Identification

Process/System Fault Breakdown
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Purpose

The 32 fault conditions included in the GE-645 fault repertoire
are divided into two categories, process faults and system
faults, for Multics fault handling. This section contains
a list of the faults in each category. The GE-645 processor
reference manual should be consulted for information concerning
the causes of the various faults.

Discussion

We define four general classifications of faults; program
generated, operating system generated, hardware generated,
and manually generated. Each fault is placed in the classifi-
cation that corresponds to the possible cause of the fault.
If a fault could only be caused by a hardware malfunction,
it is classified as hardware generated; if it could possibly
be caused by the execution of a program, it is classified
as program (or operating system) generated. All hardware
and manually generated and certain operating system generated
faults are called system faults. They may occur at any
time, regardless of which user process has control of
the processor. They may not, in general, be considered
"programmed by" the running process. The remaining program
generated and operating system generated faults are called
process faults. Since Multics executes as part of the
user process, all process faults may be attributed to
the running process.

Certain of the process faults and certain of the system
faults have special meanings to the Multics operating
system when they occur in specified contexts. In addition,
certain faults are reserved for future assignment. Faults
which are either assigned or reserved for future assignment
are called reserved faults.

Process Faults

The process faults are as follows:

    1. Derail
    2. Divide check
    3. Fault tag 1

4.   Fault tag 2
5.   Fault tag 3
6.   Illegal procedure (5 sub-conditions)
   a. GE-645 privileged instruction in slave mode
   b. GE-645 semi-privileged instruction in slave
       mode with locked base
   c. Illegal operation code
   d. Out-of-bounds (may occur simultaneously with
       access violation)
   e. Access violation (may occur simultaneously with
       out of bounds)

7.   Operation not completed (See Section BC.3.06)
8.   Overflow (3 sub-conditions)
   a. Fixed overflow
   b. Floating overflow
   c. Floating underflow
9.   Master mode entry 1
10. Master mode entry 2
11. Master mode entry 3
12. Master mode entry 4
13. 635 compatability
14. 635/645 compatability

Reserved Process Faults

Process faults which are either assigned or reserved for
future assignment are as follows:

1.   Fault tag 2. Fault tag 2 is the standard Multics
     linkage fault when it occurs in the linkage section.
     (See Section BD.7.01 for a description of the linkage
     section and Section BD.7.04, Linker, for a discussion
     of how the linkage fault is handled.)

2.   Fault tag 3. (reserved for future assignment)

3.   Master mode entry 1. (reserved for future
     assignment)

4.   Master mode entry 2. (reserved for future
     assignment)

5.   Master mode entry 3. (reserved for future
     assignment)

6.   Master mode entry 4. (reserved for future
     assignment)

7.   illegal procedure, illegal operation code sub-condition. From time to time, new instructions may be added to the processor. During the interim period, before the instructions are retrofitted onto the processor; the Multics fault handler will simulate the new instructions.

8.   illegal procedure, out of bounds sub-condition. This fault is used by the Basic File System (Section BG).

9.   illegal procedure, access violation (attempt to execute data) subcondition. This fault is used to intercept an attempted outward wall crossing. (See Section BD.9, Protection of the Supervisor.)

System Faults

The system faults are as follows:

1.   Startup
2.   Shutdown
3.   Execute
4.   Memory parity
5.   Trouble
6.   Lockup
7.   illegal descriptor
8.   illegal memory command
9.   Directed fault 0
10. Directed fault 1
11. Directed fault 2
12. Directed fault 3
13. Directed fault 4
14. Directed fault 5
15. Directed fault 6
16. Directed fault 7
17. Timer runout
18. Connect

Reserved System Faults

The reserved system faults are as follows:

1.   Timer runout. The timer runout fault is transformed into an interrupt signal, the time-out interrupt, which competes with other interrupt signals on a priority basis for recognition by that processor.

2.   Connect. The connect fault is reserved to mean "clear your associative memory".

3. Directed fault 0. Directed fault 0 is used to indicate page or segment not in core memory. The distinction between page and segment faults is made on the basis of information saved by the processor control unit.

4. Directed fault 1. Directed fault 1 is used as a tool for metering core storage usage.

5. Directed fault 2. Directed fault 2 is used to intercept attempted wall crossings.

6. Directed fault 3. Directed fault 3 is used to deny all access to pages and/or segments (even to master mode procedures).

7. Directed fault 4. Directed fault 4 is used for "unusual mode simulation".

8. Directed fault 5. (reserved for future assignment)

9. Directed fault 6. (reserved for future assignment)

10. Directed fault 7. (reserved for future assignment)