To: Distribution

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Subject: Load Control Groups

This memo describes the inital implementation of a load control
group mechanism for Multics. The implementation is split into an
initial part, which is very easy and solves most of our current
problems in the load control area, and a second part, which puts
in several fancy features.

The first phase will provide the biggest change to the user
interface: it introduces "CTSS-style" load control groups, and
the notion of primary and secondary status for users. The load
control groups can be allocated a quota of primary load units
representing a guaranteed number of users; users in excess of
the quota will be logged in as secondary, and will be subject to
preemption if a user who receives primary status logs in; and
preemption within a load control group across project boundaries
will work.

This first phase will be accomplished by the installation of two
procedures, and the creation of a single new data segment.

We will attempt to install the load control programs and tables
in a way that will not change the appearance of the system to the
average user, and then later perform the actual division of
projects into groups by editing the various system tables.

The second part of the pary-group implementation could provide
some or all of the following features:

    1) Scheduled service

    2) Edit-only service

    3) Load Control group administrators

    4) load control group control of some project attributes

All of these functions are easy to code but involve more
programming than the basic load control group mechanism.
Furthermore, these functions may not be necessary at all; We
should live with the basic implementation for a month or two
before dedicating the resources necessary to provide what may
turn out to be nothing but "frills".

There are a few miscellaneous tasks which fall between part one
and part two. These tasks include:

    1) Modifications to "who" to show group and secondary status

    2) Administrative reports by group

    3) Minimum waiting time after user is preempted before he
    can login again.

Detailed description of part one

Only one module in the system is involved in the actual
load-control decision. Replacing this program, "load_ctl_", with
a version that uses a new strategy, is straightforward.

The new version of load_ctl_ will discover the group associated
with each project by inspecting a slot in the SAT which is
currently ignored. This slot holds an 8-character group
identifier, which will be looked up in the "master group table"
(MGT) to find the current and maximum number of primary load
units for the group.

The other module that will be installed is a simple-minded editor
which allows the system administrator to create and edit the MGT.
Group administrators who wish to change parameters of a project
in their group and the moving of projects from one group to
another will be handled by the system administrators on a request
basis. These changes should be infrequent enough so that not
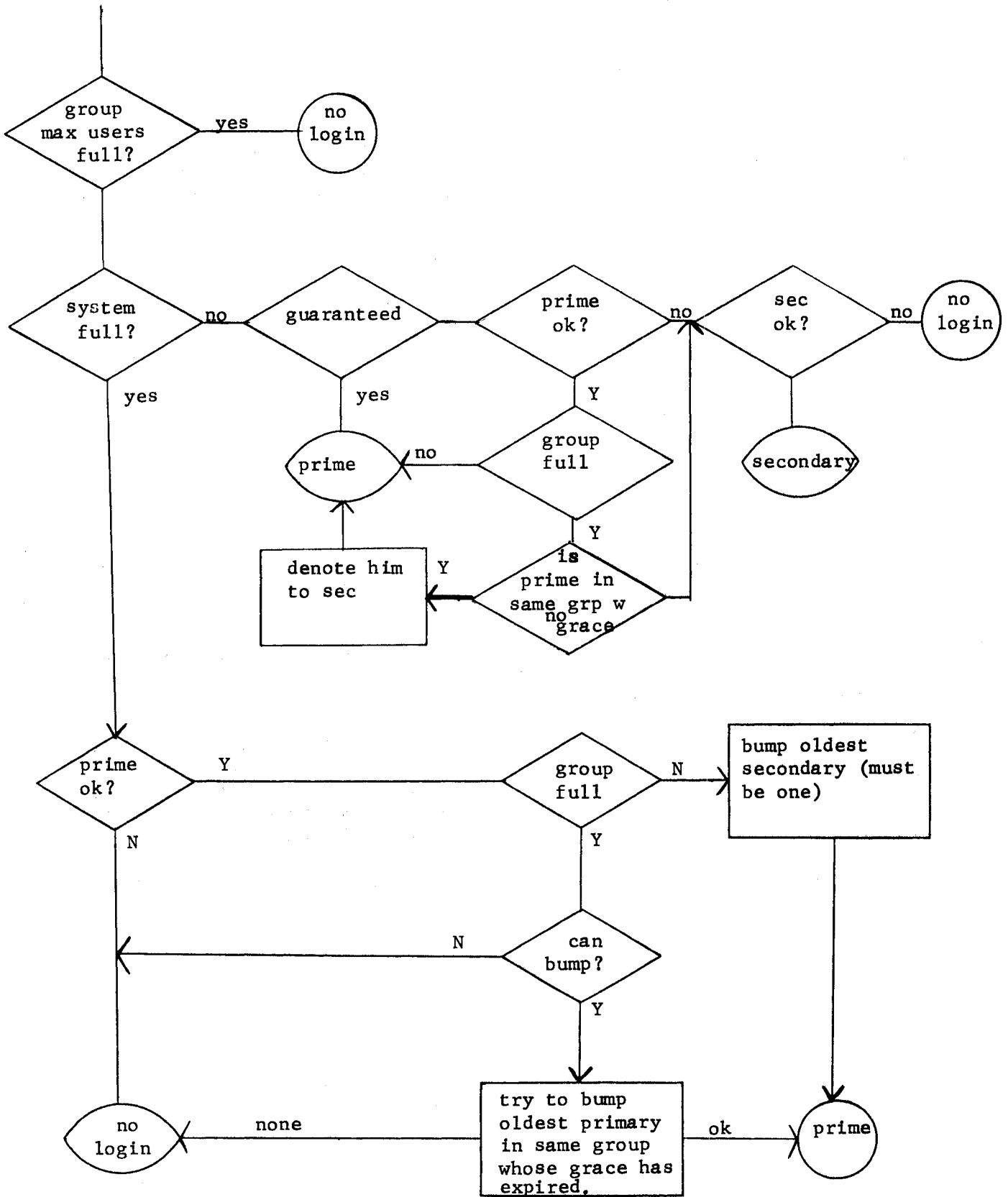much work is involved.

The MGT for the basic load control group mechanism will contain
little more than the group identifier, the current and maximum
number of primary units, and the current number of secondary
units for the group. Later, we may want to add pointers to a
schedule data base, attribute masks, administrator identifiers,
and a count of edit-only users.

The flowchart provided as figure 1 shows the guts of the login
decision. The algorithm references the following data items:

    1) System maxunits (already in SAT)

    2) System current units (already in SAT)

    3) System max. users (already in SAT)

    4) System current users (already in SAT)

    5) Group max. primary units (new, in MGT)

    6) Group current primary units (new, in MGT)

    7) User "guaranteed_login" attribute (already in pdt)

    8) User "prime_ok" attribute (new, in pdt)

    9) User "secondary_ok" attribute (new, in pdt)

10) User primary flag (new, in answer table)

11) User "preempting" attribute (already in pdt as "bumping")

12) User "grace" (already in pdt)

13) User login time (already in answer table)

14) User group identifier (new, in answer table, from sat)

15) Absolute maximum number of users in group (new, in MGT)

load_ctl_ -- decision at login

group
max users
full?

yes

no
login

system
full?

no

guaranteed

prime
ok?

no

sec
ok?

no

no
login

yes

yes

Y

Y

prime

no

group
full

secondary

denote him
to sec

Y

is
prime in
same grp w
grace

Y

no

prime
ok?

Y

group
full

N

bump oldest
secondary (must
be one)

N

Y

N

can
bump?

Y

no
login

try to bump
oldest primary
in same group
whose grace has
expired.

ok

prime

User Interface

A user who logs in and is awarded primary status will get one of
two messages, depending on whether he has a grace which is
meaninglessly large, or not. If the user will become subject to
bumping within the next 24 hours, a message of the form

        You are protected from preemption until 1527.

Will be typed just before the "Name,Proj logged in..." message.

If the user has a grace which is greater than 24 hours, he will
just be told

        You are protected from preemption.

Users who are given secondary status at login will be told

        You are subject to preemption.

even though "preemption" does not mean quite the same thing here,
since secondary users can be preempted by users from any group.

No message will be sent to the user if he is demoted from primary
to secondary after his grace runs out, or if he is promoted to
primary from secondary as a result of some primary user in his
group logging out. This is mostly because the answering service
has no clean communication channel to created processes, other
than grabbing the typewriter by force. The "who" command will be
modified to show primary or secondary status, and time bumpable,
and the "user_info_" subroutine can be changed to return these
parameters.   Users may then write whatever programs they want to
list who is bumpable and when, or to check their own status.

The answering service will still grab the typewriter away from
the user process to give him a three-minute warning before he is
to be preempted. The message will be of the form

        ****
        From Multics: Secondary user preemption.
        You will be logged out in 3 minutes.
        ****

If emergency preemption or group preemption takes place, the
message will say "Group preemption" or "Emergency preemption"
instead of "Secondary user preemption".

Users who get such a message should clean up and log out.
Logging right back in again, in the hope of preempting some other
user in the same group whose grace has also run out, is

considered antisocial.   The group supervisor will be able to
detect this practice easily, by examining a filtered copy of the
answering service message log which contains only those messages
pertaining to his load control group.