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FREEDOM TO OPERATE SEARCH

Title: Method and apparatus for breakpoint analysis of computer programming code using unexpected code path conditions Submitted to:

Address:

Email:

Client Reference No:

Patent Number: [US7353427](#)

Priority Date: 8 Apr 2004 Date:

Claims:

1. A method for analyzing a computer program, comprising the steps of: defining a plurality of breakpoints for said computer program, at least one of said breakpoints including a respective expected code path condition; executing said computer program;

with respect to each breakpoint including a respective expected code path condition encountered during execution of said computer program, automatically determining whether an actual code path taken during execution of said computer program matches the respective expected code path condition of the encountered breakpoint; and

automatically halting execution of said program if said actual code path taken during execution of said computer program does not match the expected code path condition regardless of the condition of any key variable specified as a condition of the conditional breakpoint.

Feature to Search

E1.A method for analyzing a computer program, comprising a plurality of breakpoints for said computer program, at least one of said breakpoints including a respective expected code path condition,

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E2. Executing said computer program; with respect to each breakpoint including a respective expected code path condition encountered during execution of said computer program, automatically determining whether an actual code path taken during execution of said computer program matches the respective expected code path condition of the encountered breakpoint;

E3. Automatically halting execution of said program if said actual code path taken during execution of said computer program does not match the expected code path condition regardless of the condition of any key variable specified as a condition of the conditional breakpoint.

Search Strategy

Database: AcclaimIP, USPTO, Patentscope, Espacenet, Google Patents, Inpass.

Keywords:

Set 1	breakpoint
Set 2	Computer program, coding, application program
Set 3	Halt, stop,
Set 4	Match, emulate

US CLASSIFICATIONS

717/124 Testing or debugging

717/129 Using breakpoint

713/2 Loading initialization program (e.g., booting, rebooting, warm booting, remote booting, BIOS, initial program load (IPL), bootstrapping)

INTERNATIONAL CLASSIFICATIONS

G06F11/36 Preventing errors by testing or debugging of software

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G06F9/46 Multiprogramming arrangement

G06F9/44 Arrangements for executing specific programmes

Search Results Reference 1:

Patent/Publication Number [US6434741](#)

Title: Method and apparatus for debugging of optimized code using emulation

Assignee/Applicant: Hewlett-Packard Company

Filing Date: 30 Apr 1998

Priority Date: 30 Apr 1998

Also Published as: NONE

Relevant Excerpt E1

IN CLAIMS:

1. A method for debugging a machine code of a program that has been subjected to an optimizing action, wherein the machine code may have been reordered, duplicated, eliminated or transformed so as not to correspond with the program's source code order, said method comprising the steps of:

- a) deriving a table which associates each machine code instruction with a source construct for which it was generated;
- b) **setting one or more breakpoints in said source code;**
- c) **determining at least one corresponding location for a breakpoint in said machine code through use of said table;**

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Relevant Excerpt E2	<u>IN CLAIMS:</u>
	1.d) executing, by emulation, only machine code instructions which correspond to source constructs that precede said breakpoint in said source code order to provide for a user, execution of a sequence of said machine code instructions in accordance with a sequence of corresponding source constructs;
Relevant Excerpt E3	<u>IN CLAIMS:</u> 1.e) Emulating the machine code instructions in the order in which instructions appear in the machine code; and f) Comparing results of steps d) and e) and if a difference is detected in an effect produced by any emulated instruction, indicating a bug or an optimizer error.

Reference 2:

Patent/Publication Number [US6681384](#)

Title: Multi-threaded break-point

Assignee/Applicant: International Business Machines Corporation

Filing Date: 23 Dec 1999

Priority Date: 23 Dec 1999

Also Published as: None

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Relevant Excerpt E1	<u>IN CLAIMS:</u> 22. (a) determining that a pre-determined number of the plurality of threads have reached the synchronization breakpoint, (b) determining that a predetermined amount of time has
	elapsed since said first thread reached the synchronization break-point, and (c) determining that a user-specified thread has reached the synchronization break-point ; and; and responsive to determining that a break condition has been satisfied, halting execution of all threads of said multi-thread program.
Relevant Excerpt E2	<u>IN CLAIMS:</u> 11. a debug controller, resident in the memory and executing on the processor, wherein the debug controller is configured to execute a portion of the multi-threaded program for debugging, wherein the debug controller, when read and executed by the processor, comprises steps of: executing the multi-thread program, wherein the multi-thread program comprises a plurality of threads, halting execution of a first thread at a synchronization breakpoint, while the first thread is halted, continuing execution of other of the plurality of threads that have not yet reached the synchronization break-point;

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Relevant Excerpt E3	<u>IN CLAIMS:</u> 22. halting execution of a first thread at a synchronization break-point, while the first thread is halted, continuing execution of other of the plurality of threads that have not yet reached the
	synchronization break-point; thereafter determining that a synchronization break condition has been satisfied, while said first thread remains halted, wherein said synchronization break condition includes at least one condition from the set consisting of: (a) determining that a pre-determined number of the plurality of threads have reached the synchronization break-point, (b) determining that a predetermined amount of time has elapsed since said first thread reached the synchronization break-point, and (c) determining that a user-specified thread has reached the synchronization break-point; and; and responsive to determining that a break condition has been satisfied, halting execution of all threads of said multi-thread program.

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Reference 3:

Patent/Publication Number [US7827540](#)

Title: Method for program debugging

Assignee/Applicant: Micro-Star Int'l Co., Ltd.

Filing Date: 11 Feb 2004

Priority Date: 13 Feb 2003

Also Published as: US20040194067, TW588238, TW200415461, US7827540

Relevant Excerpt E1

IN CLAIMS:

1. A method for program debugging, the method comprising:

setting a plurality of breakpoints corresponding to a plurality of events in a Basic Input/Output System (BIOS) program code, each event being a test executed by the BIOS program code to a peripheral device and taking a general processing path when the peripheral device is working well or an error processing path when the peripheral device is in an error state;

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Relevant Excerpt E2	<p><u>IN CLAIMS:</u></p> <p>7. A method for program debugging, the method comprising:</p> <p>setting a plurality of breakpoints corresponding to a plurality of events in a driver program code, each event being a test executed by the driver program code to a peripheral device and taking a general processing path when the peripheral device is working well or an error processing path when the peripheral device is in an error state; setting a parameter by a branch command of a script file via an emulator to simulate that the peripheral device is working well throughout execution of the driver program code; executing the driver program code according to the parameter for outputting a diagnosis code corresponding to each breakpoint of the plurality of breakpoints; for said each breakpoint, determining whether the diagnosis code matches a user defined diagnosis code; and resetting the parameter by the branch command of the script file via the emulator to simulate that the peripheral device is in the error state and executing the event corresponding to the</p>
	<p>diagnosis code according to the reset parameter for making the event undergo the error processing path when it is determined that the diagnosis code matches the user defined diagnosis code;</p>

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Relevant Excerpt E3	<u>IN CLAIMS:</u> 7. wherein the breakpoints are software interrupt, using a trap to stop the execution of the emulator ; wherein the breakpoint can be set ahead or after program codes of the corresponding event; if the breakpoints are set ahead of the corresponding events, the parameters are reset after the breakpoints; if the breakpoints are set after the corresponding events, the script file should spontaneously jump ahead of the branch command of the event and reset the parameter of the event.
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