THIS OPINION WAS NOT WRITTEN FOR PUBLICATION

The opinion in support of the decision being entered today (1) was not written for publication in a law journal and (2) is not binding precedent of the Board.

Paper No. 30

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte GEORGE A. SPIX, DIANE M. WENGELSKI, STUART W. HAWKINSON, MARK D. JOHNSON, JEREMIAH D. BURKE, KEITH J. THOMPSON, GREGORY G. GAERTNER, GIACOMO G. BRUSSINO, RICHARD E. HESSEL, DAVID M. BARKAI, STEVE S. CHEN, STEVEN G. OSLON, ROBERT E. STROUT II, JON A. MASAMITSU, DAVID M. COX, LINDA J. O'GARA, KELLY T. O'HAIR, DAVID A. SEBERGER, JAMES C. RASBOLD, TIMOTHY J. CRAMER, DON A. VAN DYKE, and ASHOK CHANDRAMOULI

Appeal No. 1997-0760
Application No. 08/003,000[1]

HEARD: November 15, 1999

Before THOMAS, DIXON, and GROSS, Administrative Patent Judges.

GROSS, Administrative Patent Judge.

---

[1] Application for patent filed January 11, 1993. According to appellants, this application is a division of Application No. 07/537,466, filed June 11, 1990, now U.S. Patent No. 5,179,702, which is a continuation-in-part of Application No. 07/459,083, filed December 29, 1989, now U.S. Patent No. 5,197,130.

DECISION ON APPEAL

This is a decision on appeal from the examiner's final rejection of claims 20 through 23, 29, and 30, which are all of the claims pending in this application.

Appellants' invention relates to an integrated software architecture that efficiently executes programs on a highly parallel multiprocessor system. More specifically, the architecture includes a multithreaded operating system which provides two levels of scheduling. Claim 20 is illustrative of the claimed invention, and it reads as follows:

20. An integrated operating system program for controlling execution of a plurality of multithreaded computer programs in a multiprocessor system having a plurality of tightly-coupled processors that share a common memory and a common atomic resource allocation mechanism, the plurality of multithreaded computer programs comprising one or more executable processes, the integrated operating system program comprising:

multithreading scheduling means to be executed simultaneously on one or more of the processors for distributively scheduling execution of executable processes; and

user-side scheduling means to be compiled with the executable processes, the user-side scheduling means and executable processes comprising an executable computer program for scheduling the execution of other executable processes and for examining one or more work request queues stored in the

common memory to coordinate work requested by executing processes with available non-executing processes, [.][2]

such that both the multithreaded scheduling means and the user-side scheduling means utilize the common atomic resource allocation mechanism to interrogate and modify the one or more work request queues for each computer program that represents the number of executable processes that need to be executed for that computer program.

The prior art reference of record relied upon by the examiner in rejecting the appealed claims is:

Parkin 4,073,005 Feb. 07, 1978

Claims 20, 21, 23, and 29 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Parkin.

Claims 22 and 30 stand rejected under 35 U.S.C. § 103 as being unpatentable over Parkin.

Reference is made to the Examiner's Answer (Paper No. 26, mailed August 8, 1996) for the examiner's complete reasoning in support of the rejections, and to appellants' Brief (Paper No. 25, filed May 17, 1996) for appellants' arguments thereagainst.

OPINION

[2] We note an incorrect placement of a period in the claim and have replaced it with a comma.

We have carefully considered the claims, the applied prior art reference, and the respective positions articulated by appellants and the examiner. As a consequence of our review, we will reverse the anticipation rejection of claims 20, 21, 23, and 29 and also the obviousness rejection of claims 22 and 30.

For claim 20, the examiner refers (Answer, page 2) to column 2, lines 12-31, of Parkin for all elements of the claim. The examiner points to Parkin's tasks for appellants' multiple threads, Parkin's task list for the atomic resource allocation mechanism, Parkin's Executive program (Exec) for the user-side scheduling means, and to Parkin's column 2, lines 12-22, for the multi-threaded scheduling means.

Appellants contend (Brief, pages 7-8) that Parkin's "tasks" are different from appellants' "threads." The examiner responds (Answer, page 3) that "to the extent the word 'multithreading,' 'threading,' or 'thread' is utilized in applicant's [sic] claim language, it refers to nothing more than a stream of executable instructions to be scheduled." In addition, the examiner states (Answer, page 4) that "[t]here

is no claimed 'independent nature' [of the threads]" as argued. We disagree with the examiner.

Appellants clearly define "thread" in the specification (page 4, lines 1-3) as "a part of a program that is logically independent from another part of the program and can therefore be executed in parallel with other threads of the program." (Emphasis added). On page 38 of the article provided by appellants entitled "MULTITHREADED Processor Architectures" (Brief, Appendix 3), reference is made to "multiple concurrent streams of execution, or threads, which are independent of one another." (Emphasis added). On page 40 of the same article, "thread" is defined as "a statically ordered sequence of instructions. Multiple threads may operate concurrently within a task or process, each with its own program counter and local state but with some state shared by all the threads in the process." (Emphasis added). Although the article was published in 1995, six years after the effective filing date of appellants' application, page 38 explains that "[e]xperimental multithreaded systems have existed since the 1950's" and [t]he first commercial multithreaded system was the Heterogeneous Element Processor (HEP), introduced in

1978." Thus, the term "thread" has clearly been used for independent streams of execution which can operate concurrently, since long before appellants' effective filing date. Accordingly, we cannot agree that a thread is merely "a sequence of instructions for execution on a processor," as asserted by the examiner (Answer, page 4). Therefore, we agree with appellants that their threads are not the same as Parkin's tasks.

Further, appellants (Brief, page 7) contend that Parkin does not teach a multithreading scheduling means. The examiner asserts (Answer, page 7) that

> Parkin states that the Exec is stored at least partially in the memory of each processor. Therefore, this portion of the Exec is also present in memory when the processor is performing a task. Therefore, because it is present along with the task, and because the task is presumably performing work for a user, the Exec is at least in part "user-side" to the extent necessary to read upon the broad claim language. Furthermore, as Parkin states that the Exec is present in memory of the processor along with the task, it had to become present within the memory in some manner such as by being compiled with the tasks.

Also, the examiner argues (Answer, page 8),

> as quoted, supra., a portion of the Exec is stored in the memory of the processor. Therefore, another portion of the Exec is not stored within the memory

> of the processor. Accordingly, the portion stored in the memory of the processor is the "user-side" and the portion stored outside the memory of the processor is the "multithreading scheduling means." Therefore, there are dual schedulers to the extent required by the claim language.

In other words, the examiner has arbitrarily divided Parkin's Executive program into two parts to meet the limitations of both user-side scheduling and also multithreading scheduling.

There is no indication in Parkin that the Executive program has two independent parts, one of which schedules execution of executable processes, and a second of which comprises an executable computer program for scheduling execution of other processes and for searching request queues stored in the common memory to coordinate work requested by executing processes with non-executing processes. Parkin's statement that the Executive program is "stored at least partially in the memory of each [processor]" is insufficient to conclude that a second portion not stored in the memory of the individual processor functions separately from the first portion.

Appellants further assert (Brief, page 13) that there is "no teaching in the Parkin invention that dual scheduler

access to the list is available." The examiner's response is merely that the two schedulers are part of the Executive program, which in turn accesses the task list. Therefore, the two schedulers, as parts of the Executive program, access the task list. The first problem with such reasoning is that, as explained above, the Executive program does not satisfy the limitation of two scheduling means. Therefore, the Executive program's access to the task list is insufficient to establish dual scheduler access. Second, even if we were to consider the Executive program as having two portions, the examiner has not established that both portions of the program access the task list. From Parkin (column 2, lines 23-28), it appears that only the portion of the Executive program which is stored in the memory of the processor (the portion described by the examiner as being the user-side scheduling means) accesses the task list. Therefore, Parkin fails to disclose dual scheduler access to the task list.

In summary, Parkin does not teach a multithreaded system, both multithreading scheduling means and also user-side scheduling means, nor dual scheduler access to the task list. As "[i]t is axiomatic that anticipation of a claim under §102

can be found only if the prior art reference discloses every element of the claim," In re King, 801 F.2d 1324, 1326, 231 USPQ 136, 138 (Fed. Cir. 1986); Lindemann Maschinenfabrik v. American Hoist and Derrick, 730 F.2d 1452, 1458, 221 USPQ 481, 485 (Fed. Cir. 1984), and Parkin does not disclose every element of claim 20, Parkin does not anticipate claim 20 nor its dependents, claims 21 and 23. Further, since claim 29 includes the same limitations which have been found to be lacking from Parkin as claim 20, Parkin does not anticipate claim 29. With respect to claims 22 and 30, although the rejection was made under 35 U.S.C. § 103, since no additional reference or motivation for modification was applied which might overcome the deficiencies described above, Parkin does not render obvious claims 22 and 30. Therefore, we will reverse both the anticipation rejections and the obviousness rejections.

CONCLUSION

The decision of the examiner rejecting claims 20, 21, 23, and 29 under 35 U.S.C. § 102 and claims 22 and 30 under 35 U.S.C. § 103 is reversed.

REVERSED

JAMES D. THOMAS Administrative Patent Judge	)	
JOSEPH L. DIXON Administrative Patent Judge	)	BOARD OF PATENT APPEALS AND INTERFERENCES
ANITA PELLMAN GROSS Administrative Patent Judge	)	

Appeal No. 1997-0760
Application No. 08/003,000

TIMOYHY E. BIANCHI
SCHWEGMAN, LUNDBERG & WOESSNER, P.A.
P.O. BOX 2938
MINNEAPOLIS, MN 55402