

# Advanced Operating Systems

## Assignment Week 10

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## 1 Assignment

Create a user-space program (any language is acceptable) that differentiates the performance of the Linux Kernel with the PREEMPT\_RT patches from that without the PREEMPT\_RT patches. Compile and run the program. Submit the source code and the screen shots of the standard output and the kernel log message, respectively, when the program is being executed.

## 2 Code

The following code is just a shell script that makes use of two programs provided by the `rt-tests` package (Arch Linux). It uses the `hackbench` program to put stress on the system and then evaluates the maximum latency with the `cyclicttest` program. This provides a much more reliable method of testing the real-time capabilities of the system than any self-developed code I was able to come up with.

```
0 #!/bin/bash
1 echo "===== " >> output.txt
2 uname -a >> output.txt
3 echo "----- " >> output.txt
4 hackbench -l 40000 >> output.txt &
5 sleep 1
6 echo "----- " >> output.txt
7 sudo cyclicttest -q --mlockall --smp --priority=80 --interval=200 --distance
   =0 -D 1m >> output.txt
8 echo "----- " >> output.txt
```

The code is based on the following two sources:

[https://wiki.archlinux.org/title/Realtime\\_kernel\\_patchset](https://wiki.archlinux.org/title/Realtime_kernel_patchset)

<https://shuhaowu.com/blog/2022/02-linux-rt-appdev-part2.html>

## 3 Output

### 3.1 with PREEMPT\_RT

```
=====
Linux advancedoperatingsystemsvm 6.0.5-2-rt14-MANJARO #1 SMP PREEMPT_RT Sun Nov 6 15:25:56 CET 2022 x86_64 GNU/Linux
-----
Running in process mode with 10 groups using 40 file descriptors each (== 400 tasks)
Each sender will pass 40000 messages of 100 bytes
-----
# /dev/cpu_dma_latency set to 0us
T: 0 ( 2872) P:80 I:200 C: 297927 Min:    2 Act:  51 Avg:  37 Max:  1756
T: 1 ( 2873) P:80 I:200 C: 297834 Min:    2 Act:  29 Avg:  37 Max:  1726
T: 2 ( 2874) P:80 I:200 C: 297550 Min:    3 Act:  31 Avg:  47 Max:  1815
T: 3 ( 2875) P:80 I:200 C: 297519 Min:    3 Act:  34 Avg:  30 Max:  1743
-----
Time: 153.851
```

### 3.2 without PREEMPT\_RT

```
=====
Linux advancedoperatingsystemsvm 6.0.11-1-MANJARO #1 SMP PREEMPT_DYNAMIC Fri Dec 2 21:23:52 UTC 2022 x86_64 GNU/Linux
-----
Running in process mode with 10 groups using 40 file descriptors each (== 400 tasks)
Each sender will pass 40000 messages of 100 bytes
-----
# /dev/cpu_dma_latency set to 0us
T: 0 ( 2846) P:80 I:200 C: 297642 Min:    3 Act:   8 Avg:  41 Max:  34750
T: 1 ( 2847) P:80 I:200 C: 297348 Min:    3 Act:  17 Avg:  35 Max:  34712
T: 2 ( 2848) P:80 I:200 C: 297864 Min:    3 Act:  58 Avg:  60 Max:  34786
T: 3 ( 2849) P:80 I:200 C: 298013 Min:    3 Act:  50 Avg:  35 Max:  34711
-----
Time: 89.334
```