How to optimize Tasks PC1, PC2, C2?

Environment variable for Performance Tuning miner

1. variable `BELLMAN_CPU_UTILIZATION`

`export BELLMAN_CPU_UTILIZATION=0.875`

BELLMAN_CPU_UTILIZATION is an optional variable used to specify part of the multi-power calculation to move it to the CPU parallel to the GPU. This is to keep all hardware in an occupied state. The interval must be a number between **0 and 1.** The **0.875** value is a good starting point, but if you need the best setting, you should adjust it further. Different hardware sets the best value.

2. variable `FIL_PROOFS_MAXIMIZE_CACHING`

`export FIL_PROOFS_MAXIMIZE_CACHING=1`

FIL_PROOFS_MAXIMIZE_CACHING is an optional variable More speed at RAM cost (1x sector-size of RAM - 32 GB)

3. variable `FIL_PROOFS_USE_GPU_COLUMN_BUILDER and FIL_PROOFS_USE_GPU_TREE_BUILDER`

`export FIL_PROOFS_USE_GPU_COLUMN_BUILDER=1`
`export FIL_PROOFS_USE_GPU_TREE_BUILDER=1`

FIL_PROOFS_USE_GPU_COLUMN_BUILDER and FIL_PROOFS_USE_GPU_TREE_BUILDER is an precommit2 GPU acceleration

3. variable `FIL_PROOFS_USE_MULTICORE_SDR`

`export FIL_PROOFS_USE_MULTICORE_SDR=1`

FIL_PROOFS_USE_MULTICORE_SDR The following increases speed of PreCommit1 at the cost of using a full CPU Core-Complex rather than a single core. Should be used with CPU affinities set!

Add the necessary swap area PC1

If you only have **128 GB** of RAM, you need to ensure that the system provides at least an extra **256 GB** of very fast swap (preferably NVMe SSD).

```
sudo fallocate -l 256G /swapfile
sudo chmod 600 /swapfile
sudo mkswap /swapfile
sudo swapon /swapfile
# show current swap spaces and take note of the current highest priority
swapon --show
# append the following line to /etc/fstab (ensure highest priority) and then reboot
# /swapfile swap swap pri=50 0 0
sudo reboot
# check a 256GB swap file is automatically mounted and has the highest priority
swapon -show
```

Turn off Numa Function for miner and workers

First of all, we have to figure out one thing, why turn off NUMA?

The Linux system turns on NUMA by default. The default memory allocation strategy of NUMA is to prioritize the allocation in the local memory of the CPU node where the process is located, which will lead to unbalanced memory allocation among CPU nodes.

For example, when the memory of a CPU node is insufficient, it will cause Swap to be generated instead of allocating memory from the remote node, even if there is enough physical memory on another CPU node.
The original intention of this memory allocation strategy is good, in order to get the memory closer to the process that needs it, but it is not suitable for large-scale memory usage application scenarios, and it is not conducive to making full use of the physical memory of the system.

However, as we all know, Filecoin's demand for memory is almost greedy. And you will find that there are dozens of GB of physical memory, but it happens to load dozens of GB of Swap. **Once Swap is used, the performance immediately drops by one ten thousandth of the memory or even lower.**

First you need to check whether your machine has opened Numa mode, you can use numastat this command to see if the machine does not have this command, you need to install `numactl`.

```
sudo apt install numactl
```

Then you can use **numastat** to see if the current system has enabled Numa.

```
numastat
                          node0
numa_hit             484417331
numa_miss                    0
numa_foreign                 0
interleave_hit           40687
local_node           484417331
other_node                   0
```

If your machine is only one like me node , then you do not need to explain the close Numa, Numa at this time because there is no work. Generally speaking, the number of CPU cores in home machines is not too high, so Numa does not need to be optimized.

```
root@miner1:~# numastat
                          node0              node1
numa_hit             2093513830         2859729719
numa_miss             949731552          128562031
numa_foreign          128562031          949731552
interleave_hit            51160              50655
local_node           2093549941         2859639315
other_node            949695441          128652435
```

From the above results, Numa is obviously enabled, and both CPU and memory are allocated to 2 nodes. **Cross-node physical memory access will reduce performance by ten times .**

There are two ways to disable Numa. One is to set up via Bios. Different motherboards have different setting methods.

- https://access.redhat.com/solutions/23216

Turn on the CPU to high performance mode with cpfrequtils tools for miner and workers

The default CPU in the Ubuntu system is working in powersave (power saving) mode, so the performance is not maximized, so it needs to be adjusted to performance (high performance) mode. You can adjust it temporarily by setting Bios or by software.

Note : turbo boost under normal conditions does not effect the life expectancy of a CPU. It operates within the power and frequency limits set by the manufacturer and is perfectly safe.

1. Install cpufrequtils :

```
sudo apt install cpufrequtils
```

2. View the current state of the CPU :

```
sudo cpufreq-info
```

3. Adjust the CPU to performance mode (Afer restart os this settings back to powersave) :

```
sudo cpufreq-set -g performance
```