TO: F. J. Corbató
C. T. Clingen
J. Gintell
N. Morris
D. Vinograd
J. H. Saltzer ✓

FROM: R. J. Feiertag, V. L. Voydock

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SUBJECT: Extension of the signal mechanism to include cross ring signals

With the imminent reawakening of the full Multics ring mechanism it becomes necessary to properly implement a more general signalling mechanism that allows conditions to be signalled across rings. Cross ring signalling is essential because the situation arises in which the ring in which a signal originates is not the ring prepared to handle the signal. This situation presently results in what is termed a "crawl out". The proposed cross ring signalling mechanism is a generalization of crawl outs and behaves as follows.

When a condition is signalled in a given ring, the condition stack for that ring is searched for a handler for the condition and if a handler is found it is invoked. If the handler for the condition is not found in this ring the condition stack is then searched for an unclaimed signal handler and if one is found it is invoked. If neither a handler for the condition nor an unclaimed signal handler is found in this ring then a cross ring signal must be attempted.

A cross ring signal first causes this ring's stack to be unwound, and truncated. (Recall that unwinding causes all handlers for the "cleanup" condition in this ring to be invoked and all stack frames to be discarded. The cleanup handler will be notified that this is a crawl out rather than a normal cleanup.) The process is then switched to the ring from which this ring was invoked and the condition is signalled in this new ring, this causes the sequence of events to begin again. If upon trying to detemine which ring to go out to, it is found that the calling ring has a lower number than the current ring (this would indicate a call out) or that a calling ring does not exist (this indicates the process started in this ring) then the process will be terminated. could crawl out to ring 4 and command level ?

The effect of the above described method is to signal a condition in each ring in the process's virtual (cross ring) stack until a handler for that condition or an unclaimed signal handler is found. After each ring's condition stack is unsuccessfully searched the stack for that ring is unwound and truncated.

In order that the FIM be able to invoke the signallers in each ring it is necessary to keep a separate pointer to the signaller in each ring. This information can most easily be kept in the stack header. The pointer will be filled in when the stack is created.

For reasons of upward compatability it may be necessary to temporarily special case cross ring signals originating in ring 0. This is because a special check is made at crawl out time to make sure no locks are set. This mechanism should eventually be replaced by "cleanup" conditions established in those procedures that set locks, to perform these checks. when the stack is unwound.

The areas of the system which will have to be modified to perform this change include:

1. signal
2. fim (and friends)
3. gatekeepter (and friends)
4. crawl out