University of BRISTOL

Computer Systems B

COMS20012

Introduction to Operating Systems and Security

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Linux CFS

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Linux Completely Fair Scheduler

- Each thread is assigned a **weight**
- **Objective:** give every thread execution time proportional to its weight
- **Approach:**
  - assign to each thread a virtual runtime
  - pick the thread with the lowest virtual runtime
  - $vruntime_1 = vruntime_0 + quantum/weight$
    - vruntime grow more slowly for high priority threads
  - All thread will execute at least once per period T
  - quantum is T/total_weight
    - The quantum get smaller the more threads are running
  - We multiply the quantum f(weight)
    - Give more time to high priority thread to execute

CFS example (T is 5, f is id(x))

Thread	Weight	Actual Runtime	Virtual Runtime
T1	25	5	
T2	20	5	
T3	5	5	

CFS example (T is 5, f is id(x))

Thread	Weight	Actual Runtime	Virtual Runtime
T1	25	5	5*50/25 = 10
T2	20	5	5*50/20 = 12.5
T3	5	5	5*50/5 = 50

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CFS example (T is 5, f is id(x))

Thread	Weight	Actual Runtime	Virtual Runtime
T1	25	7.5 = 5 + 5/50 * 25	5*50/25 = 10
T2	20	5	5*50/20 = 12.5
T3	5	5	5*50/5 = 50

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CFS example (T is 5, f is id(x))

Thread	Weight	Actual Runtime	Virtual Runtime
T1	25	7.5	
T2	20	5	
T3	5	5	

CFS example (T is 5, f is id(x))

Thread	Weight	Actual Runtime	Virtual Runtime
T1	25	7.5	15
T2	20	7	12.5
T3	5	5	50

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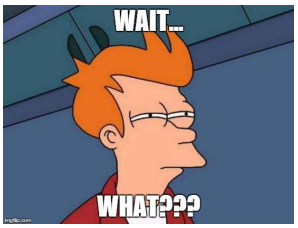
CFS example (T is 5, f is id(x))

Thread	Weight	Actual Runtime	Virtual Runtime
T1	25	7.5	
T2	20	7	
T3	5	5	

Something wrong?



- Next thread to be picked is not T3!
- You told every thread will run for a period T
- It does!
- Go back to the exercise setting the actual runtime to zero!

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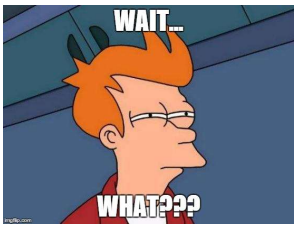
Something wrong?



- Next thread to be picked is not T3!
- You told every thread will run for a period T
- It does!
- Go back to the exercise setting the actual runtime to zero!

- The Linux deal with this through a *min_vruntime* mechanism so that newer threads catch up with older ones.
- Otherwise, old threads could get starved

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Note

- Actual Linux implementation use red black tree to find the next thread to run
  - You should have seen that in algorithms!

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Thank you

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