c_i
$t_o -$
t_o

$\lfloor t_1 - t_o \cdot w \; c_i \rfloor$ $t_1 - t_o$
t_o, t_o $, \ldots, t_1 -$ c_i

1.2. High-bandwidth connectivity

m

m

$m >$

m
m

B
n $c_1, c_2, \ldots, c_n$

$\sum_{i=1}^{n} f \; c_i \; \leq m \cdot B$

c_i

[1]

$\rightarrow$

The parallel switching problem: n
C $\{c_1, c_2, \ldots, c_n\}$ m
c_i
$w \; c_i$
C m

1.3. Proportionate Progress and Pfairness

The multiprocessor periodic scheduling problem: n τ $\{x_1, x_2, \ldots, x_n\}$ m

x_i

---

[1] This design decision has two significant consequences: First, no individual connection with a bandwidth requirement greater than B can be admitted over this link, despite the fact that the total link capacity is $m \cdot B$. Second, we are no longer using a *work conserving* scheduling descipline — if less than m connections have cells waiting to use the network edge, then the edge will not be used at full capacity despite the fact that there are cells that need to use it.

to execute on a processor for a fraction $<_i$ *of the time quanta, choose, for each time quantum, a subset of of size at most of the tasks that will be permitted to use the processors during this time slot.*

x
bmm *pfair nb*
w $-$
$_i$ *x* *w*
$\lfloor <_i \cdot \rfloor$ $\lceil <_i \cdot \rceil$ $\in \mathbf{N}$,

bmm *x* *x*
w
b

b *ub*
b

x *b*
b

S *x*
on-line

a priori *x*

w
ub
nb
x
w *x*

t

xt

t
w

bmm
t

x

2. A brief introduction to pfairness

b

w

-

- *w*

  $-$

- *S* *bm*
  bm *x*
  b
  x **slot** $\in \mathbf{N}$
- $\sum_{x\in\tau} <$
  density

  x t
- *schedule*
  $\times\mathbf{N}$ $\{ \}$ $\sum_{x\in\tau} <$ $\leq$
  $\in \mathbf{N}$ $<$
- allocated$<$ *b*
  x *xt.*

  allocated$<$ $\overset{\text{def}}{} \sum_{t'\in ,t} <$ $'$
- *lag* *b* *x*
  lag$<$

  lag$<$ $<$ $\cdot$ $-$ allocated$<$

  $< \cdot$
  should *w*
  w allocated$<$
  x bt b
  bmm

  w

  t
- *pfair*

  $\forall$. $\in$ $\in \mathbf{N}$. $-$ lag$<$

  if it is never the case that any task is overallocated or underallocated by an entire slot

earliest>
latest>
j i i
i
jm earliest>
latest>

earliest>
. ∈ **N** . > · > − −
$\left\lfloor \frac{-}{>} \right\rfloor$ >
Sj

latest>
. ∈ **N** . > · − > −
$\left\lceil \frac{}{>} \right\rceil -$ >

i i t i
j w
> − jt **eligible** j i
j
xj w

allocated> ∧ >earliest> ≤

S jt i
i
xj wj x −

> · > − >allocated> −

w

> · > − allocated> >

lag>
wj i $>j$ wj
allocated> allocated>
m i j
mxt

Lemma 1

□

> i

t i
> xj
w

Theorem 1

w □

i
i
i t t t

i i t i
j w
> − **'th pseudo-deadline** j i jt
latest> allocated>

m i xij i

jt **solid pseudo-deadline** j

latest> allocated> $\equiv \frac{\text{allocated>}}{>} -$

⌈ ⌉
⌈ ⌉ jt j
i **pf-priorities**
wj
x i

xj j

L1:

jt
$>j$
t

t

j

x

3. Fairness and the parallel switching problem

i
t i

t w i

i **pf-priority** t i
i t $\geq$

$\leq$
t i **and**
t i **and**
t
and
t i **or**
t i

Figure 1. Definition of pf-priorities

t i w
cannot
m y y m

Example 1
$_1$ $_2$ $_3$ $<_1$ $<_2$ $<_3$
/ w
wit /
t
t c
y t t t t

wit y
$_1$ $_2$ t
$_3$
tim $_1$ $_2$ t
w

□

y
i y
c
w
w **Algorithm NF** $<$ w y
weakening t t
w t $_i$
t

y t
y t t /
t
during
next w
t *no cell is delayed by more than one slot from where it should have been transmitted in accordance with pfairness*
w
w w w
admission control /
i y
w i
w
$<$ w

t
tim

§1. Connection establishment. S
t y
$_1$ t $_2$ / w
network edge $<_1$ $_2$
$_i$ t
t w $_1$ $_2$
weight $<_i$ $\leq$ $<_i$ $\leq$
t $_i$
$<_i$.
S w

m t
i t t
$<$ y
m t y t w c
$_1$ $<$ t
w $_1$ $_2$
y ℓ
w ℓ k
t
i y w
it y
i
c
c [2]

---

[2]

`ftp.cs.utexas.edu`

References