.tar
  inflating: romulus/obmc-phosphor-image-romulus-20250912220446.static.mtd.tar
  inflating: romulus/obmc-phosphor-image-romulus-20250912220446.testdata.json
  inflating: romulus/obmc-phosphor-image-romulus.jffs2
  inflating: romulus/obmc-phosphor-initramfs-romulus-20250912220446.cpio.xz
  inflating: romulus/obmc-phosphor-initramfs-romulus-20250912220446.manifest
  inflating: romulus/obmc-phosphor-initramfs-romulus-20250912220446.qemuboot.conf
  inflating: romulus/obmc-phosphor-initramfs-romulus-20250912220446.spxd.json
  inflating: romulus/obmc-phosphor-initramfs-romulus-20250912220446.testdata.json
  inflating: romulus/u-boot-romulus-v2019.04+git-r0.bin
  inflating: romulus/vmlinux--6.12.43+git0+050998469a-r0-romulus-20250912220446.bin
gastello123@gastello123:~$
```

### 3. Запуск в QEMU:

```
gastello123@gastello123:~$ qemu-system-arm -m 256 -M romulus-bmc -nographic -drive file=romulus/obmc-phosphor-image-romulus-20250212052422.static.mtd,format=raw,if=mtd -net nic -net user,hostfwd=:0.0.0.0:2222::22,hostfwd=:0.0.0.0:2443::443,hostfwd=udp:0.0.0.0:2623::623,hostname=qemu
qemu-system-arm: -drive file=romulus/obmc-phosphor-image-romulus-20250212052422.static.mtd,format=raw,: Could not open 'romulus/obmc-phosphor-image-romulus-20250212052422.static.mtd':
No such file or directory
gastello123@gastello123:~$ qemu-system-arm -m 256 -M romulus-bmc -nographic -drive file=romulus/obmc-phosphor-image-romulus-20250212052422.static.mtd,format=raw,if=mtd -net nic -net user,hostfwd=:0.0.0.0:2222::22,hostfwd=:0.0.0.0:2443::443,hostfwd=udp:0.0.0.0:2623::623,hostname=qemu
qemu-system-arm: -drive file=romulus/obmc-phosphor-image-romulus-20250212052422.static.mtd,format=raw,: Could not open 'romulus/obmc-phosphor-image-romulus-20250212052422.static.mtd':
No such file or directory
gastello123@gastello123:~$ qemu-system-arm -m 256 -M romulus-bmc -nographic -drive file=romulus/obmc-phosphor-image-romulus-20250912220446.static.mtd,format=raw,if=mtd -net nic -net user,hostfwd=:0.0.0.0:2222::22,hostfwd=:0.0.0.0:2443::443,hostfwd=udp:0.0.0.0:2623::623,hostname=qemu
qemu-system-arm: if=mtd: drive with bus=0, unit=0 (index=0) exists
gastello123@gastello123:~$ qemu-system-arm -m 256 -M romulus-bmc -nographic -drive file=romulus/obmc-phosphor-image-romulus-20250912220446.static.mtd,format=raw,if=mtd -net nic -net user,hostfwd=:0.0.0.0:2222::22,hostfwd=:0.0.0.0:2443::443,hostfwd=udp:0.0.0.0:2623::623,hostname=qemu
qemu-system-arm: warning: nic ftgmac100.1 has no peer

U-Boot 2019.04 (May 23 2025 - 06:46:26 +0000)

SOC : AST2500-A1
RST : Power On
2nd Boot : Enable
LPC Mode : SIO:Enable : SuperIO-2e
Eth : MAC0: RMII/NCSI, , MAC1: RMII/NCSI,
Model: Romulus BMC
DRAM: 192 MiB (capacity:256 MiB, VGA:64 MiB, ECC:off)
MMC:
Loading Environment from SPI Flash... SF: Detected n25q256a with page size 256 Bytes, erase size 4 KiB, total 32 MiB
*** Warning - bad CRC, using default environment

In: serial@1e784000
Out: serial@1e784000
Err: serial@1e784000
Net: ftgmac100_probe - NCSI detected

Warning: ethernet@1e660000 (eth0) using random MAC address - a6:4f:1f:80:2d:37
eth0: ethernet@1e660000
Hit any key to stop autoboot: 0
## Loading kernel from FIT Image at 20000000 ...
Using 'conf-aspeed-bmc-opp-romulus.dtb' configuration
Trying 'kernel-1' kernel subImage
Description: Linux kernel
Type: Kernel Image
Compression: uncompressed
Data Start: 0x20000118
Data Size: 3170256 Bytes = 3 MiB
Architecture: ARM
OS: Linux
Load Address: 0x80001000
Entry Point: 0x80001000
Hash algo: sha256
Hash value: 03f3a8fa68abbd3d718f958a19b340b361c673a51f5ec8662a7dac2b22c272bc
Verifying Hash Integrity ... sha256+ OK

romulus login: [ OK ] Started Phosphor Hwmon Poller.
[ OK ] Started Phosphor Hwmon Poller.
Starting Phosphor LED Group Management Daemon...
Starting Phosphor Chassis0 State Manager...
[ OK ] Finished Wait for /org/openbmc/control/power0.
[ OK ] Finished Wait for /xyz/openbmc_project/control/host0/auto_reboot.
[ OK ] Finished Wait for /xyz/openbmc_project/control/host0/boot/one_time.
[ OK ] Finished Wait for /xyz/openbmc_project/control/host0/boot.
[ OK ] Finished Wait for /xyz/openbmc_project/control/host0/power_restore_policy.
[ OK ] Finished Wait for /xyz/openbmc_project/control/host0/restriction_mode.
[ OK ] Finished Wait for /xyz/openbmc_project/time/sync_method.
[ OK ] Finished Phosphor Sysfs - Add LED.
[ OK ] Finished Phosphor Sysfs - Add LED.
[ OK ] Finished Phosphor Sysfs - Add LED.
root
Password:
Login incorrect
romulus login: root
Password:
root@romulus:~#
```

```
root@romulus:~# obmcutil state
CurrentBMCState      : xyz.openbmc_project.State.BMC.BMCState.Ready
CurrentPowerState    : xyz.openbmc_project.State.Chassis.PowerState.Off
CurrentHostState     : xyz.openbmc_project.State.Host.HostState.Off
BootProgress         : xyz.openbmc_project.State.Boot.Progress.ProgressStages.Unspecified
OperatingSystemState : xyz.openbmc_project.State.OperatingSystem.Status.OSStatus.Inactive
root@romulus:~#
```

```
root@romulus:~# obmcutil poweron
root@romulus:~# obmcutil poweroff
root@romulus:~#
```

### 5. Получение доступа к BMC через IPMI с другого хоста

```
gastello123@gastello123:~/Desktop$ ipmitool -I lanplus -H 127.0.0.1 -p 2623 -U root -P OpenBmc fru print
FRU Device Description : BuiltIn FRU Device (ID 0)
Device not present (Requested sensor, data, or record not found)

FRU Device Description : cpu0 (ID 1)
Device not present (Requested sensor, data, or record not found)

FRU Device Description : cpu1 (ID 2)
Device not present (Requested sensor, data, or record not found)

FRU Device Description : system (ID 3)
Device not present (Requested sensor, data, or record not found)

FRU Device Description : dimm0 (ID 4)
Device not present (Requested sensor, data, or record not found)

FRU Device Description : dimm1 (ID 5)
Device not present (Requested sensor, data, or record not found)

FRU Device Description : dimm2 (ID 6)
Device not present (Requested sensor, data, or record not found)

FRU Device Description : dimm3 (ID 7)
Device not present (Requested sensor, data, or record not found)

FRU Device Description : dimm4 (ID 8)
Device not present (Requested sensor, data, or record not found)

FRU Device Description : dimm5 (ID 9)
Device not present (Requested sensor, data, or record not found)

FRU Device Description : dimm6 (ID 10)
Device not present (Requested sensor, data, or record not found)

FRU Device Description : dimm7 (ID 11)
Device not present (Requested sensor, data, or record not found)

FRU Device Description : dimm8 (ID 12)
Device not present (Requested sensor, data, or record not found)

FRU Device Description : dimm9 (ID 13)
Device not present (Requested sensor, data, or record not found)

FRU Device Description : dimm10 (ID 14)
Device not present (Requested sensor, data, or record not found)
```

## 6. Получение доступа к BMC через Redfish с другого хоста:

```
gastello123@gastello123:~/Desktop$ curl -k https://127.0.0.1:2443/redfish/v1/ -u root:openBmc
{
  "@odata.id": "/redfish/v1",
  "@odata.type": "#ServiceRoot.v1_15_0.ServiceRoot",
  "AccountService": {
    "@odata.id": "/redfish/v1/AccountService"
  },
  "Cables": {
    "@odata.id": "/redfish/v1/Cables"
  },
  "CertificateService": {
    "@odata.id": "/redfish/v1/CertificateService"
  },
  "Chassis": {
    "@odata.id": "/redfish/v1/Chassis"
  },
  "EventService": {
    "@odata.id": "/redfish/v1/EventService"
  },
  "Id": "RootService",
  "JsonSchemas": {
    "@odata.id": "/redfish/v1/JsonSchemas"
  },
  "Links": {
    "ManagerProvidingService": {
      "@odata.id": "/redfish/v1/Managers/bmc"
    },
    "Sessions": {
      "@odata.id": "/redfish/v1/SessionService/Sessions"
    }
  },
  "Managers": {
    "@odata.id": "/redfish/v1/Managers"
  },
  "Name": "Root Service",
  "ProtocolFeaturesSupported": {
    "DeepOperations": {
      "DeepPATCH": false,
      "DeepPOST": false
    },
    "ExcerptQuery": false,
    "ExpandQuery": {
      "MaxDepth": 2
    }
  }
}
```

## 7. Анализ логов и документации:

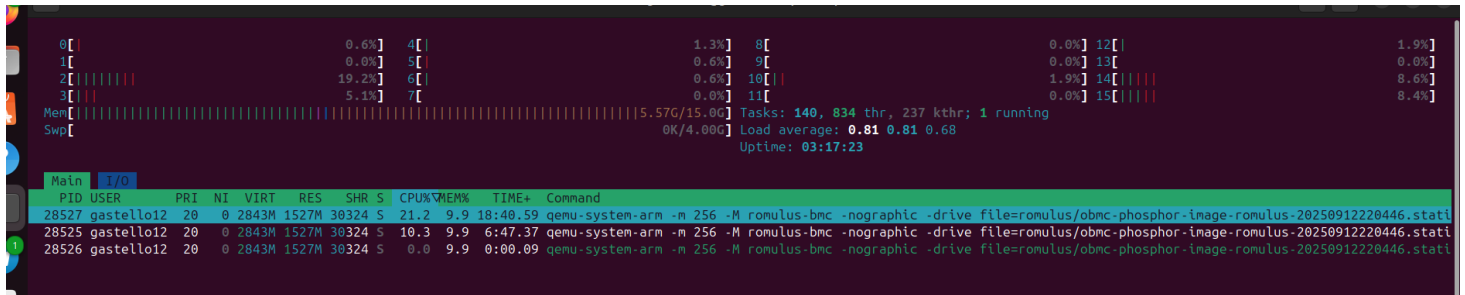
```
root@romulus:~# systemctl poweroff
root@romulus:~# journalctl -u xyz.openbmc_project.State.BMC.service
Sep 13 17:44:57 romulus systemd[1]: Starting Phosphor BMC State Manager...
Sep 13 17:44:58 romulus phosphor-bmc-state-manager[353]: Unit obmc-bmc-service-quiet@0.target not found: sd_bus_call: org.freedesktop.systemd1.NoSuchUnit: Unit obmc-bmc-service-quiet@0.target not loaded.
Sep 13 17:44:58 romulus phosphor-bmc-state-manager[353]: Setting the BMCState field to BMC_NOTREADY
Sep 13 17:44:58 romulus phosphor-bmc-state-manager[353]: Setting the BMCState field to xyz.openbmc_project.State.BMC.BMCState.NotReady
Sep 13 17:44:58 romulus phosphor-bmc-state-manager[353]: Setting the RebootCause field to xyz.openbmc_project.State.BMC.RebootCause.POR
Sep 13 17:44:58 romulus systemd[1]: Started Phosphor BMC State Manager.
Sep 13 17:45:01 romulus phosphor-bmc-state-manager[353]: BMC_READY
Sep 13 17:45:01 romulus phosphor-bmc-state-manager[353]: Setting the BMCState field to xyz.openbmc_project.State.BMC.BMCState.Ready
root@romulus:~#
```

Все вышеуказанные логи описывают успешный запуск и готовность BMC к работе.

## 8. Анализ потребляемых ресурсов QEMU:

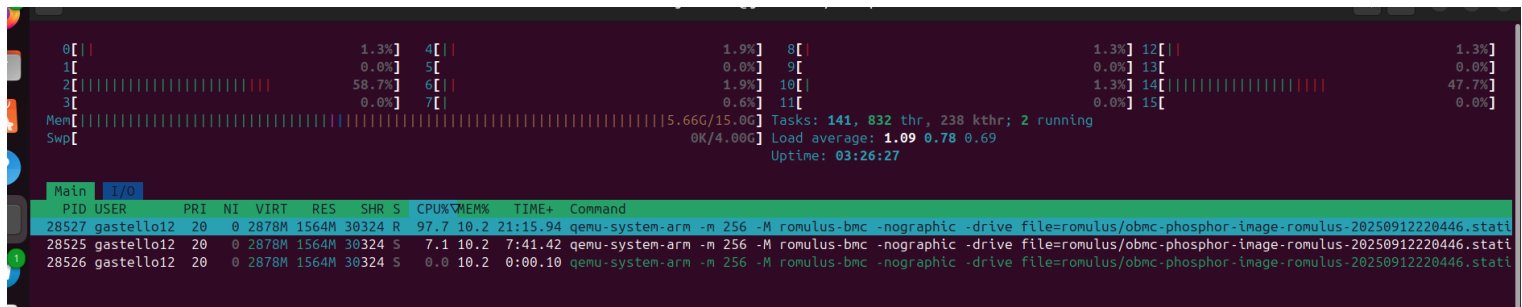
Использую команду: `htop -p $(pgrep qemu-system-arm)` для наглядного отображения показателей в реальном времени.

В простое:



Под интенсивным тестом:

```
while true; do curl -k https://127.0.0.1:2443/redfish/v1/  
-u root:OpenBmc -o /dev/null; done
```



Очевидный значительный рост нагрузки на процессор и незначительное увеличение используемой памяти.