PRIORITY SCHEDULING

HLSUA
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HARRY QUACKENBOSS, MULTICS MARKETING (PHOENIX)
RESOURCE ALLOCATION FACILITIES

- LOAD CONTROL GROUPS
  * CONTROL MAX (WEIGHTED) LOGGED IN USERS BY GROUP
  * DEFINE: BUMPING (PREEMPTING) RULES

- WORK CLASSES
  * DYNAMIC CONTROL OF CPU ALLOCATION

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WORK CLASSES: PERCENT MODE

- EACH CLASS ASSIGNED A GUARANTEED MINIMUM OF
  CPU AVAILABLE

- WORK CLASS "SIZE" IS CONSTANT AS # OF USERS
  CHANGES
  (BUT PER-USER RESPONSE VARIES)

- IDLE CPU IS AVAILABLE FOR RE-DISTRIBUTION

- SUM OF PERCENTS MUST = 100%

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WORK CLASSES: DEADLINE MODE

- EACH CLASS ASSIGNED

R1 - RESPONSE TIME AFTER INTERACTION

Q1 - QUANTA FOR FIRST INTERVAL

R2 - INTERVAL BETWEEN SUBSEQUENT QUANTA

Q2 - QUANTA FOR SUBSEQUENT INTERVALS

PER-USER NON-INTERACTIVE USAGE RATE =

\[ \frac{Q2}{Q2 + R2} \]

EXAMPLE: \[ \frac{.25 \text{ SEC}}{.25 + 4.75 \text{ SEC}} \] = 5% OF 1 CPU

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REALTIME WORK CLASSES

- CAN BE ADDED WHEN SCHEDULER IS IN % MODE OR DEADLINE MODE
- ASSIGNED QUANTA & RESPONSE TIME LIKE DEADLINE MODE
- READY PROCESSES PLACED IN REAL-TIME QUEUE
- USED FOR:
  INITIALIZE
  IO DAEMON
  DEMO FOR PROSPECTS
  BENCHMARKS
  HIGH PRIORITY USERS

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CHANGEABLE SCHEDULING PARAMETERS

TEFIRST - TIME QUANTA AWARDED AFTER INTERACTION

TELAST - SUBSEQUENT TIME QUANTA

TIMAX - DETERMINES HOW "NON-INTERACTIVE" JOBS ARE
SORTED INTO READY QUEUE. A PROCESS WILL
NOT BE SORTED LOWER THAN TIMAX SECONDS SINCE
INTERACTION

MAXE - MAX ELIGIBLE PROCESS

WSF - WORKING SET FACTOR

WSA - WORKING SET ADDEND
READY- HAS WORK TO DO. READY TO RUN
RUNNING- EXECUTING ON A PROCESSOR
BLOCKED- NOT READY. Awaiting an EVENT:

- INPUT FROM TERMINAL
- TAPE MOUNT
- SIGNAL FROM ANOTHER PROCESS

EVENT OCCURRENCE IS AN INTERACTION AND CAUSES A WAKEUP.

WAITING- WAITING FOR A PREDICTABLY SHORT EVENT.

- DISK PAGE ARRIVAL

STOPPED- PENDING DESTRUCTION BY INITIALIZER

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ELIGIBILITY:

- NOT ALL READY PROCESSES ARE CANDIDATES TO RUN
- ELIGIBILITY IS AWARDED SUBJECT TO:

(A) ELIGIBLE PROCESSES  MAXE

(B) WORKING SET ESTIMATES  SYSTEM W.S.

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GUIDELINES

(1) **CAUTION:** USE REALTIME SPARINGLY

- WHEN DEADLINE ARRIVES, ELIGIBILITY IS AWARDED WITHOUT LOOKING AT MAXE, WSF

- INITIALIZER SHOULD BE HIGHEST PRIORITY REALTIME PROCESS. (AVOID DEADLY EMBRACES DURING FATAL PROCESS ERRORS)

- LOAD CONTROL CAN HELP KEEP FROM OVER-BOOKING

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(2) IF SOME WORK CLASSES ARE SMALL (10%), RESPONSE AT USER LEVEL WILL BE MORE CONSISTENT WITH SHORT QUANTA:

EXAMPLE: TEFIRST = .75 SEC — 1 SEC
TELAST = .25 SEC — .5 SEC

PERMITS GOOD RESPONSE TO SMALL COMMANDS, BUT PROHIBITS HOGGING THE MACHINE.
TRANSACTION PROCESSING ENVIRONMENT EXAMPLE

(1) PLACE "WORKER" PROCESSES IN % MODE WORK CLASS, CHOOSE TEFIRST & TELAST IN ACCORDANCE WITH TRANSACTION CHARACTERISTICS. (HEAVY TRANSACTIONS ⇒ LONGER QUANTA TO MAXIMISE THROUGHPUT)

(2) PLACE I/O PROCESSES (HANDLING TERMINALS) IN REALTIME CLASS, CHOOSE R1, Q1, R2, Q2 COMPATIBLE WITH LINE SPEEDS AND TERMINAL I/O VOLUMES.

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