Kiyokuni (Kiyo) KAWACHIYA, Ph.D.

Manager of Deep Computing & Analytics

Research Staff Member, IBM Research - Tokyo

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(See http://ibm.biz/kawatiya for more detailed information.)

EDUCATION

Ph.D. in Media and Governance, Keio University, Japan, 2005

By "Java Locks: Analysis and Acceleration" (PDF at http://ibm.biz/kawatiya-phd)

M.S. in Information Science, University of Tokyo, Japan, 1987

By "Transparent Object Management in the GALAXY Holonic Processing System"

B.S. in Information Science, University of Tokyo, Japan, 1985

PROFESSIONAL EXPERIENCE

Career History

1987/04–present Researcher at IBM Research - Tokyo, Japan

Since joining IBM Research - Tokyo in 1987, he has been working on operating systems, multimedia systems, and programming languages such as Java and X10. From 2014, he is managing a group named "Deep Computing & Analytics" and leading the research in High Performance Computing.

2007/10–2007/12 Assignment to IBM T. J. Watson Research Center, U.S.A.

He has been assigned to IBM T. J. Watson Research Center as a visiting staff of Research HQ.

Most Significant Achievements

His largest accomplishment is the improvement of Java runtime environments, some of which are included in IBM's production Java Virtual Machines (JVMs). He led the development of a JIT compiler for IBM Linux JVM, which was widely downloaded as the fastest JVM for Linux. Another important achievement is the improvement of Java synchronization [OOPSLA'99, OOPSLA'02, ECOOP'04], where he developed several new lock algorithms for Java, including a new concept of "lock reservation" to do most Java locks without atomic operations. He also developed "Cloneable JVM" [VEE'07] to reduce the startup times, "JVM on Hypervisors" [VEE'07b] for more flexible resource management, and "String waste reductions" [OOPSLA'08, VEE'14] for better memory utilization [OOPSLA'10].

Recently, he is working for a parallel distributed programming language X10. He is mainly working for an X10 implementation running on multiple JVMs, named

"Managed X10" [X10'11]. He developed a distributed GC for Managed X10 [X10'12], which is one of the key functions to make the language usable for products. He is also working for a fault-tolerant extension named "Resilient X10" [PPoPP'14, X10'14].

He also worked for operating systems research. He first participated in the development of multiprocessor OS [IPSJ'95], then worked for a multimedia OS based on Real-Time Mach. He developed a framework to control QoS of continuous media processing [NOSSDAV'93, NOSSDAV'96, ICMCS'96]. He also proposed several mechanisms for VOD systems [INFOCOM'96, INTERWORKING'96/96b] and a one finger input device to control multimedia easily on mobile devices [CHI'98].

MEMBERSHIP IN PROFESSIONAL ORGANIZATION

Membership

Senior Member of Association for Computing Machinery (ACM)

Senior Member of Information Processing Society of Japan (IPSJ)

Member of Japan Society for Software Science and Technology (JSSST)

Awards

2008 JSSST Takahashi Award

2005 IPSJ Best Paper Award

1994 IPSJ Convention Award

Professional Activities

2015 PC Member of JSSST PPL2015 Workshop

2014 PC Member of WANC2014 Workshop in CANDAR2014 Symposium

2014 External Reviewer of a Ph.D. Dissertation in University of Tokyo

2014– Editorial Committee Member of IPSJ Transactions on Programming

2014– Organizing Member of IPSJ SIG Programming

2014– Vice Chief Editor of JSSST "Computer Software"

2014– Steering Committee Member of JSSST SIG Prog. and Prog. Languages (PPL)

2014 External Reviewer of EuroPar2014 Conference

2014 External Reviewer of IEEE/ACM CGO2014 Symposium

2013 PC Member of ACM OOPSLA2013 Conference

2013 PC Member of ACM VEE2013 Conference

2012 PC Member of VMIL2012 Workshop in ACM SPLASH2012 Conference

2012– Editorial Committee Member of JSSST "Computer Software"

2011 PC Member of OOPS2011 Track in ACM SAC2011 Symposium

2011 PC Co-chair of JSSST PPL2011 Workshop

2011 External Reviewer of AOSD2011 Conference

2011 External Reviewer of ACM PPoPP2011 Symposium

2010 PC Member of JSSST PPL2010 Workshop

2007–2011 Board Member of JSSST

2007–2011 Editorial Committee Member of IPSJ Transactions on Programming

PUBLICATIONS (selected)

(See http://ibm.biz/kawatiya-pub for the complete list.)

- [X10'15] **Optimization of X10 Programs with ROSE Compiler Infrastructure,** By Michihiro Horie, Mikio Takeuchi, Kiyokuni Kawachiya, and David Grove. In *Proceedings of the 2015 ACM SIGPLAN X10 Workshop*, pp. 19–24, 2015.
- [X10'14] **Writing Fault-Tolerant Applications Using Resilient X10,** By Kiyokuni Kawachiya. In *Proceedings of the 2014 X10 Workshop*, 8 pages, 2014.
- [X10'14b] **Porting MPI based HPC Applications to X10,** By Hiroki Murata, Michihiro Horie, Koichi Shirahata, Jun Doi, Hideki Tai, Mikio Takeuchi, and Kiyokuni Kawachiya. In *Proceedings of the 2014 X10 Workshop*, 7 pages, 2014.
- [VEE'14] **String Deduplication for Java-based Middleware in Virtualized Environments,** By Michihiro Horie, Kazunori Ogata, Kiyokuni Kawachiya, and Tamiya Onodera. In *Proceedings of the 2014 ACM SIGPLAN/SIGOPS International Conference on Virtual Execution Environments*, pp. 177–188, 2014.
- [PPoPP'14] **Resilient X10: Efficient Failure-Aware Programming,** By David Cunningham, David Grove, Benjamin Herta, Arun Iyengar, Kiyokuni Kawachiya, Hiroki Murata, Vijay Saraswat, Mikio Takeuchi, and Olivier Tardieu. In *Proceedings of the 19th ACM SIGPLAN Symposium on Principles and Practice of Parallel Programming*, pp. 67–80, 2014.
- [X10'12] **Distributed Garbage Collection for Managed X10,** By Kiyokuni Kawachiya, Mikio Takeuchi, Salikh Zakirov, and Tamiya Onodera. In *Proceedings of the 2012 ACM SIGPLAN X10 Workshop*, 11 pages, 2012.
- [X10'12b] **Fast Method Dispatch and Effective Use of Primitives for Reified Generics in Managed X10,** By Mikio Takeuchi, Salikh Zakirov, Kiyokuni Kawachiya, and Tamiya Onodera. In *Proceedings of the 2012 ACM SIGPLAN X10 Workshop*, 7 pages, 2012.
- [X10'11] **Compiling X10 to Java,** By Mikio Takeuchi, Yuki Makino, Kiyokuni Kawachiya, Hiroshi Horii, Toyotaro Suzumura, Toshio Suganuma, and Tamiya Onodera. In *Proceedings of the 2011 ACM SIGPLAN X10 Workshop*, 10 pages, 2011.
- [OOPSLA'10] **A Study of Java's non-Java Memory,** By Kazunori Ogata, Dai Mikurube, Kiyokuni Kawachiya, Scott Trent, and Tamiya Onodera. In *Proceedings of the*

25th Annual ACM Conference on Object-Oriented Programming, Systems, Languages, and Applications, pp. 191–204, 2010.

- [VEE'10] **Efficient Runtime Tracking of Allocation Sites in Java,** By Rei Odaira, Kazunori Ogata, Kiyokuni Kawachiya, Tamiya Onodera, and Toshio Nakatani. In *Proceedings of the 2010 ACM SIGPLAN/SIGOPS International Conference on Virtual Execution Environments*, pp. 109–120, 2010.
- [IPSJ'09] **Java Virtual Machine's Memory Usage with Dynamic Scripting Languages,** By Dai Mikurube, Kazunori Ogata, Kiyokuni Kawachiya, and Tamiya Onodera. In *IPSJ Transactions on Programming*, Vol. 2, No. 5, pp. 28–42, 2009.
- [OOPSLA'08] **Analysis and Reduction of Memory Inefficiencies in Java Strings,** By Kiyokuni Kawachiya, Kazunori Ogata, and Tamiya Onodera. In *Proceedings of the 23rd Annual ACM Conference on Object-Oriented Programming, Systems, Languages, and Applications*, pp. 385–401, 2008.
- [VEE'07] **Cloneable JVM: A New Approach to Start Isolated Java Applications Faster,** By Kiyokuni Kawachiya, Kazunori Ogata, Daniel Silva, Tamiya Onodera, Hideaki Komatsu, and Toshio Nakatani. In *Proceedings of the 3rd International ACM SIGPLAN/SIGOPS Conference on Virtual Execution Environments*, pp. 1–11, 2007.
- [VEE'07b] **Libra: A Library Operating System for a JVM in a Virtualized Execution Environment,** By Glenn Ammons, Jonathan Appavoo, Maria Butrico, Dilma Da Silva, David Grove, Kiyokuni Kawachiya, Orran Krieger, Bryan Rosenburg, Eric Van Hensbergen, and Robert W. Wisniewski. In *Proceedings of the 3rd International ACM SIGPLAN/SIGOPS Conference on Virtual Execution Environments*, pp. 44–54, 2007.
- [OOPSLA'06] **Replay Compilation: Improving Debuggability of a Just-in-Time Compiler,** By Kazunori Ogata, Tamiya Onodera, Kiyokuni Kawachiya, Hideaki Komatsu, and Toshio Nakatani. In *Proceedings of the 21st Annual ACM Conference on Object-Oriented Programming, Systems, Languages, and Applications*, pp. 241–251, 2006.
- [IPSJ'05] **Problem Determination for a Java JIT Compiler Using Replay Compilation,** By Kazunori Ogata, Tamiya Onodera, Kiyokuni Kawachiya, Hideaki Komatsu, and Toshio Nakatani. In *IPSJ Transactions on Programming*, Vol. 46, No. SIG 14, pp. 1–11, 2005.
- [IBMJ'04] **Evolution of a Java Just-In-Time Compiler on IA-32 Platforms,** By Toshio Suganuma, Takeshi Ogasawara, Kiyokuni Kawachiya, Mikio Takeuchi, Kazuaki Ishizaki, Akira Koseki, Tatsushi Inagaki, Toshiaki Yasue, Motohiro Kawahito,

Tamiya Onodera, Hideaki Komatsu, and Toshio Nakatani. In *IBM Journal of Research and Development*, Vol. 48, No. 5/6, pp. 767–795, 2004.

- [IPSJ'04] **Asymmetric Spin Lock and its Application to Java,** By Kiyokuni Kawachiya, Akira Koseki, and Tamiya Onodera. In *IPSJ Transactions on Programming*, Vol. 45, No. SIG 5, pp. 62–76, 2004.
- [ECOOP'04] **Lock Reservation for Java Reconsidered,** By Tamiya Onodera, Kiyokuni Kawachiya, and Akira Koseki. In *Lecture Notes in Computer Science, LNCS 3086*, Springer-Verlag GmbH, pp. 559–583, 2004.
- [IPSJ'03] **Accelerating Java Locks by Utilizing Their Thread Locality,** By Kiyokuni Kawachiya, Akira Koseki, and Tamiya Onodera. In *IPSJ Transactions on Programming*, Vol. 44, No. SIG 15, pp. 13–23, 2003.
  * Received IPSJ Best Paper Award in 2005.
- [OOPSLA'03] **Effectiveness of Cross-Platform Optimizations for a Java Just-In-Time Compiler,** By Kazuaki Ishizaki, Mikio Takeuchi, Kiyokuni Kawachiya, Toshio Suganuma, Osamu Gohda, Tatsushi Inagaki, Akira Koseki, Kazunori Ogata, Motohiro Kawahito, Toshiaki Yasue, Takeshi Ogasawara, Tamiya Onodera, Hideaki Komatsu, and Toshio Nakatani. In *Proceedings of the 18th Annual ACM Conference on Object-Oriented Programming, Systems, Languages, and Applications*, pp. 187–204, 2003.
- [OOPSLA'02] **Lock Reservation: Java Locks Can Mostly Do Without Atomic Operations,** By Kiyokuni Kawachiya, Akira Koseki, and Tamiya Onodera. In *Proceedings of the 17th Annual ACM Conference on Object-Oriented Programming, Systems, Languages, and Applications*, pp. 130–141, 2002.
- [IPSJ'00] **Tuplink: A Meta-middleware System for Micro-clients,** By Yasushi Negishi, Kiyokuni Kawachiya, Hiroki Murata, and Kazuya Tago. In *Journal of IPSJ*, Vol. 41, No. 10, pp. 2881–2894, 2000.
- [OOPSLA'99] **A Study of Locking Objects with Bimodal Fields,** By Tamiya Onodera and Kiyokuni Kawachiya. In *Proceedings of the 14th Annual ACM Conference on Object-Oriented Programming, Systems, Languages, and Applications*, pp. 223–237, 1999.
- [CHI'98] **NaviPoint: An Input Device for Mobile Information Browsing,** By Kiyokuni Kawachiya and Hiroshi Ishikawa. In *Proceedings of the ACM SIGCHI Conference on Human Factors in Computing Systems*, pp. 1–8, 1998.
- [IEICE'97] **A Framework for Dynamic QoS Control of Multimedia Processing,** By Kiyokuni Kawachiya. In *Transactions of IEICE*, Vol. J80-B-I, No. 6, pp. 465–471, 1997.

- [INTERWORKING'96] **VideoProxy: A Media and Protocol Converter for Internet Video,** By Kiyokuni Kawachiya, Nagatsugu Yamanouchi, and Takayuki Kushida. In *Proceedings of the INTERWORKING '96: Global Information Infrastructure Evolution: Interworking Issues*, IOS Press, pp. 541–550, 1996.
- [INTERWORKING'96b] **An Experimental Dynamic QoS Control System over Internet,** By Nagatsugu Yamanouchi, Kiyokuni Kawachiya, and Takayuki Kushida. In *Proceedings of the INTERWORKING '96: Global Information Infrastructure Evolution: Interworking Issues*, IOS Press, pp. 368–377, 1996.
- [ICMCS'96] **Dynamic QOS Control Based on the QOS-Ticket Model,** By Kiyokuni Kawachiya and Hideyuki Tokuda. In *Proceedings of the 3rd IEEE International Conference on Multimedia Computing and Systems*, pp. 78–85, 1996.
- [NOSSDAV'96] **Q-Thread: A New Execution Model for Dynamic QOS Control of Continuous-Media Processing,** By Kiyokuni Kawachiya and Hideyuki Tokuda. In *Proceedings of the 6th International Workshop on Network and Operating System Support for Digital Audio and Video*, pp. 149–156, 1996.
- [INFOCOM'96] **A Portable Communication System for Video-on-Demand Applications using the Existing Infrastructure,** By Yasushi Negishi, Kiyokuni Kawachiya, and Kazuya Tago. In *Proceedings of IEEE INFOCOM '96 – The Conference on Computer Communications*, Vol. 1, pp. 18–26, 1996.
- [MMJ'96] **QOS-Ticket: A New Resource-Management Mechanism for Dynamic QOS Control of Multimedia,** By Kiyokuni Kawachiya and Hideyuki Tokuda. In *Proceedings of the Multimedia Japan '96*, pp. 14–21, 1996.
- [IPSJ'95] **Operating Systems on the TOP-1 Multiprocessor,** By Kiyokuni Kawachiya. In *Journal of IPSJ*, Vol. 36, No. 8, pp. 734–738, 1995.
- [NOSSDAV'95] **Evaluation of QOS-Control Servers on Real-Time Mach,** By Kiyokuni Kawachiya, Masanobu Ogata, Nobuhiko Nishio, and Hideyuki Tokuda. In *Lecture Notes in Computer Science, LNCS 1018*, Springer-Verlag GmbH, pp. 117–120, 1995.
- [NOSSDAV'93] **Extending Real-Time Mach for Continuous Media Applications,** By Kiyokuni Kawachiya, Hidehiko Wada, Shigeto Mochida, Masanobu Ogata, and Hideyuki Tokuda. In *Collected Abstracts from the 4th International Workshop on Network and Operating Systems Support for Digital Audio and Video*, pp. 55–58, 1993.
- [IFIP'86] **Multimedia Information Processing Based on a General Media Model,** By Masataka Ohta, Mamoru Maekawa, Takashi Arano, Kiyokuni Kawachiya, and Yoshikazu Noguchi. In *Information Processing 86: Proceedings of the IFIP 10th World Computer Congress*, Science Publishers B. V., pp. 957–962, 1986.

LECTURES (selected)

- **Resilient Distributed Programming Language X10,** By Kiyokuni Kawachiya. Departmental Colloquium CCE 2015 No. 3, Department of Communications and Computer Engineering, Graduate School of Informatics, Kyoto University, 2015.
- **Implementation Techniques of Programming Languages: Object Management and Garbage Collection,** By Kiyokuni Kawachiya. Lecture at Tokyo Institute of Technology as a part of Special Lecture on Computer Science III, 2014.
- **Parallel Distributed Programming Language "X10", and its Implementation on Java,** By Kiyokuni Kawachiya. Seminar at Aoyama Gakuin University, 2014.
- **Parallel Distributed Programming Language X10,** By Kiyokuni Kawachiya. Special Lecture on Frontier Informatics II, No. 3, School of Engineering, University of Tokyo, 2011.
- **Programming Language X10,** By Kiyokuni Kawachiya. In PPL Summer School 2010 "New Languages in the Multicore Era" by JSSST SIG Programming and Programming Languages, 2010.

PATENTS

Granted

- US Patent 9,003,146. Managing memory of a computer
- US Patent 8,938,728. Dynamic compiler program, dynamic compiling method and dynamic compiling device
- US Patent 8,930,677. Computer operation control method, program, and system
- US Patent 8,838,874. Method, program, and system for processing object in computer
- US Patent 8,782,623. Profiler for executing computer program
- US Patent 8,566,802. Method of ascertaining primary cause of memory consumption in program, and computer system and computer program for the same
- US Patent 8,495,647. Method and program for recording object allocation site
- US Patent 8,495,041. Data structure, computer system, method and computer program for searching database
- US Patent 8,473,969. Method and System for Speeding Up Mutual Exclusion
- US Patent 8,411,091. Image drawing system, image drawing server, image drawing method, and computer program
- US Patent 8,275,812. Method to reduce wasted character data areas of java strings
- US Patent 8,230,045. System, method, and computer program for determining whether object is genuine or fake in metaverse

- US Patent 8,201,178. Preventing delay in execution time of instruction executed by exclusively using external resource
- US Patent 8,176,100. System for storing and managing objects
- US Patent 7,793,023. Exclusion control
- US Patent 7,703,095. Information processing and control
- US Patent 7,685,565. Run time reconfiguration of computer instructions
- US Patent 7,543,295. Method for enhancing efficiency in mutual exclusion
- US Patent 7,337,298. Efficient class memory management
- US Patent 7,219,334. Program conversion method, data processing apparatus and program
- US Patent 6,971,102. Computer system, memory management method, storage medium and program transmission apparatus
- US Patent 6,883,026. Method and apparatus for managing locks of objects and method and apparatus for unlocking objects
- US Patent 6,208,328. Manipulative pointing device, and portable information processing apparatus
- US Patent 5,550,560. Image displaying apparatus
- US Patent 5,528,761. Message passing apparatus for determining if counted acknowledgements from a set of processors are within a defined range

Applying

- US Patent App. 13/752,435. Method, program and system for generating hash codes to identify objects
- US Patent App. 13/658,884. Method, program, and system for specification verification
- US Patent App. 13/568,646. Garbage collection of an object
- US Patent App. 13/532,842. Network computing over multiple resource centers
- US Patent App. 13/221,171. Method and system for code generation and inlining
- US Patent App. 12/881,667. Compiler program, compilation method, and computer system
- US Patent App. 12/787,500. Method for Optimizing Processing of Character String During Execution of a Program, Computer System and Computer Program for the Same
- US Patent App. 11/054,899. Method and system for efficiently starting a JAVA application
- US Patent App. 10/376,090. Data processing method, and memory area search system and program