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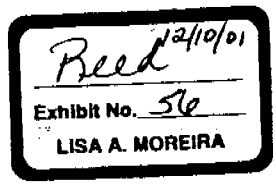
October 12, 1989



Mr. J. Ben Williams
President
Rational Systems Inc.
220 No. Main Street, 2nd Floor
P.O. Box 480
Natick, MA 01760

Re: Compatibility Issues for Rational Dos Extender ISVs With 1386 Virtual Mode Memory Managers

Dear Mr. Williams:

This letter seeks to solicit your immediate support and cooperation in ensuring that the Rational Dos extender and your ISVs adopt some programming guidelines that are essential if the Dos market is to evolve to address the virtualization capabilities of the 386-class of Intel processors. We believe that by acting immediately to communicate this information to your ISVs and in modifying your code, that we all can avoid limitations that would be implied by continuing with the current approach.

The 1386 class of machine has seen enormous growth in the past few months and we expect this class of machines to dominate the market, making this issue critical for the DOS community. Our own experience with Windows 3.0, which does fully exploit the virtualization capabilities of the 386-class of processor, indicates that the end-user community is very excited about virtualization. We expect to be shipping several million copies of Windows 3.0 over the next year. While we do enable your ISVs to run in "standard mode" of Windows 3.0 (no virtualization; no multitasking of Dos applications), these applications will not be able to co-exist with the 386 virtual mode of Windows 386.

Our desire would be to ensure that your ISVs can co-exist with the 386 virtual mode of Windows 3.0. At minimum, it would be important to get your ISVs to strictly adhere to the attached guidelines. Given that, we can have a productive set of discussions to ensure a coherent future for us all. Fortunately the attached guidelines are very straightforward and should not present an undue burden for your ISVs.

Our recent discussions have helped us prepare the attached analysis. Since we are still lacking detail about the architecture of your Dos Extender, it may be that some other issues exist.

After you have had a chance to review the attached I would appreciate the opportunity to discuss this further with you.

Sincerely,

Russell S. Werner

Russell S. Werner
General Manager-Dos/Windows

CC: Fank King - Lotus Development
Dave House —Intel Corporation
Steve Ballmer-Microsoft
Bill Gates- Microsoft

Marc D. Wilson
Windows Lead Developer

Dear Mr. Williams:

This letter is intended to clarify some of the restrictions on protected mode applications and DOS extender software that we feel is necessary in order to work with multitasking protected mode operating systems such as Windows/386. It is important that all protected mode applications using the DOS extender fully understand what they must do to be compatible with these operating systems. Also included are some suggestions for implementation that affect the efficiency of these pieces of software. Along with this letter is the most recent version of the document describing the services we have implemented to support extended software.

SELECTORS AND THE DESCRIPTOR TABLES

First and foremost of these restrictions is access to system software data structures such as the LDT, GDT and IDT. These structures must be maintained by the OS. If you make the simplifying assumption that the only one application/task will run in a Virtual Machine, we can give access to the LDT since the application/extender could handle the allocation/deallocation of selectors in the LDT instead of the OS. The current WIN386 architecture, however, allocates memory to the LDT based on usage. In order for the application software to manage that, we would have to implement a call for the application to allocate all of the LDT or some other call that dynamically allocates memory for the LDT (and the application would have to deal with the situation where the LDT cannot be extended). It is simpler for the OS to hide the selector management from the application. WIN386 provides this with the INT 31h services (see DDK documentation). Since the GDT is a constant across tasks, we recommend that applications not make use of GDT selectors. However, a scheme similar to the LDT management could be implemented. Additionally, WIN386 could set aside certain GDT entries for special usage (e.g. 40h is a selector for segment 40h) when that usage is common across VMs. If you would like to have some GDT entries reserved for the DOS extender, which might run in multiple VMs, please let us know what your requirements are. I will leave discussion of the IDT till later when interrupt processing is discussed.