(19) World Intellectual Property **Organization**

International Bureau





(43) International Publication Date 20 January 2005 (20.01.2005)

PCT

(10) International Publication Number WO 2005/006120 A3

(51) International Patent Classification⁷: 9/44, 11/00

G06F 9/45.

(21) International Application Number:

PCT/US2004/015965

21 May 2004 (21.05.2004) (22) International Filing Date:

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data: 10/609,275

26 June 2003 (26.06.2003) US

- (71) Applicant (for all designated States except US): MI-CROSOFT CORPORATION [US/US]; One Microsoft Way, Building 8, Redmond, WA 98052-6399 (US).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): GROVER, Vinod, K. [IN/US]; 4420 92nd Ave. SE, #1, Mercer Island, WA 98040 (US). SASTRY, Akella, V., S. [IN/US]; 3620 146th Place, NE - #D12, Bellevue, WA 98007 (US).
- (74) Agent: MAURER, Gregory, L.; Klarquist Sparkman, LLP, One World Trade Center, Suite 1600, 121 SW Salmon Street, Portland, OR 97204 (US).

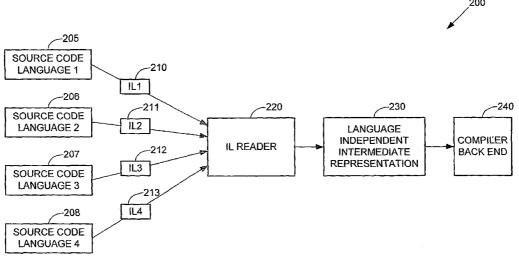
- (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO. CR. CU. CZ. DE. DK. DM. DZ. EC. EE. EG. ES. FI. GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM,
- (84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

- with international search report
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

[Continued on next page]

(54) Title: AN INTERMEDIATE REPRESENTATION FOR MULTIPLE EXCEPTION HANDLING MODELS



(57) Abstract: As described herein, an intermediate representation of a source code file may be used to explicitly express exception handling control flow prior to generating object code for the source code. As further described herein, a single uniform set of instructions of the intermediate representation may be used for expressing multiple different exception handling mechanisms related to multiple different programming languages. The intermediate form of the exception (10) handling instructions may be generated by translating an intermediate language representation of the source code file. Representations of the source code in multiple different intermediate languages may be translated to a single uniform set of instructions of the intermediate representation. The intermediate form of the exception handling instructions may then be used by software development tools for such tasks as code generation, code optimization, code analysis etc. Thus, the same methods for code optimizations, analysis and generation may be used for intermediate representations of multiple different languages.

WO 2005/006120 A3



(88) Date of publication of the international search report: 3 November 2005

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US04/15965

A. CLASSIFICATION OF SUBJECT MATTER IPC(7) : G06F 9/45, 9/44, 11/00 US CL : 717/114, 146; 714/48				
According to International Patent Classification (IPC) or to both national classification and IPC				
B. FIELDS SEARCHED				
Minimum documentation searched (classification system followed by classification symbols) U.S.: 717/114, 116, 118, 146, 148; 714/48				
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched				
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EAST, ACM, Software Patent Institute, Google				
C. DOCUMENTS CONSIDERED TO BE RELEVANT				
Category *	Citation of document, with indication, where appropriate, of the relevant passages			Relevant to claim No.
A	US 5628016 (KUKOL) 06 May 1997 (06.05.1997), whole document			1-53
Y	US 5966702 A (FRESKO et al.) 12 October 1999 (12.11.1999), column 42 lines 10-39			8,11,12,23,24,27,28,38 ,48,49
A	US 6149318 A (CHASE et al.) 21 November 2000 (21.11.2000), Whole document			1-53
A	US 6247169 B1 (DELONG) 12 June 2001 (12.06.2001), Whole document			1-53
Y	US 6289446 B1 (NILSSON) 11 September 2001 (11.09.2001), column 17 line 63 - column 18 line 13			43
A	US 6412109 B1 (GHOSH) 25 June 2002 (25.06.2002), Whole document			1-53
Y	US 6421667 B1 (CODD et al.) 16 July 2002 (16.07.2002), column 18 lines 39-41			2-8, 17-24, 32-47
A	US 2004/0049769 A1 (LUEH et al.) 11 March 2004 (11.03.2004), Whole document			1-53
Y	US 5918235 A (KIRSHENBAUM et al.) 29 June 1999 (29.06.1999), column 7 lines 50-64			3,4,19,20,41,42
				,
Further	documents are listed in the continuation of Box C.		See patent family annex.	
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of		"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention		
particular relevance "E" earlier application or patent published on or after the international filing date		"X"	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone	
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)		«Yn		
"O" document	document referring to an oral disclosure, use, exhibition or other means		to a person skilled in the art	and complianted completely
priority date claimed		" <u>&</u> "	"&" document member of the same patent family	
Date of the actual completion of the international search		Date of mailing of the international search report 1 SFP 2008		
10 July 2005 (10.07.2005) Name and mailing address of the ISA/US		Authorize		
Mail Stop PCT, Attn: ISA/US		Tuen O	Dam	
Commissioner of Patents P.O. Box 1450		Tuan Q. Dam		
Alexandria, Virginia 22313-1450 Tele Facsimile No. (703) 305-3230			ie No. (571) 272-2100	
Facsimile No. (703) 303-3230 Form PCT/ISA/210 (second sheet) (July 1998)				

PCT/US04/15965

INTERNATIONAL SEARCH REPORT

C. (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT Relevant to claim No. Category * Citation of document, with indication, where appropriate, of the relevant passages Y Norman Ramsey, Simon Peyton Jones, "A single intermediate language that supports 47 multiple implementations of exceptions", May 2000, ACM SIGPLAN Notices, PLDI 2000, Volume 35 Issue 5, ISBN:1-58113-199-2, Pages: 285 - 298 Jong-Deok Choi, David Grove, Michael Hind, Vivek Sarkar, "Efficient and precise modeling 1-53 A of exceptions for the analysis of Java programs", September 1999, ACM SIGSOFT Software Engineering Notes, PASTE '99, Volume 24 Issue 5, ISSN:0163-5948, Pages: 21 - 31 John Hennessy, "Program optimization and exception handling", January 1981, Proceedings 1-53 A of the 8th ACM SIGPLAN-SIGACT symposium on Principles of programming languages, ISBN:0-89791-029-X, Pages: 200 - 206 A Jongwook Woo et al., "Alias analysis for exceptions in Java", January 2002, Australian 1-53 Computer Science Communications, ACSC2002, Volume 24 Issue 1, ISBN ~ ISSN:1445-1336, 0-909925-82-8, Pages: 321 - 329 Martin P. Robillard, Gail C. Murphy, "Analyzing exception flow in Java programs", October 1-53 Α 1999, ACM SIGSOFT Software Engineering Notes, ESEC/FSE-7, Volume 24 Issue 6, ISBN:3-540-66538-2, Pages: 322 - 337 James Gosling, "Java intermediate bytecodes", March 1995, ACM SIGPLAN Notices, IR '95, 1-53 Α Volume 30 Issue 3, ISSN:0362-1340, Pages: 111 - 118 Kenneth Litwak, "PURE JavaTM 2", December 1999, Sams Publishing, ISBN: 0-672-31654-2-12,17-28,32-49 Y 4, Chapter 10 Kienle, "A SUIF Java Compiler", August 1998, University of California Santa Barbara, A 1-53 Technical Report TRCS98-18, Section 5.9, 6.9, 8.3, and 9.2.15 Aho, Sethi, and Ullman, "Compilers: Principles, Techniques, and Tools", 1986, Addison-2-12,17-28,32-49 Y Wesley, ISBN 0-201-10088-6, pages 467, 468, 491, 506, 592 Y FITZGERALD et al., "Marmot: An Optimizing Compiler for Java" Technical Report MSR-2-8,17-24,32-43 TR-99-33, June 16 1999, page 3 Y "C/C++ Language Reference: try-except Statement", May 11 2000, Microsoft Corp., acessed 13,14,29-31,50-52 7/10 at , Whole document