Scheduler Fairness

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Scheduler MC

Fairness problem description

- How to balance a use case that can't be balanced?
- When the load granularity doesn't match with the topology
  - Odd number of tasks on even number of cpus as an example
- Apply only when system is overloaded
  - For one sched group at least
  - Otherwise tasks have enough runtime
  - scheduling latency not taken into account

Fairness problem example

- 9 tasks on 8 CPUs
  - Can’t be balanced
  - But should be fair
- Test with 9 always running rt-app tasks on 2x4 CPUs
  - Count effective work per task: number of run events
  - 16 test iterations
- Average unfairness above 20%
  - Ratio between min and max values
- One iteration with more than 40% difference
  - Can’t be higher than 50%

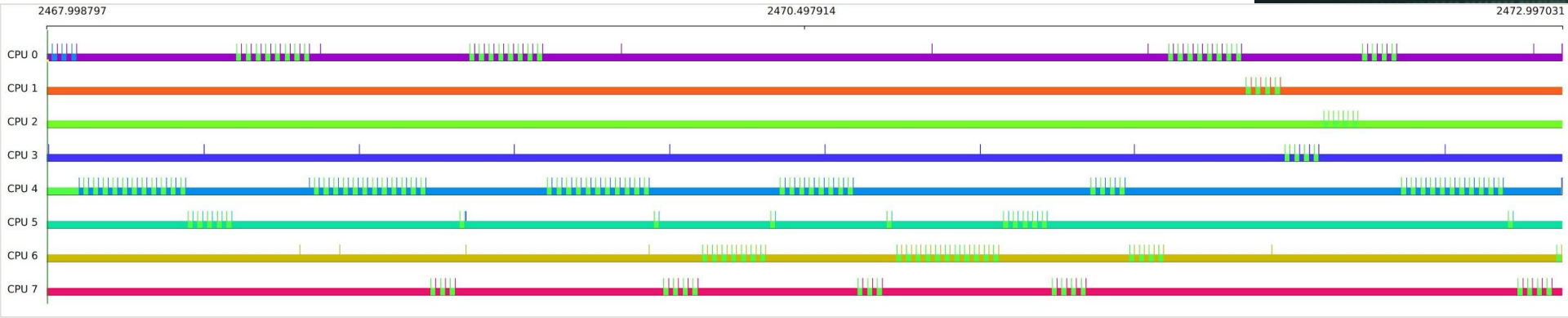
Current rules

- Migrate task with load/2 < imbalance

  OR

- Any tasks when nr_balance_failed > cache_nice_tries

- The result is an unfair decision



Fairness issues

- Simultaneous busy Load Balance (LB)
  - Smaller domain faster to pull task
  - Some CPUs fail to pull task

Decrement by 1 jiffies the busy interval

- Huge busy interval on large system

	2 x 4 cores	2 nodes x 28 cores x 4 threads
SMT		4ms: 1 tick 128ms : 32 ticks
MC	4ms : 1 tick 128ms : 32ticks → 64ms	112ms: 28 ticks 3584ms : 896 ticks → 1792ms
DIE	8ms : 2 ticks 256ms : 64 ticks → 128ms	
NUMA		224ms : 56 ticks 7168ms : 1792 ticks → 3584ms

Reduce default interval: use ilog(weight) instead of weight?

Reduce busy_factor ?

Fairness issues

- Task selection
  - load/2
  - Any task : LB > sd->cache_nice_tries

Monitor average min_vruntime increase per sched_slice

or

Use load_avg/util_avg ratio to calculate imbalance

or

Accumulate imbalance of failed LB in shared data

or

Increase margin during task selection as nr_failed increase

- Active migration
  - LB > sd->cache_nice_tries+2

Remove this active migration use case

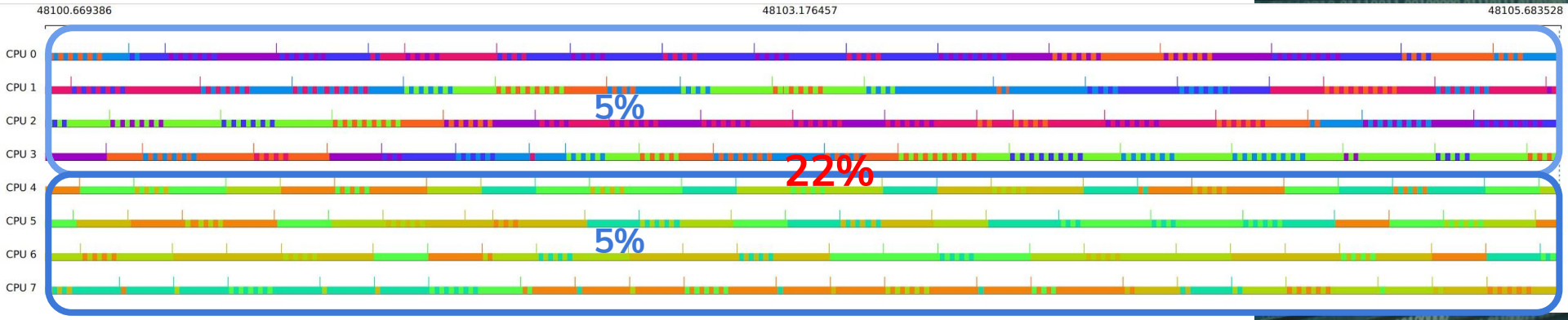
Test results

- Same test environnement as previous test
- Average unfairness around 8%
- One iteration with 12% difference
  - Can’t be higher than 50%
- Don’t solve completely the “always same task” problem
  - Only reduce the occurence

Fairness issues

- Often the same task that is pulled
  - Kind of sync between sched_slice and LB interval

- imbalance_pct threshold discards task migration
  - 25% at DIE, NUMA levels
  - Test with 11 always running rt-app tasks on 8 cpus



Thank you