Published: 12/29/67

Identification

Control Unit Validator
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Purpose

Control Unit Validator is called by the Fault Interceptor and the Interrupt Interceptor, whenever the user has had an opportunity to modify the Control Unit Data that is about to be restored.

After receiving a process fault and after calling signal, control may return to the FIM from the fault handling procedure. If and when this occurs, the FIM calls the Control Unit Validator to check the validity of the possibly changed control unit data. If the control unit data describes a legitimately obtainable processor state, the FIM then restores the processor state to the point at which the fault occurred.

The Interrupt Interceptor calls the Control Unit Validator when it is about to resume a process that has been saved.

Discussion

In order to validate the CU, the Control Unit Validator follows the following rules (see Fig. 1 for format of control unit):

1) In word 2 (Bits 18, 19, 27, 28 and 29), of the control unit, there must be one and only one of the P cycle bits on. If less than one or more than one of these bits were left on the processor may hang up upon executing an RCU.

2) The master/slave bit in word 2 (Bit 26), and the absolute mode bit (Bit 28) of word 4, must be off. If either were on it would indicate that a master mode (system) fault had occurred and was handled by a user. This cannot be the case.

3) In word 4 (Bits 31, 32 and 33), no more than one of the FT, FL or FD bits may be on. These bits specify the type of repeat instruction being executed, if any.

4) In word 2 (Bits 21 and 22) no more than one of the XDE and XDO bits may be on.

5) In word 2 (Bit 24) the temporary absolute mode (MASF) flag must be off. To insure against the possibility of returning to or using a master mode segment, the validator also checks the Segment Descriptor Words referenced by the PBR and TBR. If the segment referenced is in core the SDW will indicate whether or not it is master mode, and if the segment is not in core it cannot be master mode.

6) The Validator also checks the ring number that is to be returned to. This ring number must not be less than the ring number of the handler's ring.

The validator does not detect all possible errors in the control unit, however it does detect all errors that could conceivably hang up the processor or violate protection restrictions. The undetected errors will cause a fault upon execution of the instructions contained in the Control Unit Data.

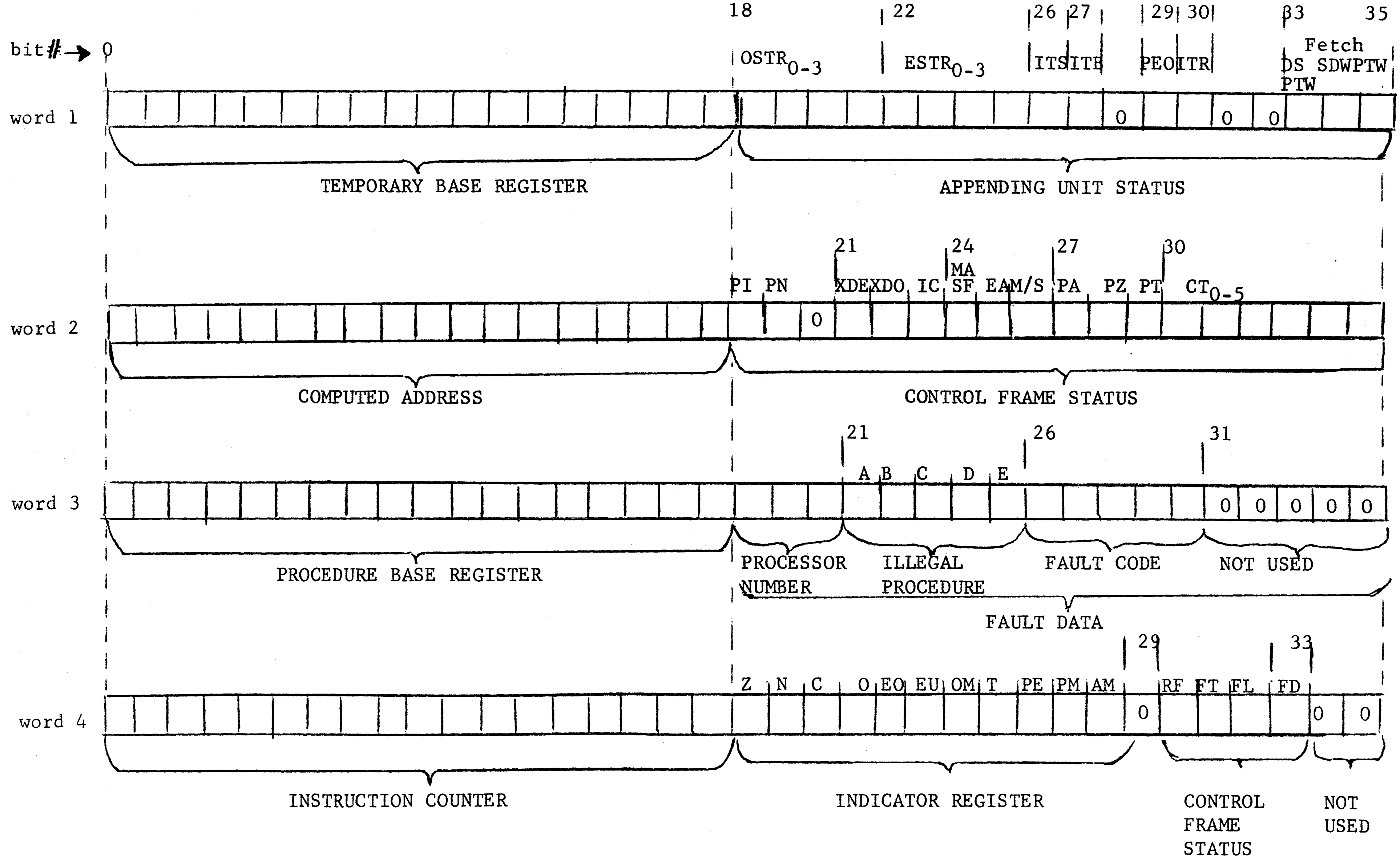
Calling Sequence

```
     call      validator$control_unit (cu_ptr,error);

               dcl  cu_ptr pointer,
               error fixed bin(17);
```

will check the validity of the Control Unit Data pointed to by cu_ptr. If the Control Unit Data is not valid, error will be set to a one.

Format of words stored by SCU instruction



word 5: even instruction

word 6: odd instruction

(abbreviations explained on next page)

figure 1.

Explanation of Abbreviations in SCU format chart

Word 1, bits 18-35:

APPENDING UNIT STATUS

OSTR	Odd Seg. Tag Reg + Use Flag
ESTR	Even " " " " "
ITS	ITS Tag
ITB	ITB Tag
PEO	Parity Error Operand
ITR	Indir. Tally ≠ Tally Runout Indicator
DS PIW	Desc. Seg. PTW Fetch
SDW	Seg. Desc. Word Fetch
PTW	Page Table Word Fetch

Word 2, bits 18-35:

CONTROL FRAME STATUS

PI	-Instr. Fetch(1)Addr. Mod.(0)
PN	-Indirect Addr-Forced R/N Mod.
XDE	-Execute Double Even
XDO	-Execute Double Odd
IC	-Even(0)/Odd(1) Instr.
MASF	-Temporary Absolute Mode
EA	-Final Effective Addr.(1)
M/S	-Master(1)/Slave(0)
PA	-Initial Address Prep.
PZ	-Indirect Addr. Prep. (RI or IR)
PT	-Indirect Address Prep. (IT)
CT	-Control Tag Register

Word 3, bits 21-25:

ILLEGAL PROCEDURE CODE

A -645 privileged instruction (SDBR, LDBR, STAM, STAZ, CLAM, SCU, TSS, RCU, LACL)

B -Locked base, slave mode execution of EAPn, EABn, TSBn, LDCF, ADBN, LBRn

C -Op code ng defined

D -EA or pointer out of bounds

E -No access - access, write permit or class conventions

Word 3, bits 26-30:

FAULT CODE

00-shutdown
01-MME1
02-derail
03-timer runout
04-MME2
05-MME3
06-connect
07-MME4
10-F1
11-635 compat.
12-illegal proc.
13-illegal desc.
14-parity
15-ill.mem.com.
16-F2
17-F3
20-DF0
21-DF1
22-DF2
23-DF3
24-DF4
25-DF5
26-DF6
27-DF7
30-635/645
31-overflow
32-dvdcheck
33-execute
34-lockup
35-op not complete
36-startup
37-trouble

Word 4, bits 18-28:

INDICATOR REGISTER

Z - Zero
N - Negative
C - Carry
O - Overflow
EO - Exponent overflow
EU - Exponent underflow
OM - Overflow mask
T - Tally runout
PE - parity error
PM - parity mode
AM - absolute mode

Word 4, bits 30-33:

CONTROL FRAME STATUS

RF -Init. Repeated Instr.
FT -Repeat
FL -Repeat Link
FD -Repeat Double