3.2

pid 4

proctype 0

clktimemilli 4706

gross cpu usage 681 ms

average waiting time 143 ms

pid 5

proctype 0

clktimemilli 4891

gross cpu usage 681 ms

average waiting time 149 ms

pid 6

proctype 0

clktimemilli 5052

gross cpu usage 681 ms

average waiting time 153 ms

pid 7

proctype 0

clktimemilli 5188

gross cpu usage 681 ms

average waiting time 155 ms

pid 8

proctype 0

clktimemilli 5298

gross cpu usage 681 ms

average waiting time 156 ms

pid 9

proctype 0

clktimemilli 5384

gross cpu usage 681 ms

average waiting time 154 ms

pid 10

proctype 0

clktimemilli 5445

gross cpu usage 681 ms

average waiting time 151 ms

pid 11

proctype 0

clktimemilli 5481

gross cpu usage 681 ms

average waiting time 151 ms

pid 5

proctype 1

cl

pid 7

proctype 1

ktimemilli 15601

gross

pid 4

proctype 1

clktimemilliclktimemill

pid 6

proctype 1

 cpu usage 303 ms

aver

pid 8

proctype 1

clktimemilli 15616

gross cpu usage 304 ms

average waiting time 1 ms

 15608

gross cpu usage 377 ms

average waiting time 0 ms

pid 9

proctype 1

clktimemilli 15629

gross cpu usage 304 ms

average waiting time 1 ms

i 15609

gross cpu usage 304 ms

average waiting time 1 ms

pid 11

proctype 1

clktimemilli 15642

gross cpu usage 378 ms

average waiting time 1 ms

clktimemilli 15649

gross cpu usage 377 ms

average waiting time 0 ms

pid 10

proctype 1

clktimemilli 15657

gross cpu usage 379 ms

average waiting time 1 ms

age waiting time 1 ms

Benchmark #3 (4 CPU processes and 4 I/O processes)

pid 5

proctype 0

clktimemilli 2638

gross cpu usage 682 ms

average waiting time 64 ms

pid 4

proctype 0

clktimemilli 2709

gross cpu usage 685 ms

average waiting time 63 ms

pid 6

proctype 0

clktimemilli 2818

gross cpu usage 686 ms

average waiting time 63 ms

pid 7

proctype 0

clktimemilli 2860

gross cpu usage 684 ms

average waiting time 63 ms

pid 8

proctype 1

clktimemilli 16766

gross cpu usage 304 ms

average waiting time 7 ms

pid 10

proctype 1

clktimemilli 16840

gross cpu usage 304 ms

average waiting time 6 ms

pid 9

proctype 1

clktimemilli 16978

gross cpu usage 303 ms

average waiting time 7 ms

pid 11

proctype 1

clktimemilli 17122

gross cpu usage 303 ms

average waiting time 7 ms

R3 benchmarks

Benchmark #1 (8 CPU processes)

pid 4

proctype 0

clktimemilli 4706

gross cpu usage 681 ms

average waiting time 143 ms

pid 5

proctype 0

clktimemilli 4891

gross cpu usage 681 ms

average waiting time 149 ms

pid 6

proctype 0

clktimemilli 5052

gross cpu usage 681 ms

average waiting time 153 ms

pid 7

proctype 0

clktimemilli 5188

gross cpu usage 681 ms

average waiting time 155 ms

pid 8

proctype 0

clktimemilli 5298

gross cpu usage 681 ms

average waiting time 156 ms

pid 9

proctype 0

clktimemilli 5384

gross cpu usage 681 ms

average waiting time 154 ms

pid 10

proctype 0

clktimemilli 5445

gross cpu usage 681 ms

average waiting time 151 ms

pid 11

proctype 0

clktimemilli 5481

gross cpu usage 681 ms

average waiting time 151 ms

Benchmark #2 (8 I/O processes)

pid 5

proctype 1

cl

pid 7

proctype 1

ktimemilli 15601

gross

pid 4

proctype 1

clktimemilliclktimemill

pid 6

proctype 1

 cpu usage 303 ms

aver

pid 8

proctype 1

clktimemilli 15616

gross cpu usage 304 ms

average waiting time 1 ms

 15608

gross cpu usage 377 ms

average waiting time 0 ms

pid 9

proctype 1

clktimemilli 15629

gross cpu usage 304 ms

average waiting time 1 ms

i 15609

gross cpu usage 304 ms

average waiting time 1 ms

pid 11

proctype 1

clktimemilli 15642

gross cpu usage 378 ms

average waiting time 1 ms

clktimemilli 15649

gross cpu usage 377 ms

average waiting time 0 ms

pid 10

proctype 1

clktimemilli 15657

gross cpu usage 379 ms

average waiting time 1 ms

age waiting time 1 ms

Benchmark #3 (4 CPU processes and 4 I/O processes)

pid 5

proctype 0

clktimemilli 2638

gross cpu usage 682 ms

average waiting time 64 ms

pid 4

proctype 0

clktimemilli 2709

gross cpu usage 685 ms

average waiting time 63 ms

pid 6

proctype 0

clktimemilli 2818

gross cpu usage 686 ms

average waiting time 63 ms

pid 7

proctype 0

clktimemilli 2860

gross cpu usage 684 ms

average waiting time 63 ms

pid 8

proctype 1

clktimemilli 16766

gross cpu usage 304 ms

average waiting time 7 ms

pid 10

proctype 1

clktimemilli 16840

gross cpu usage 304 ms

average waiting time 6 ms

pid 9

proctype 1

clktimemilli 16978

gross cpu usage 303 ms

average waiting time 7 ms

pid 11

proctype 1

clktimemilli 17122

gross cpu usage 303 ms

average waiting time 7 ms

Finding and discussion:

Compare the average waiting time and gross cpu usage of the processes in both CFS and R3 scheduling, for different process combinations (8 processes with same/differet types), I found that they are almost the same. The cpu processes are always having longer average waiting time than I/O processes. This is reasonable, since our processes are purely I/O or CPU bund, the former always relinquishes cpu before consuming all its time slice, and the latter always consume a full time slice and leave the cpu or be preempted by high-priority I/O processes.

3.3

CFS Benchmark dynamic workload (4 CPU processes and 4 I/O processes)

pid 4

proctype 0

clktimemilli 831

gross cpu usage 681 ms

average waiting time 16 ms

pid 5

proctype 0

clktimemilli 1641

gross cpu usage 681 ms

average waiting time 22 ms

pid 6

proctype 0

clktimemilli 2455

gross cpu usage 682 ms

average waiting time 25 ms

pid 7

proctype 0

clktimemilli 2749

gross cpu usage 682 ms

average waiting time 21 ms

pid 8

proctype 1

clktimemilli 17596

gross cpu usage 303 ms

average waiting time 0 ms

pid 9

proctype 1

clktimemilli 18073

gross cpu usage 303 ms

average waiting time 0 ms

pid 10

proctype 1

clktimemilli 18575

gross cpu usage 303 ms

average waiting time 0 ms

pid 11

proctype 1

clktimemilli 19077

gross cpu usage 303 ms

average waiting time 0 ms

Finding and discussion:

Compare the static workload and the dynamic one, I found that the average waiting time of both processes (CPU and I/O) are lower in dynamic workload. Dynamic workload allows a sparse creation of processes across the time axis and thus each process receives more cpu resource averaged in time.

4.5

Running result of four rms processes (ct=50, 75,100,125; period=800,850,900,950 respectively)

pid 4

x=50

y=800

period number 1

clktimemilli 54

y - (clktimemilli - period_start) 746

pid 5

x=75

y=850

period number 1

clktimemilli 137

y - (clktimemilli - period_start) 771

pid 6

x=100

y=900

period number 1

clktimemilli 245

y - (clktimemilli - period_start) 796

pid 7

x=125

y=950

period number 1

clktimemilli 378

y - (clktimemilli - period_start) 821

pid 4

x=50

y=800

period number 2

clktimemilli 854

y - (clktimemilli - period_start) 746

pid 5

x=75

y=850

period number 2

clktimemilli 987

y - (clktimemilli - period_start) 771

pid 6

x=100

y=900

period number 2

clktimemilli 1145

y - (clktimemilli - period_start) 796

pid 7

x=125

y=950

period number 2

clktimemilli 1328

y - (clktimemilli - period_start) 821

pid 4

x=50

y=800

period number 3

clktimemilli 1654

y - (clktimemilli - period_start) 746

pid 5

x=75

y=850

period number 3

clktimemilli 1837

y - (clktimemilli - period_start) 771

pid 6

x=100

y=900

period number 3

clktimemilli 2045

y - (clktimemilli - period_start) 796

pid 7

x=125

y=950

period number 3

clktimemilli 2278

y - (clktimemilli - period_start) 821

pid 4

x=50

y=800

period number 4

clktimemilli 2454

y - (clktimemilli - period_start) 746

pid 5

x=75

y=850

period number 4

clktimemilli 2687

y - (clktimemilli - period_start) 771

pid 6

x=100

y=900

period number 4

clktimemilli 2945

y - (clktimemilli - period_start) 796

pid 4

x=50

y=800

period number 5

clktimemilli 3254

y - (clktimemilli - period_start) 746

pid 7

x=125

y=950

period number 4

clktimemilli 3287

y - (clktimemilli - period_start) 762

pid 5

x=75

y=850

period number 5

clktimemilli 3537

y - (clktimemilli - period_start) 771

pid 6

x=100

y=900

period number 5

clktimemilli 3845

y - (clktimemilli - period_start) 796

pid 4

x=50

y=800

period number 6

clktimemilli 4054

y - (clktimemilli - period_start) 746

pid 7

x=125

y=950

period number 5

clktimemilli 4187

y - (clktimemilli - period_start) 821

pid 5

x=75

y=850

period number 6

clktimemilli 4387

y - (clktimemilli - period_start) 771

pid 6

x=100

y=900

period number 6

clktimemilli 4745

y - (clktimemilli - period_start) 796

pid 4

x=50

y=800

period number 7

clktimemilli 4854

y - (clktimemilli - period_start) 746

pid 7

x=125

y=950

period number 6

clktimemilli 5137

y - (clktimemilli - period_start) 821

pid 5

x=75

y=850

period number 7

clktimemilli 5237

y - (clktimemilli - period_start) 771

pid 4

x=50

y=800

period number 8

clktimemilli 5654

y - (clktimemilli - period_start) 746

pid 6

x=100

y=900

period number 7

clktimemilli 5704

y - (clktimemilli - period_start) 737

pid 5

x=75

y=850

period number 8

clktimemilli 6087

y - (clktimemilli - period_start) 771

pid 7

x=125

y=950

period number 7

clktimemilli 6171

y - (clktimemilli - period_start) 737

pid 4

x=50

y=800

period number 9

clktimemilli 6454

y - (clktimemilli - period_start) 746

pid 6

x=100

y=900

period number 8

clktimemilli 6562

y - (clktimemilli - period_start) 796

pid 5

x=75

y=850

period number 9

clktimemilli 6937

y - (clktimemilli - period_start) 771

pid 7

x=125

y=950

period number 8

clktimemilli 7070

y - (clktimemilli - period_start) 821

pid 4

x=50

y=800

period number 10

clktimemilli 7254

y - (clktimemilli - period_start) 746

pid 6

x=100

y=900

period number 9

clktimemilli 7462

y - (clktimemilli - period_start) 796

pid 5

x=75

y=850

period number 10

clktimemilli 7787

y - (clktimemilli - period_start) 771

pid 4

x=50

y=800

period number 11

clktimemilli 8054

y - (clktimemilli - period_start) 746

pid 7

x=125

y=950

period number 9

clktimemilli 8079

y - (clktimemilli - period_start) 762

pid 6

x=100

y=900

period number 10

clktimemilli 8362

y - (clktimemilli - period_start) 795

pid 5

x=75

y=850

period number 11

clktimemilli 8637

y - (clktimemilli - period_start) 771

pid 4

x=50

y=800

period number 12

clktimemilli 8854

y - (clktimemilli - period_start) 746

pid 7

x=125

y=950

period number 10

clktimemilli 8987

y - (clktimemilli - period_start) 820

pid 6

x=100

y=900

period number 11

clktimemilli 9262

y - (clktimemilli - period_start) 795

pid 5

x=75

y=850

period number 12

clktimemilli 9487

y - (clktimemilli - period_start) 771

pid 4

x=50

y=800

period number 13

clktimemilli 9654

y - (clktimemilli - period_start) 746

pid 7

x=125

y=950

period number 11

clktimemilli 9937

y - (clktimemilli - period_start) 820

pid 6

x=100

y=900

period number 12

clktimemilli 10162

y - (clktimemilli - period_start) 795

pid 5

x=75

y=850

period number 13

clktimemilli 10337

y - (clktimemilli - period_start) 770

pid 4

x=50

y=800

period number 14

clktimemilli 10454

y - (clktimemilli - period_start) 745

pid 7

x=125

y=950

period number 12

clktimemilli 10887

y - (clktimemilli - period_start) 820

pid 6

x=100

y=900

period number 13

clktimemilli 11062

y - (clktimemilli - period_start) 795

pid 5

x=75

y=850

period number 14

clktimemilli 11187

y - (clktimemilli - period_start) 770

pid 4

x=50

y=800

period number 15

clktimemilli 11254

y - (clktimemilli - period_start) 745

pid 7

x=125

y=950

period number 13

clktimemilli 11837

y - (clktimemilli - period_start) 820

pid 4

x=50

y=800

period number 16

clktimemilli 12054

y - (clktimemilli - period_start) 745

pid 5

x=75

y=850

period number 15

clktimemilli 12096

y - (clktimemilli - period_start) 711

pid 6

x=100

y=900

period number 14

clktimemilli 12105

y - (clktimemilli - period_start) 652

pid 4

x=50

y=800

period number 17

clktimemilli 12854

y - (clktimemilli - period_start) 745

pid 5

x=75

y=850

period number 16

clktimemilli 12937

y - (clktimemilli - period_start) 770

pid 6

x=100

y=900

period number 15

clktimemilli 13004

y - (clktimemilli - period_start) 653

pid 7

x=125

y=950

period number 14

clktimemilli 13038

y - (clktimemilli - period_start) 569

pid 4

x=50

y=800

period number 18

clktimemilli 13654

y - (clktimemilli - period_start) 745

pid 5

x=75

y=850

period number 17

clktimemilli 13787

y - (clktimemilli - period_start) 770

pid 6

x=100

y=900

period number 16

clktimemilli 13846

y - (clktimemilli - period_start) 711

pid 7

x=125

y=950

period number 15

clktimemilli 13979

y - (clktimemilli - period_start) 820

pid 4

x=50

y=800

period number 19

clktimemilli 14454

y - (clktimemilli - period_start) 745

pid 5

x=75

y=850

period number 18

clktimemilli 14637

y - (clktimemilli - period_start) 770

pid 6

x=100

y=900

period number 17

clktimemilli 14745

y - (clktimemilli - period_start) 795

pid 7

x=125

y=950

period number 16

clktimemilli 14929

y - (clktimemilli - period_start) 820

pid 4

x=50

y=800

period number 20

clktimemilli 15254

y - (clktimemilli - period_start) 745

pid 5

x=75

y=850

period number 19

clktimemilli 15487

y - (clktimemilli - period_start) 770

pid 6

x=100

y=900

period number 18

clktimemilli 15645

y - (clktimemilli - period_start) 795

pid 7

x=125

y=950

period number 17

clktimemilli 15879

y - (clktimemilli - period_start) 820

pid 5

x=75

y=850

period number 20

clktimemilli 16337

y - (clktimemilli - period_start) 770

pid 6

x=100

y=900

period number 19

clktimemilli 16545

y - (clktimemilli - period_start) 795

pid 7

x=125

y=950

period number 18

clktimemilli 16829

y - (clktimemilli - period_start) 820

pid 6

x=100

y=900

period number 20

clktimemilli 17445

y - (clktimemilli - period_start) 795

pid 7

x=125

y=950

period number 19

clktimemilli 17779

y - (clktimemilli - period_start) 820

pid 7

x=125

y=950

period number 20

clktimemilli 18729

y - (clktimemilli - period_start) 820

Finding and discussion:

Since process with ct=50 and period=800 has the highest priority, you can see that it has always been scheduled before other processes. And the last process to finish in the running are two consecutive pid=7 processes, since it has the lowest priority.

Running result of 4 rms processes and 4 non-real-time processes

 pid 4

x=50

y=800

period number 1

clktimemilli 54

y - (clktimemilli - period_start) 746

pid 5

x=75

y=850

period number 1

clktimemilli 137

y - (clktimemilli - period_start) 771

pid 6

x=100

y=900

period number 1

clktimemilli 245

y - (clktimemilli - period_start) 796

pid 7

x=125

y=950

period number 1

clktimemilli 378

y - (clktimemilli - period_start) 821

pid 4

x=50

y=800

period number 2

clktimemilli 854

y - (clktimemilli - period_start) 746

pid 5

x=75

y=850

period number 2

clktimemilli 987

y - (clktimemilli - period_start) 771

pid 6

x=100

y=900

period number 2

clktimemilli 1145

y - (clktimemilli - period_start) 796

pid 7

x=125

y=950

period number 2

clktimemilli 1328

y - (clktimemilli - period_start) 821

pid 4

x=50

y=800

period number 3

clktimemilli 1654

y - (clktimemilli - period_start) 746

pid 5

x=75

y=850

period number 3

clktimemilli 1837

y - (clktimemilli - period_start) 771

pid 6

x=100

y=900

period number 3

clktimemilli 2045

y - (clktimemilli - period_start) 796

pid 7

x=125

y=950

period number 3

clktimemilli 2278

y - (clktimemilli - period_start) 821

pid 4

x=50

y=800

period number 4

clktimemilli 2454

y - (clktimemilli - period_start) 746

pid 5

x=75

y=850

period number 4

clktimemilli 2687

y - (clktimemilli - period_start) 771

pid 6

x=100

y=900

period number 4

clktimemilli 2945

y - (clktimemilli - period_start) 796

pid 4

x=50

y=800

period number 5

clktimemilli 3254

y - (clktimemilli - period_start) 746

pid 7

x=125

y=950

period number 4

clktimemilli 3287

y - (clktimemilli - period_start) 762

pid 5

x=75

y=850

period number 5

clktimemilli 3537

y - (clktimemilli - period_start) 771

pid 6

x=100

y=900

period number 5

clktimemilli 3845

y - (clktimemilli - period_start) 796

pid 4

x=50

y=800

period number 6

clktimemilli 4054

y - (clktimemilli - period_start) 746

pid 7

x=125

y=950

period number 5

clktimemilli 4187

y - (clktimemilli - period_start) 821

pid 5

x=75

y=850

period number 6

clktimemilli 4387

y - (clktimemilli - period_start) 771

pid 6

x=100

y=900

period number 6

clktimemilli 4745

y - (clktimemilli - period_start) 796

pid 4

x=50

y=800

period number 7

clktimemilli 4854

y - (clktimemilli - period_start) 746

pid 11

proct

pid 9

proctype 0

clktimemilli 4914

gross cpu usage 682 ms

average waiting time 136 ms

pid 10

proctype 0

clktimemilli 4926

gross cpu usage 682 ms

pid 8

proctype 0

clktimemilli 4961

gross cpu usage 683 ms

average waiting time 133 ms

pid 7

x=125

y=950

period number 6

clktimemilli 5137

y - (clktimemilli - period_start) 821

pid 5

x=75

y=850

period number 7

clktimemilli 5237

y - (clktimemilli - period_start) 771

pid 4

x=50

y=800

period number 8

clktimemilli 5654

y - (clktimemilli - period_start) 746

pid 6

x=100

y=900

period number 7

clktimemilli 5704

y - (clktimemilli - period_start) 737

pid 5

x=75

y=850

period number 8

clktimemilli 6087

y - (clktimemilli - period_start) 771

pid 7

x=125

y=950

period number 7

clktimemilli 6171

y - (clktimemilli - period_start) 737

pid 4

x=50

y=800

period number 9

clktimemilli 6454

y - (clktimemilli - period_start) 746

pid 6

x=100

y=900

period number 8

clktimemilli 6562

y - (clktimemilli - period_start) 796

pid 5

x=75

y=850

period number 9

clktimemilli 6937

y - (clktimemilli - period_start) 771

pid 7

x=125

y=950

period number 8

clktimemilli 7070

y - (clktimemilli - period_start) 821

pid 4

x=50

y=800

period number 10

clktimemilli 7254

y - (clktimemilli - period_start) 746

pid 6

x=100

y=900

period number 9

clktimemilli 7462

y - (clktimemilli - period_start) 796

pid 5

x=75

y=850

period number 10

clktimemilli 7787

y - (clktimemilli - period_start) 771

pid 4

x=50

y=800

period number 11

clktimemilli 8054

y - (clktimemilli - period_start) 746

pid 7

x=125

y=950

period number 9

clktimemilli 8079

y - (clktimemilli - period_start) 762

pid 6

x=100

y=900

period number 10

clktimemilli 8362

y - (clktimemilli - period_start) 795

pid 5

x=75

y=850

period number 11

clktimemilli 8637

y - (clktimemilli - period_start) 771

pid 4

x=50

y=800

period number 12

clktimemilli 8854

y - (clktimemilli - period_start) 746

pid 7

x=125

y=950

period number 10

clktimemilli 8987

y - (clktimemilli - period_start) 820

pid 6

x=100

y=900

period number 11

clktimemilli 9262

y - (clktimemilli - period_start) 795

pid 5

x=75

y=850

period number 12

clktimemilli 9487

y - (clktimemilli - period_start) 771

pid 4

x=50

y=800

period number 13

clktimemilli 9654

y - (clktimemilli - period_start) 746

pid 7

x=125

y=950

period number 11

clktimemilli 9937

y - (clktimemilli - period_start) 820

pid 6

x=100

y=900

period number 12

clktimemilli 10162

y - (clktimemilli - period_start) 795

pid 5

x=75

y=850

period number 13

clktimemilli 10337

y - (clktimemilli - period_start) 770

pid 4

x=50

y=800

period number 14

clktimemilli 10454

y - (clktimemilli - period_start) 745

pid 7

x=125

y=950

period number 12

clktimemilli 10887

y - (clktimemilli - period_start) 820

pid 6

x=100

y=900

period number 13

clktimemilli 11062

y - (clktimemilli - period_start) 795

pid 5

x=75

y=850

period number 14

clktimemilli 11187

y - (clktimemilli - period_start) 770

pid 4

x=50

y=800

period number 15

clktimemilli 11254

y - (clktimemilli - period_start) 745

pid 7

x=125

y=950

period number 13

clktimemilli 11837

y - (clktimemilli - period_start) 820

pid 4

x=50

y=800

period number 16

clktimemilli 12054

y - (clktimemilli - period_start) 745

pid 5

x=75

y=850

period number 15

clktimemilli 12096

y - (clktimemilli - period_start) 711

pid 6

x=100

y=900

period number 14

clktimemilli 12105

y - (clktimemilli - period_start) 652

pid 4

x=50

y=800

period number 17

clktimemilli 12854

y - (clktimemilli - period_start) 745

pid 5

x=75

y=850

period number 16

clktimemilli 12937

y - (clktimemilli - period_start) 770

pid 6

x=100

y=900

period number 15

clktimemilli 13004

y - (clktimemilli - period_start) 653

pid 7

x=125

y=950

period number 14

clktimemilli 13038

y - (clktimemilli - period_start) 569

pid 4

x=50

y=800

period number 18

clktimemilli 13654

y - (clktimemilli - period_start) 745

pid 5

x=75

y=850

period number 17

clktimemilli 13787

y - (clktimemilli - period_start) 770

pid 6

x=100

y=900

period number 16

clktimemilli 13846

y - (clktimemilli - period_start) 711

pid 7

x=125

y=950

period number 15

clktimemilli 13979

y - (clktimemilli - period_start) 820

pid 4

x=50

y=800

period number 19

clktimemilli 14454

y - (clktimemilli - period_start) 745

pid 5

x=75

y=850

period number 18

clktimemilli 14637

y - (clktimemilli - period_start) 770

pid 6

x=100

y=900

period number 17

clktimemilli 14745

y - (clktimemilli - period_start) 795

pid 7

x=125

y=950

period number 16

clktimemilli 14929

y - (clktimemilli - period_start) 820

pid 4

x=50

y=800

period number 20

clktimemilli 15254

y - (clktimemilli - period_start) 745

pid 5

x=75

y=850

period number 19

clktimemilli 15487

y - (clktimemilli - period_start) 770

pid 6

x=100

y=900

period number 18

clktimemilli 15645

y - (clktimemilli - period_start) 795

pid 7

x=125

y=950

period number 17

clktimemilli 15879

y - (clktimemilli - period_start) 820

pid 5

x=75

y=850

period number 20

clktimemilli 16337

y - (clktimemilli - period_start) 770

pid 6

x=100

y=900

period number 19

clktimemilli 16545

y - (clktimemilli - period_start) 795

pid 7

x=125

y=950

period number 18

clktimemilli 16829

y - (clktimemilli - period_start) 820

pid 6

x=100

y=900

period number 20

clktimemilli 17445

y - (clktimemilli - period_start) 795

pid 7

x=125

y=950

period number 19

clktimemilli 17779

y - (clktimemilli - period_start) 820

pid 7

x=125

y=950

period number 20

clktimemilli 18729

y - (clktimemilli - period_start) 820

Finding and discussion

In the above output result, the part marked red is the output message of the 4 CPU-bound processes before they terminate. They have the same parameters such as average waiting time and gross cpu usage etc. and they all terminate at the same time since their work load are the same. They will always be preempted by rms processes so their average waiting time is longer than in the situation where no rms processes are present (please refer to 3.3 Benchmark #3 (4 CPU processes and 4 I/O processes)) and of course they terminate at a later time also.

Bouns

EDF has a larger kernel overhead than RMS since it must dynamically keep track of the deadline of each process and update the priority list according to the deadlines.

To implement EDF in XINU, the following changes are needed.

1) Disable other scheduler mechanisms by setting XINUSCHED to a value that identifies EDF;

2) Add new fields in process table such as deadline, edf ct and edf period.

3) Implement a edf_create() syscall similar to rms_create(). Admission control will be different from rms control using $\sum_{i}^{n} \frac{computation\ time_i}{Period_i} < 1$. The edf_create() needs to record the fields such as period and computation time in the new process's process table. Calculate the deadline of the process and the priority of the edf process is going to be set to MAXPRIO-deadline.

4) Whenever the deadline of an edf process is changed it must be updated in the process table and the priority of the process must be recalculated (i.e. when the process had completed all computation task in the period). This can be done in the test app edf_app.

5) All other non-edf processes has to have lower priority tha nedf processes.