KVM虚拟机与特定CPU的绑定

实验过程：

查看当前内核启动时的命令参数：cat /proc/cmdline

修改内核启动参数：

使用vim编辑器以root身份打开/etc/default/grub配置文件

在文件中找到以GRUB_CMDLINE_LINUX开头的行，在后面增加参数：isolcpus=2,3

保存并退出编辑

使用编辑后的默认文件重新生成GRUB2配置：

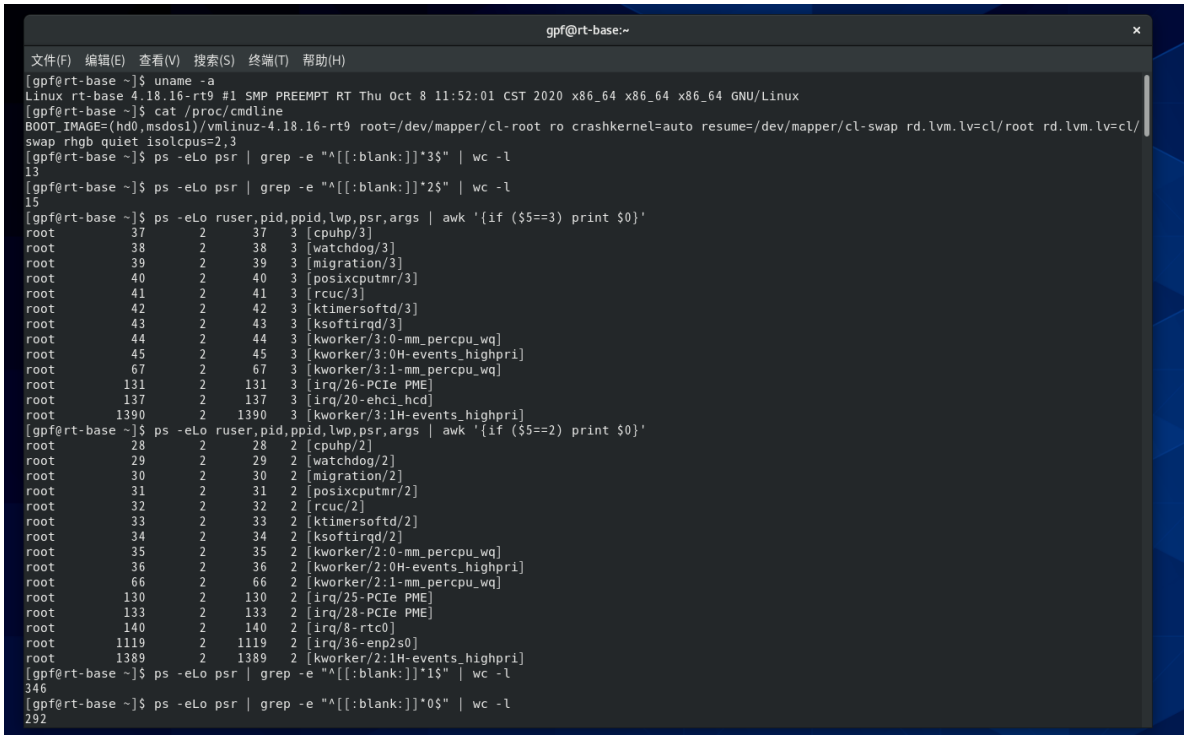
grub2-mkconfig -o /boot/grub2/grub.cfg

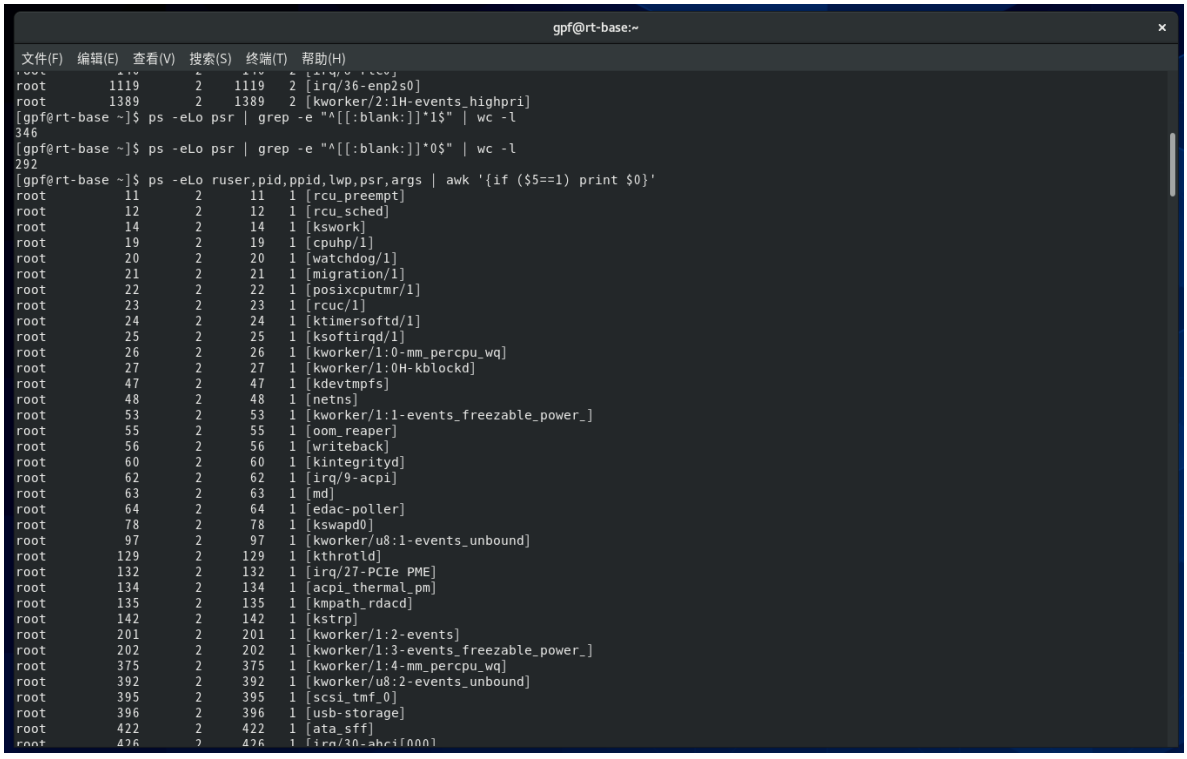
然后重启计算机

查看本次内核启动时的参数：cat /proc/cmdline

查看宿主机是否隔离成功和当前各个cpu上运行的线程信息：

```
ps -eLo ruser,pid,ppid,lwp,psr,args | awk '{if ($5==3) print $0}'
ps -eLo ruser,pid,ppid,lwp,psr,args | awk '{if ($5==2) print $0}'
ps -eLo ruser,pid,ppid,lwp,psr,args | awk '{if ($5==1) print $0}'
ps -eLo ruser,pid,ppid,lwp,psr,args | awk '{if ($5==0) print $0}'
ps -eLo psr | grep -e "^[[:blank:]]0$" | wc -l
ps -eLo psr | grep -e "^[[:blank:]]1$" | wc -l
ps -eLo psr | grep -e "^[[:blank:]]2$" | wc -l
ps -eLo psr | grep -e "^[[:blank:]]3$" | wc -l
```





根据输出信息可以看到cpu3-2上运行的进程和线程信息，分别有

migration线程：用于进程在不同CPU间迁移；

kworker线程：用于处理workqueues;

ksofttirqd线程：用于调度CPU软中断的进程；

watchdog:

cpuhp:

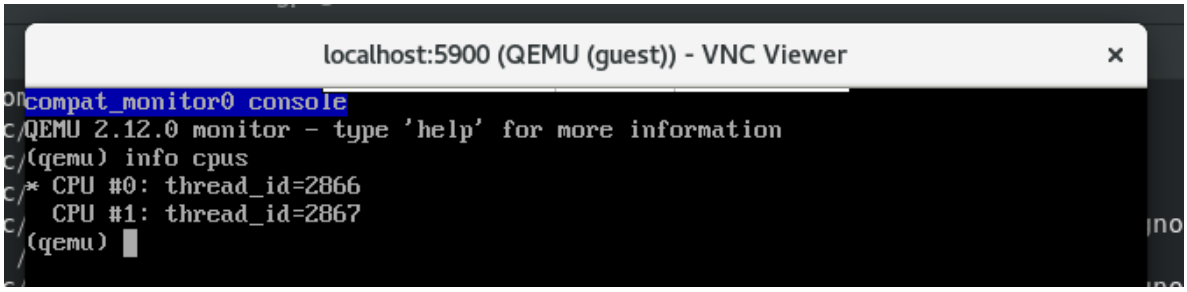
posixcputmr:

这些进程都是内核对各个CPU的守护进程。没有其他的普通进程在CPU2-3上运行，说明隔离是有效的。

启动一个拥有俩个VCPU的客户机，并将其VCPU绑定到宿主机的CPU2-3上：

启动客户机：

查看客户机的VCPU线程：



查看并改变客户机VCPU的处理器亲和性：

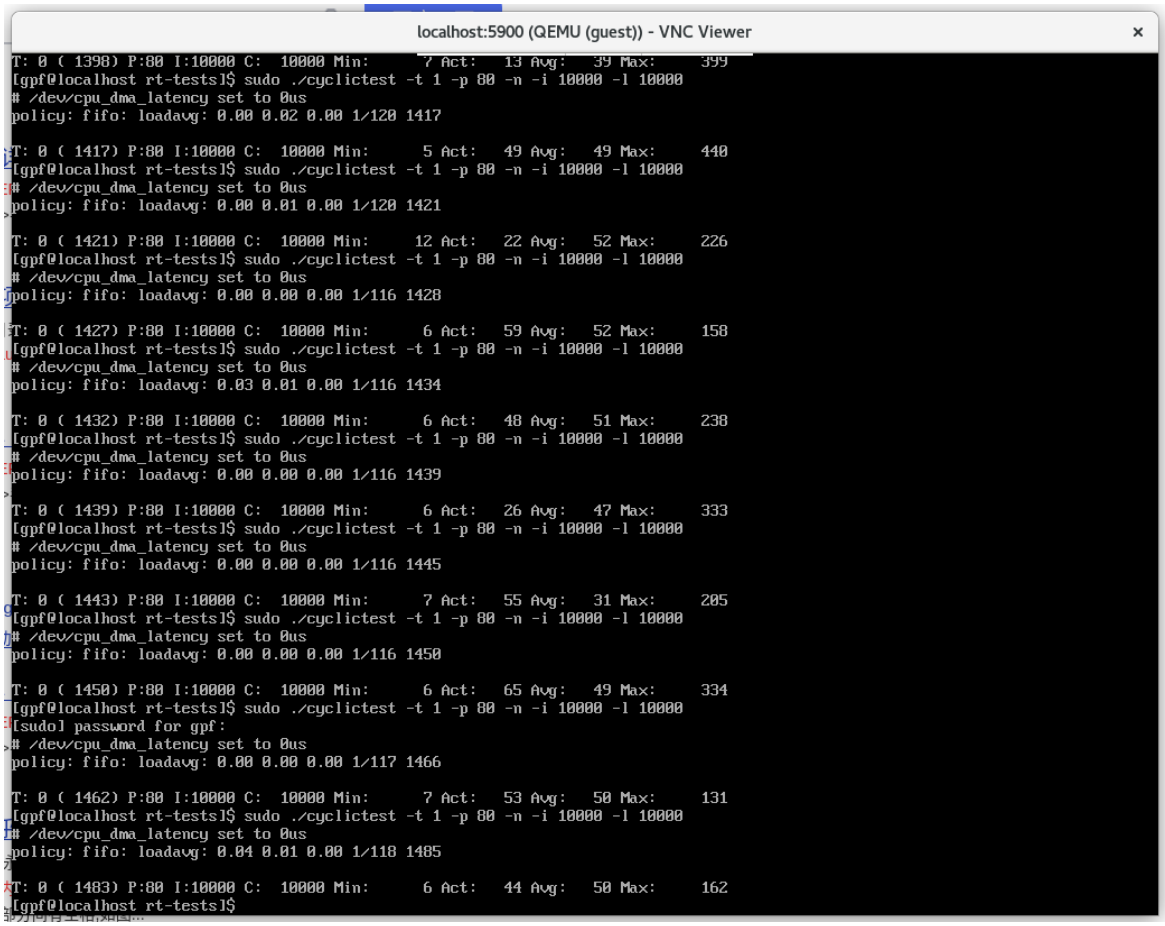
ps -eLo ruser,pid,ppid,lwp,psr,args | gerp qemu | gerp -v grep

其中，
-e:显示所有进程
L: 显示所有线程
-o:以用户自定义的格式输出
ruser:运行进程的用户名
pid:进程id
ppid:父进程id
lwp:线程的id
psr：系统当前分配给进程运行的处理器编号
args:运行的命令及其参数

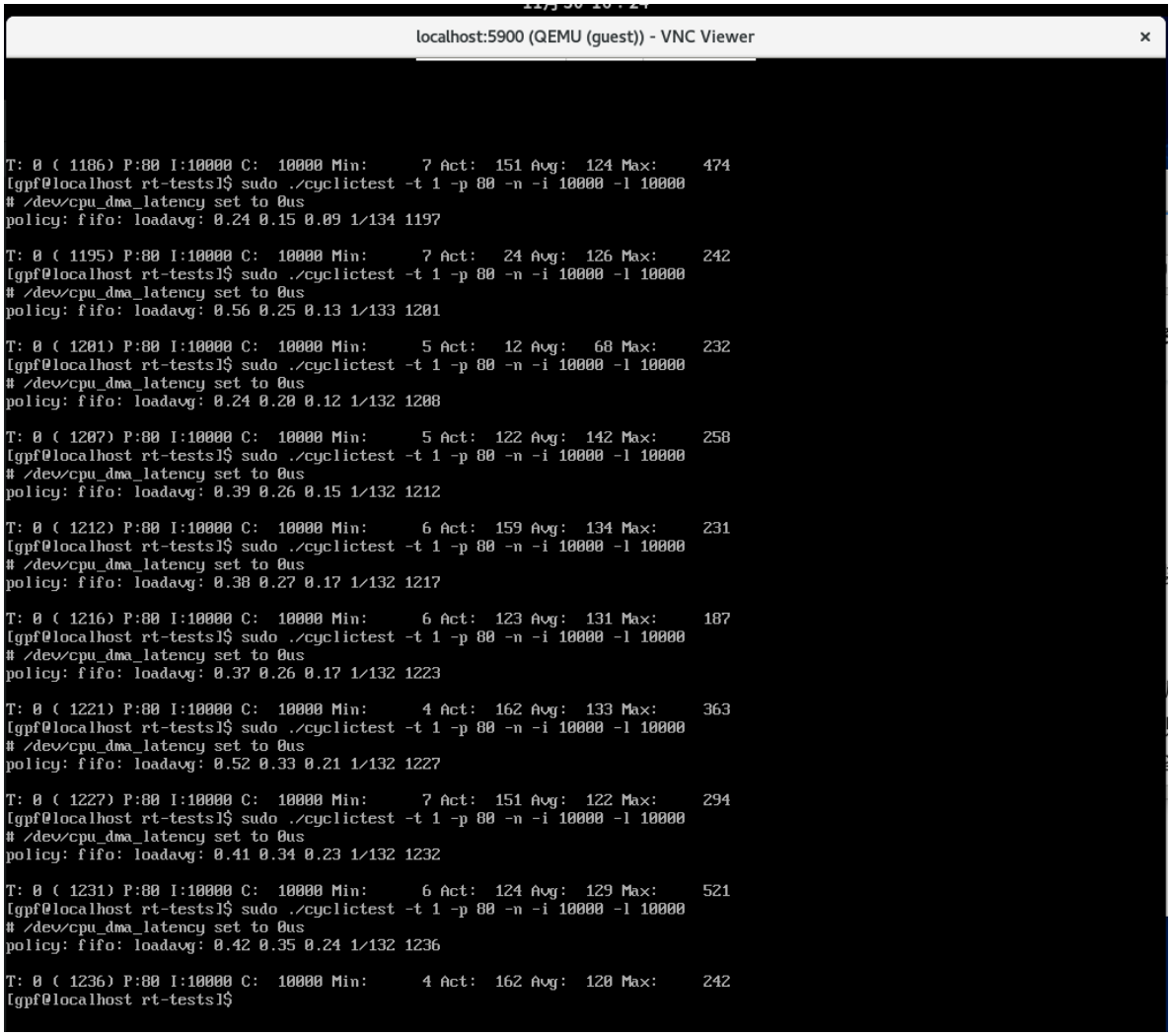
实验结果：

CPU绑定之后的内核时延：

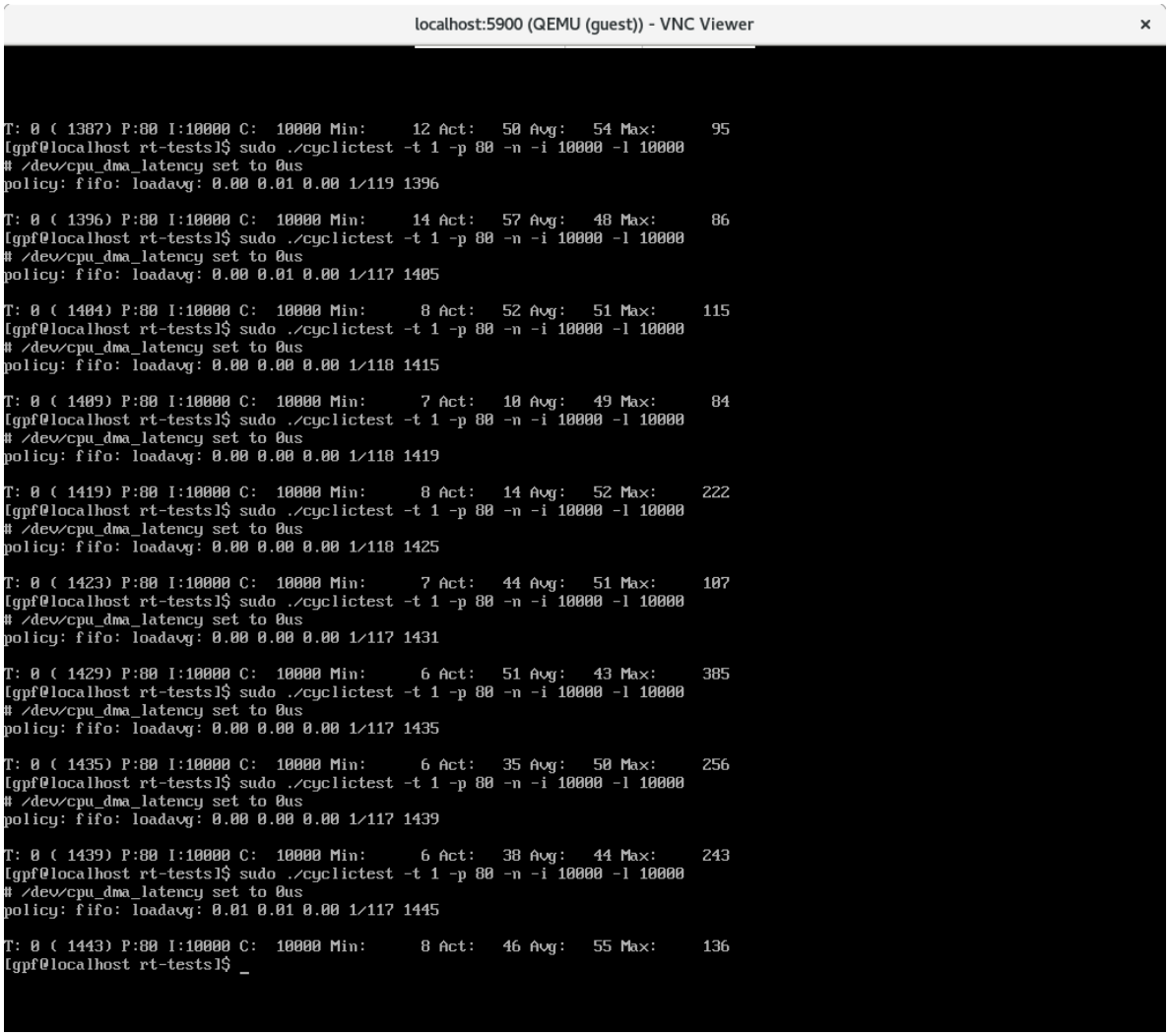
GP-GP:



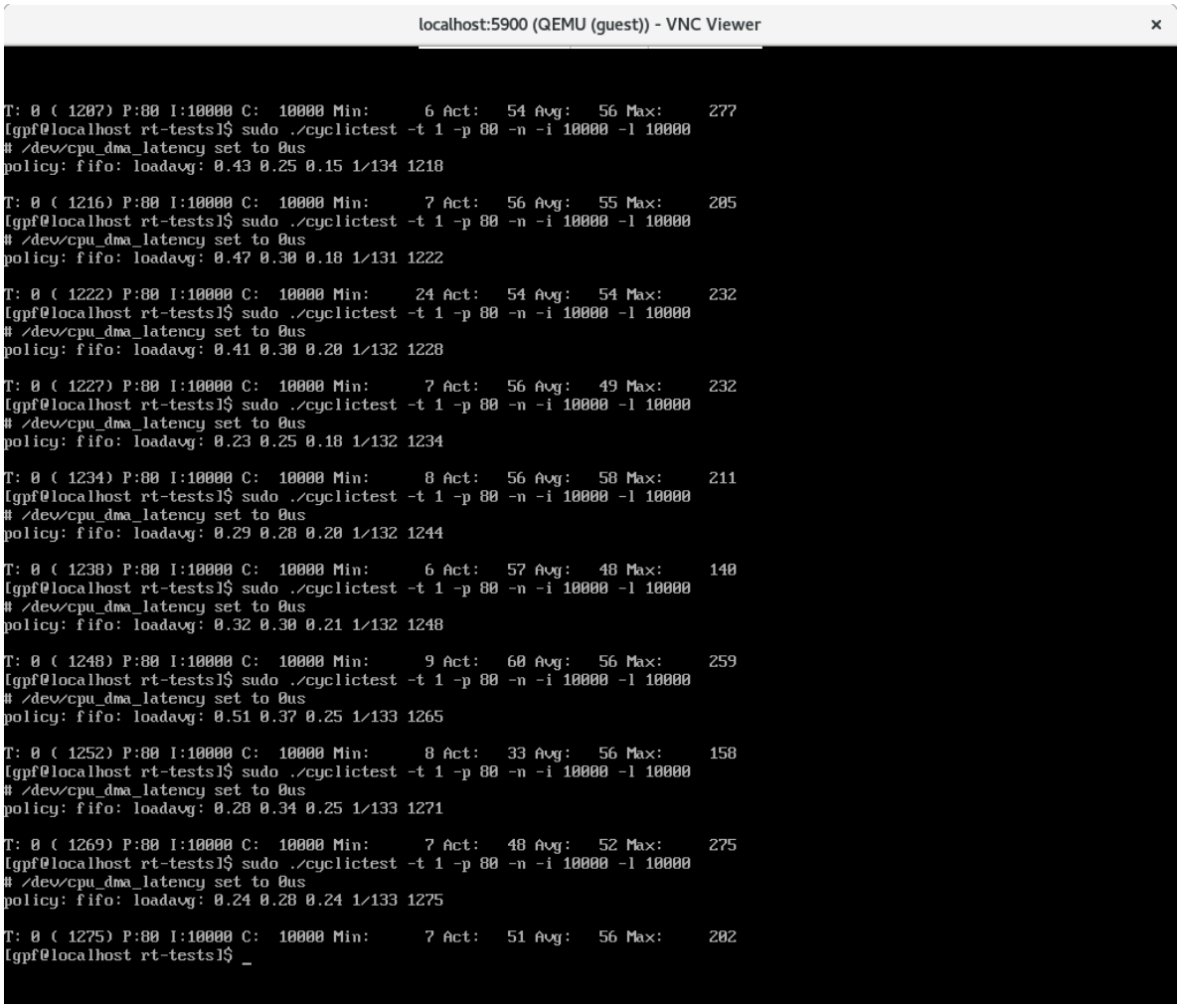
GP-RT:


localhost:5900 (QEMU (guest)) - VNC Viewer
T: 0 (1186) P:80 I:10000 C: 10000 Min: 7 Act: 151 Avg: 124 Max: 474
[gpf@localhost rt-tests]$ sudo ./cyclictest -t 1 -p 80 -n -i 10000 -l 10000
/dev/cpu_dma_latency set to 0us
policy: fifo: loadavg: 0.24 0.15 0.09 1/134 1197
T: 0 (1195) P:80 I:10000 C: 10000 Min: 7 Act: 24 Avg: 126 Max: 242
[gpf@localhost rt-tests]$ sudo ./cyclictest -t 1 -p 80 -n -i 10000 -l 10000
/dev/cpu_dma_latency set to 0us
policy: fifo: loadavg: 0.56 0.25 0.13 1/133 1201
T: 0 (1201) P:80 I:10000 C: 10000 Min: 5 Act: 12 Avg: 68 Max: 232
[gpf@localhost rt-tests]$ sudo ./cyclictest -t 1 -p 80 -n -i 10000 -l 10000
/dev/cpu_dma_latency set to 0us
policy: fifo: loadavg: 0.24 0.20 0.12 1/132 1208
T: 0 (1207) P:80 I:10000 C: 10000 Min: 5 Act: 122 Avg: 142 Max: 258
[gpf@localhost rt-tests]$ sudo ./cyclictest -t 1 -p 80 -n -i 10000 -l 10000
/dev/cpu_dma_latency set to 0us
policy: fifo: loadavg: 0.39 0.26 0.15 1/132 1212
T: 0 (1212) P:80 I:10000 C: 10000 Min: 6 Act: 159 Avg: 134 Max: 231
[gpf@localhost rt-tests]$ sudo ./cyclictest -t 1 -p 80 -n -i 10000 -l 10000
/dev/cpu_dma_latency set to 0us
policy: fifo: loadavg: 0.38 0.27 0.17 1/132 1217
T: 0 (1216) P:80 I:10000 C: 10000 Min: 6 Act: 123 Avg: 131 Max: 187
[gpf@localhost rt-tests]$ sudo ./cyclictest -t 1 -p 80 -n -i 10000 -l 10000
/dev/cpu_dma_latency set to 0us
policy: fifo: loadavg: 0.37 0.26 0.17 1/132 1223
T: 0 (1221) P:80 I:10000 C: 10000 Min: 4 Act: 162 Avg: 133 Max: 363
[gpf@localhost rt-tests]$ sudo ./cyclictest -t 1 -p 80 -n -i 10000 -l 10000
/dev/cpu_dma_latency set to 0us
policy: fifo: loadavg: 0.52 0.33 0.21 1/132 1227
T: 0 (1227) P:80 I:10000 C: 10000 Min: 7 Act: 151 Avg: 122 Max: 294
[gpf@localhost rt-tests]$ sudo ./cyclictest -t 1 -p 80 -n -i 10000 -l 10000
/dev/cpu_dma_latency set to 0us
policy: fifo: loadavg: 0.41 0.34 0.23 1/132 1232
T: 0 (1231) P:80 I:10000 C: 10000 Min: 6 Act: 124 Avg: 129 Max: 521
[gpf@localhost rt-tests]$ sudo ./cyclictest -t 1 -p 80 -n -i 10000 -l 10000
/dev/cpu_dma_latency set to 0us
policy: fifo: loadavg: 0.42 0.35 0.24 1/132 1236
T: 0 (1236) P:80 I:10000 C: 10000 Min: 4 Act: 162 Avg: 120 Max: 242
[gpf@localhost rt-tests]$

RT-GP:


localhost:5900 (QEMU (guest)) - VNC Viewer
T: 0 (1387) P:80 I:10000 C: 10000 Min: 12 Act: 50 Avg: 54 Max: 95
[gpf@localhost rt-tests1$ sudo ./cyclictest -t 1 -p 80 -n -i 10000 -l 10000
/dev/cpu_dma_latency set to 0us
policy: fifo: loadavg: 0.00 0.01 0.00 1/119 1396
T: 0 (1396) P:80 I:10000 C: 10000 Min: 14 Act: 57 Avg: 48 Max: 86
[gpf@localhost rt-tests1$ sudo ./cyclictest -t 1 -p 80 -n -i 10000 -l 10000
/dev/cpu_dma_latency set to 0us
policy: fifo: loadavg: 0.00 0.01 0.00 1/117 1405
T: 0 (1404) P:80 I:10000 C: 10000 Min: 8 Act: 52 Avg: 51 Max: 115
[gpf@localhost rt-tests1$ sudo ./cyclictest -t 1 -p 80 -n -i 10000 -l 10000
/dev/cpu_dma_latency set to 0us
policy: fifo: loadavg: 0.00 0.00 0.00 1/118 1415
T: 0 (1409) P:80 I:10000 C: 10000 Min: 7 Act: 10 Avg: 49 Max: 84
[gpf@localhost rt-tests1$ sudo ./cyclictest -t 1 -p 80 -n -i 10000 -l 10000
/dev/cpu_dma_latency set to 0us
policy: fifo: loadavg: 0.00 0.00 0.00 1/118 1419
T: 0 (1419) P:80 I:10000 C: 10000 Min: 8 Act: 14 Avg: 52 Max: 222
[gpf@localhost rt-tests1$ sudo ./cyclictest -t 1 -p 80 -n -i 10000 -l 10000
/dev/cpu_dma_latency set to 0us
policy: fifo: loadavg: 0.00 0.00 0.00 1/118 1425
T: 0 (1423) P:80 I:10000 C: 10000 Min: 7 Act: 44 Avg: 51 Max: 107
[gpf@localhost rt-tests1$ sudo ./cyclictest -t 1 -p 80 -n -i 10000 -l 10000
/dev/cpu_dma_latency set to 0us
policy: fifo: loadavg: 0.00 0.00 0.00 1/117 1431
T: 0 (1429) P:80 I:10000 C: 10000 Min: 6 Act: 51 Avg: 43 Max: 385
[gpf@localhost rt-tests1$ sudo ./cyclictest -t 1 -p 80 -n -i 10000 -l 10000
/dev/cpu_dma_latency set to 0us
policy: fifo: loadavg: 0.00 0.00 0.00 1/117 1435
T: 0 (1435) P:80 I:10000 C: 10000 Min: 6 Act: 35 Avg: 50 Max: 256
[gpf@localhost rt-tests1$ sudo ./cyclictest -t 1 -p 80 -n -i 10000 -l 10000
/dev/cpu_dma_latency set to 0us
policy: fifo: loadavg: 0.00 0.00 0.00 1/117 1439
T: 0 (1439) P:80 I:10000 C: 10000 Min: 6 Act: 38 Avg: 44 Max: 243
[gpf@localhost rt-tests1$ sudo ./cyclictest -t 1 -p 80 -n -i 10000 -l 10000
/dev/cpu_dma_latency set to 0us
policy: fifo: loadavg: 0.01 0.01 0.00 1/117 1445
T: 0 (1443) P:80 I:10000 C: 10000 Min: 8 Act: 46 Avg: 55 Max: 136
[gpf@localhost rt-tests1$ _

RT-RT:

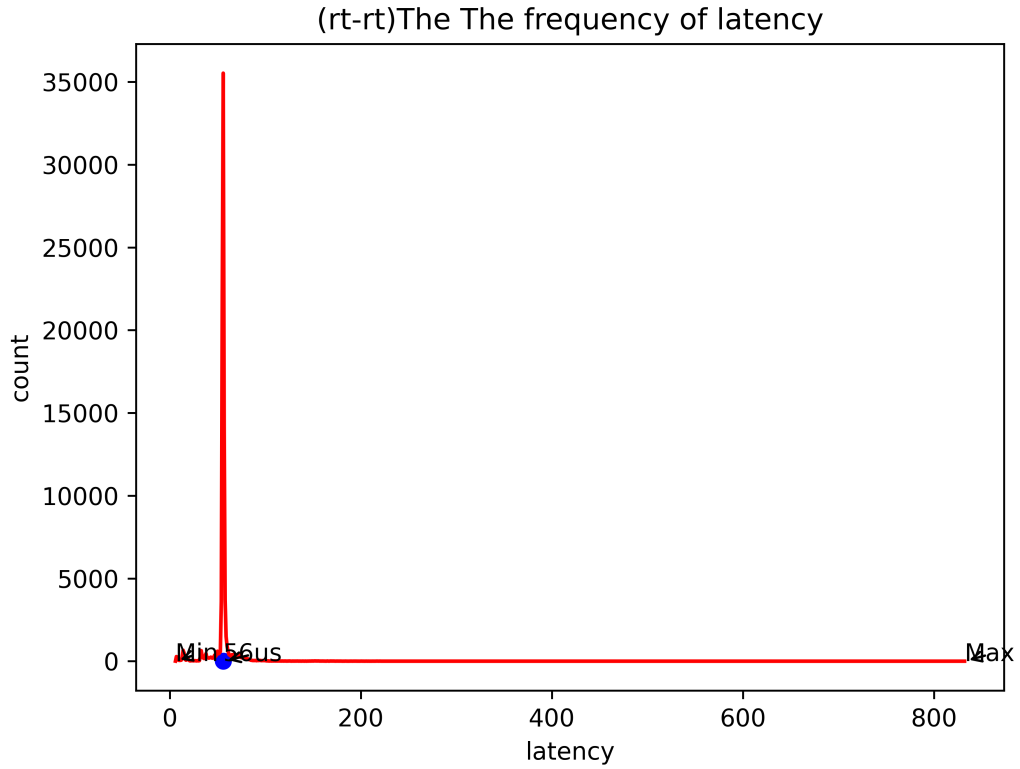


不同组合内核时延统计：

宿主机\客户机	GP	RT
GP	717、399、448、226、158、238、333、205、334、131、162	474、242、232、258、231、187、363、294、521、242、
RT	95、86、115、84、222、107、385、256、243、136	277、205、232、232、211、148、259、158、275、202

不同组合测试时延的频数统计

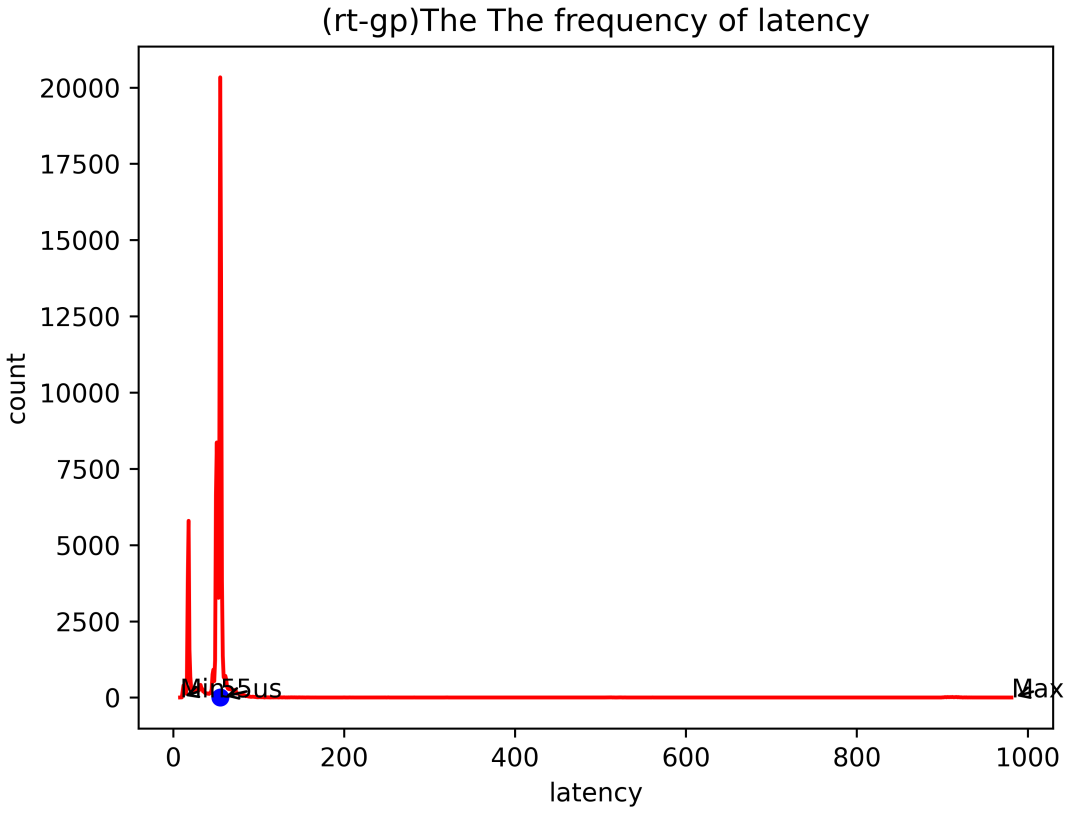
- RT-RT



出现频率最高的时延是55us，一共出现了35522次。

```
(torch) [gpf@legion 20201201 (master ✗)]$ python show_freq.py ./kvm/ans.txt rt-r
t
35522
The most frequency lactency is 56. It appeared 35522 times
```

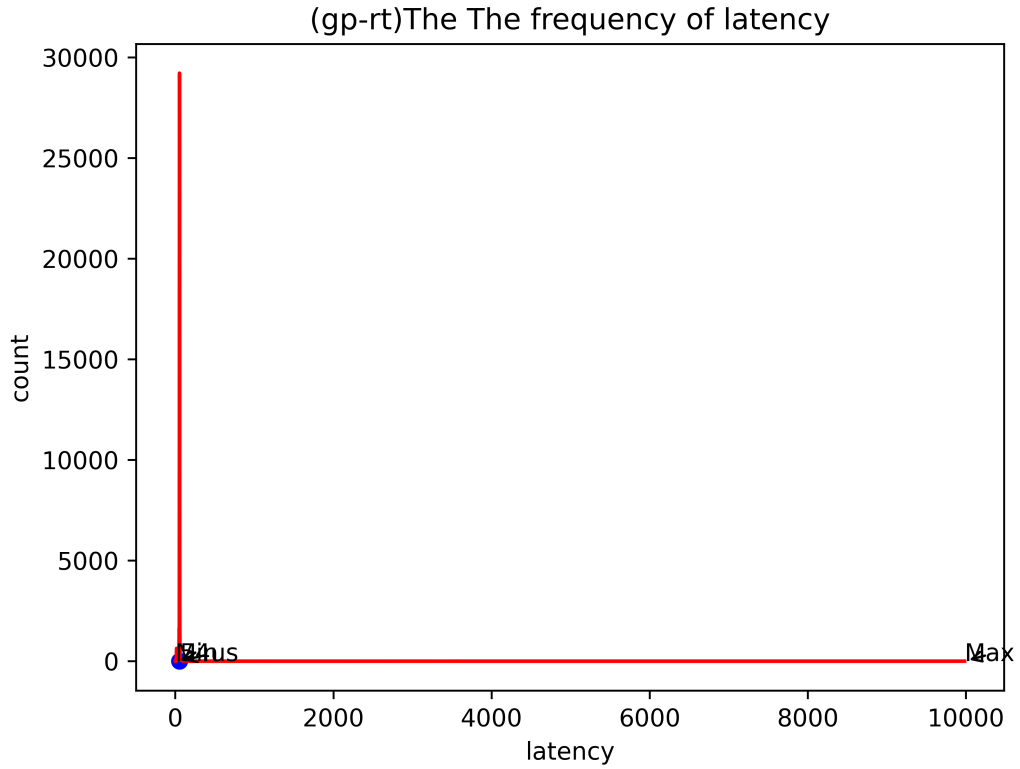
- RT-GP



出现频率最高的时延是55us，一共出现了20334次。

```
(torch) [gpf@legion 20201201 (master ✗)]$ python show_freq.py ./kvm/ans2.txt rt-
gp
20334
The most frequency lactency is 55. It appeared 20334 times
```

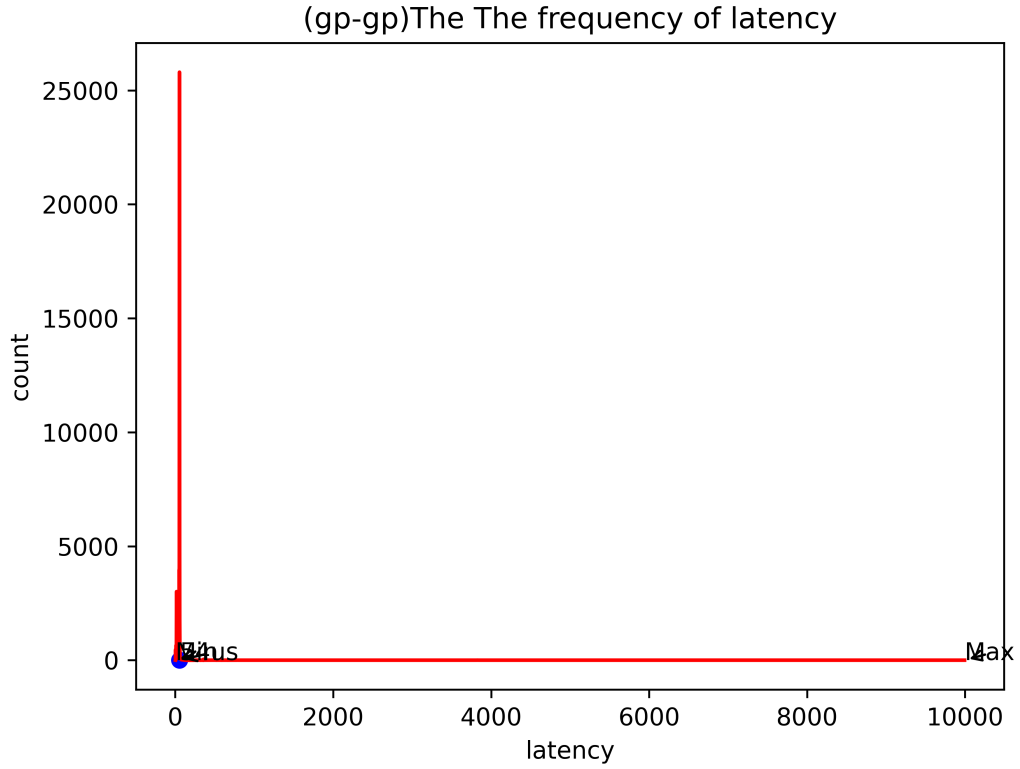
- GP-RT



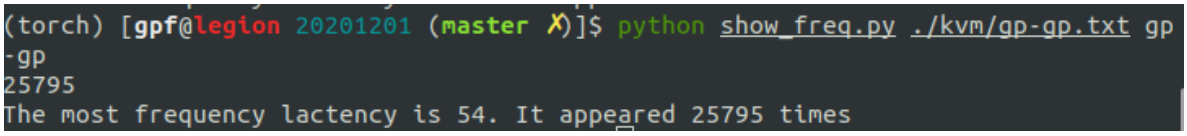
出现频率最高的时延是54us，一共出现了29215次。

```
(torch) [gpf@legion 20201201 (master ✗)]$ python show_freq.py ./kvm/ans3.txt gp-
rt
29215
The most frequency lactency is 54. It appeared 29215 times
```

- GP-GP



出现频率最高的时延是54us，一共出现了25795次。


(torch) [gpf@legion 20201201 (master ✗)]$ python show_freq.py ./kvm/gp-gp.txt gp
-gp
25795
The most frequency lactency is 54. It appeared 25795 times