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SUBJECT: Software Interrupt Control Module Proposal

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Software Interrupt Mechanism
PE-TI-879
Software Interrupt Control Module Functional Spec.
PE-T-1005
Software Interrupt Control Module Design Spec.
PE-TI-1006

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ABSTRACT

Prior to Rev. 18, PRIMOS contained only one software interrupt known as the QUIT$ condition. This condition may be enabled/disabled by calling the BREAK$ module. At both Rev. 18 and Rev. 19 new software interrupts were added to the system. Unfortunately, no method has yet been provided for the users to enable/disable these new interrupts. This is the problem addressed by this proposal.

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1 BACKGROUND

Prior to Rev. 18, PRIMOS contained only one software interrupt known as the QUIT$ condition. This condition may be enabled/disabled by calling the BREAK$ module. For more information on the BREAK$ module see PRIMOS Subroutines Guide (BREAK$ Function).

At Rev. 18 the following two interrupts with their respective conditions were added:

1) CPU watchdog timer (CPU_TIMER$ condition) and
2) Real Time watchdog timer (ALARM$ condition).

At Rev. 19 the following three interrupts with their respective conditions were added:

1) Phantom Logout Notification (PH_LOGO$),
2) Cross Process Signalling (CPS$), and
3) Logout (LOGOUT$).

CPS$ is an internal condition and will never be released to the general public. Unfortunately, no method has yet been provided for the users to enable/disable these new interrupts in either Rev. 18 or Rev. 19.

Moreover, the existing BREAK$ functionality, as an undocumented by-product, when called to disable QUITS, disables all software interrupts. This is not acceptable as some users, specifically PRIME subsystems such as DBMS, cannot have all software interrupts turned off by BREAK$.

Unfortunately, as Rev. 18 has been released, this functionality is out in the field. Fortunately, since it is not documented, no user may validly depend on this by-product of BREAK$. In other words, to the user, no method has yet been provided to turn off software interrupts except for QUITS, and to PRIMOS, we do not have to support this BREAK$ effect.

2 PROPOSAL

To allow users to control the enable/disable setting of the various software interrupts, a new module, SW$INT, will be built. Its calling sequence is

```
call sw$int(key, selection, value, ercode, [outer_ring]);
```

key - argument which specifies to either
turn interrupt(s) on, turn interrupt(s)
on, or read the present value of
interrupt(s)

selection - a bit string denoting which interrupt(s)
the caller is interested in

value - the returned value of the selected
interrupt(s) when the read key has
been passed

ercode - standard error code

outer_ring - an optional outer ring which when included
specifies to sw$int what ring to work in

The selection and value arguments are varying length bit strings. Each
bit will be associated with one specific interrupt type. The placement
of each bit within the string does not have to be one to one with the
internal placement of the bit as used by the PRIMOS software interrupt
handler. This makes the SW$INT bit definition(s) independent of the
physical bit definition(s) and makes the internal representation
transparent to the caller.

Normally SW$INT turns on/off and/or reads the status of the
interrupt(s) chosen in the ring of its caller. Including the outer
ring argument makes SW$INT operate on the software interrupt control in
the passed ring.

Presently, there are no plans to release SW$INT to the general public.
It will be released to PRIME subsystems for their use. This will allow
us to release to the general public, at a future time, a gate which
does not know of all the software interrupt types. Some subsystems,
such as DBMS, cannot ever afford to have certain interrupt types, such
as logout, turned off.

When a user turns on an interrupt which had been seen while disabled, a
signal will be immediately be generated for that interrupt condition.

Note that software interrupts normally start out enabled in the outer
rings and disabled in ring 0.

3 HOW SW$INT WILL AFFECT SYSTEM PROGRAMMERS

The following sections describe the effects of SW$INT's introduction as
it will be perceived by system programmers and who these programmers
will be.
3.1 What Will Rev. 18 Users See?

SW$INT will not be integrated into Rev. 18. This means that PRIMOS will never provide a mechanism for turning on/off the CPU and Real Time Watchdogs at this Rev. This is exactly what we have today so it seems justified. Again, any user that calls BREAK$ to turn off any interrupt other than QUIT is making use of an undocumented feature and does not have to be supported.

Note that this means that no changes will have to go into Rev. 18.

3.2 What Will Rev. 19 Users See?

SW$INT will be the only module that can turn on/off software interrupts at Rev. 19 with the exception of BREAK$ which will only affect QUITs. Either SW$INT or BREAK$ may be used to turn on/off QUITs.

3.3 What Do System Programmers Need To Know?

Basically, system programmers only need to know about two different areas to which SW$INT relates. The first is the three classes of software interrupts that are found in PRIMOS today. The second is the way in which software interrupts are handled in ring 0.

3.3.1 Software Interrupt Classes

The easiest type to explain is the simple on/off interrupt. The CPU watchdog timer is one of these. These interrupts take on only an on or off state. There is no chance that multiple instances of these interrupts will occur.

The second form of software interrupt is the counted interrupt such as QUITs. A counter is used to determine how many times at a given level the interrupt has been turned on/off. One may think of the counter as a stack. SW$INT will not maintain these counters. Separate modules/mechanism which SW$INT calls will do so. BREAK$ does this for QUITs.

The third type of interrupts is the queued data interrupt. Phantom logout notification is one of these. The queuing mechanisms for these interrupt types will be responsible for queueing the data. SW$INT will be responsible for turning the interrupt on/off.

3.3.2 Software Interrupts In Ring 0

In ring 0 the sense of the normal state of software interrupts is reversed from the state in the outer rings. In the outer rings, interrupts are normally enabled. In ring 0, interrupts are normally disabled. This allows ring 0 programmers to forget about the need for creating critical sections in ring 0. Ring 0 is normally a critical
section. Additionally, the interrupt handling code in ring 0 when it sees a software interrupt and the execution is in ring 0 defers the taking of the interrupt until execution leaves the inner ring. In this manner, PRIMOS never loses software interrupts. For more information about this deferring of interrupts see Software Interrupt Mechanism PE-TI-879.

3.4 Who Will Be SW$INT's Initial Users

Both the Data Base Management and the TP groups have requirements for the watchdog timers. They will make use of SW$INT. Phantom logout notification already has a control module which turns on/off notification. It will be superceded by SW$INT.

4 SOLUTION SUMMARY

A module, SW$INT will be introduced into Rev. 19 which will allow users to enable/inhibit specific software interrupt types. This module will be bit string oriented to make it easy for programmer's use. No changes will be made to Rev. 18. Finally, SW$INT will be built in a manner which will make the interrupt mechanism(s) transparent to the user and will allow the easy addition of new interrupt types or classes.

5 MORE INFORMATION ON THE SOFTWARE INTERRUPT MECHANISM

For information on the details of the software interrupt mechanism consult Software Interrupt Mechanism PE-TI-879.

For information relating to the use of the new software interrupt control module consult Software Interrupt Control Module Functional Spec. PE-T-1005.

For information relating to the design details of the software interrupt control mechanism consult Software Interrupt Control Module Design Spec. PE-TI-1006.