Richard Cardone, Ph.D.

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Core Competencies: Distributed System Design, Java, XML, PostgreSQL, REST

Hands-On Technology Experience

- **17 years Java development**
  - Linux; Windows; Eclipse PDE, JDT; Postgres; MongoDB; Apache ActiveMQ, Karaf, CXF, Tomcat, Xerces, Xmlbeans; Dropwizard; Hibernate, JDBC; Quartz; J2EE servlets; JavaCC; DOM, SAX, JAXB; JAX-RS; gson; W3C Xforms; XML schema; Voice XML; Swing; SWT/JFace; Ant, Gradle Maven; Jython; JSR 223 scripting; Java Native Interface; DIMACS encoding; SAT4J; lparse/smodels.
- **8 years C/C++ development**
  - AIX, OS/2, xlc+, gcc, Eclipse CDT, Sybase, TCP/IP, NetBIOS, Motif, GSS security API, Trusted Computing Group Software Stack (Trousers), Openssl.
- **3 years APL2 development**
- **5 patents issued, 8 pending**

Education

- **Ph.D. in Computer Sciences**, 2002, University of Texas, Austin, TX.
  GPA 4.0. Dissertation: *Language and Compiler Support for Mixin Programming*.
  Support: IBM Resident Study Program, UT CS Department Fellowship.
- **M.S. in Computer Sciences**, 1990, Polytechnic University, Hawthorne, NY.
- **B.S. in Mathematics** w/Honors, 1983, State University of New York, Oneonta, NY.
  Includes: 1 year at Cornell University, College of Arts and Sciences, Ithaca, NY.
  1 year exchange student at McGill University and Université de Montréal, Montréal.

Summary of Qualifications

The goal of my software engineering research and development has been to achieve design simplicity and robust software products. I have explored different methods to improve software modularity including those that compose high quality software from reusable components. My research interests also include electronic voting systems, for which I have several patents pending and issued. As a past member of the OASIS technical committee responsible for the Election Markup Language, I helped shape international standards for voting systems.

On the development side, I work every day with Java, XML, and web technologies. In addition, I can call upon my C/C++ experience when working with different operating systems. I have designed and developed knowledge base systems, large scale workflow management systems, financial data systems, web applications, compilers, communication middleware, and end user solutions where user interface design was critical.

Role at Health Symmetric

- **(2/2014-present) Senior Software Developer, Health Symmetric, Inc., Austin, TX**
  - First senior developer hired by start-up company.
  - Redesigned/hardened electronic health record demo application for beta rollout.
  - Key member of new platform architecture and implementation team.
  - Patents: 1 filed.

Leadership Roles at Dell

- **(4/2011-2/2014) Software Developer Senior Engineer, Dell, Inc., Round Rock, TX**
  - Bronze Award for proposing joint Dell/UT Software Engineering research project.
  - Patents: 2 filed, 4 under review.

  Project: ASM Java Resource Adapter Framework
  - Member Advanced Engineering Team developing new ASM product architecture.

  Project: Orion
  - Led implementation of radically new design for next generation server mgmt.
  - Improved inventory performance from **3 hours to 100 seconds** on 200 servers.

  Project: Spectre (Dell Management Plug-In for VMware vCenter)
  - Redesigned/refactored code for use in non-VMware products.
  - Re-implemented build process, task mgmt. subsystem, software configuration.

Leadership Roles at Overwatch Systems (Textron)

- **(3/2009-4/2011) Principle Software Engineer, Overwatch Systems, Austin, TX**

  Project: Brigade Combat Team Modernization (BCTM)
  - Lead developer for Simulation Authoring application.
    - Designed and implemented an authoring environment for simulation data used by over 20 testers and developers.
    - Provided GUI support for hundreds of evolving data structures.
    - Proposed and helped implement new XML-based simulator architecture.
  - Lead developer in creating Surrogate UI application for BCTM.
    - Provided a GUI for test and demonstration years before production version.
    - Demonstrated latest Overwatch technology to Army and Boeing.
  - Continued work on OASIS Election and Voter Services Technical Committee.
    - Analyzed and validated EML 6.0 schemas.
  - Technologies learned: Swing, Swingx.

Leadership Roles at IBM

- **(2008-2/2009) Senior Software Engineer, IBM Watson Research, Hawthorne, NY**

  Project: Trusted Electronic Voting System
  - Convened a group of colleagues interested in exploring new approaches to secure, reliable, accurate and verifiable electronic voting systems.
    - Gained field experience as an election judge.
    - Joined OASIS Election and Voter Services Technical Committee as a voting member.
  - Developed intellectual property in voting systems field.
    - Lead inventor for patent, "*Method and System for Verifying Election Results,*" U.S. Patent 8,145,520.

- Co-inventor for patent, "*Method for Generating Anonymous Trusted Assertions,*" U.S. Patent 7,996,891.
- Lead inventor for patent, "*Electronic Voting Using a Trusted Computing Platform,*" Docket **#** YOR9-2007-0531.
- Lead inventor for patent, "*Paper-Free Verifiable Electronic Voting*," Docket # YOR9-2007-0507.
- Lead inventor for patent "*Method and System for Ballot Composition,*" Docket # YOR8-2008-0404 (in process).

- Began architecture, design and implementation of Trusted Electronic Voting System.
  - Based on open source software, commodity hardware, and the Trusted Computing Platform as specified by the Trusted Computing Group.
  - Began implementation of Trusted Communication Services to integrate Openssl and the Trusted Computing Platform attestation protocol.
  - Began implementation of Ballot Writer application.

- University Relations
  - Mentored UT Austin graduate student as part of multidisciplinary 392J course in project management and consulting.
  - Led a group of five undergraduate honors students in e-voting research.

- Technologies learned: Trusted Computing Group Software Stack (Trousers), Integrity Measurement Architecture for Linux, Openssl, Eclipse Rich Client Platform.

- **(2007-2009) Senior Software Engineer, IBM Watson Research, Hawthorne, NY**
  Project: IBM Expert Conversation Builder (ECB)
  - Part of ECB design team that generalized SE (see below) to increase the flexibility in developing conversational recommendation systems.

  - Designed/implemented production-level ECB web application server.
    - Developed session management and multiple conversation support.
    - Developed ECB web services API.
    - Developed JSR 223 compliant scripting subsystem for simple, modular installation of scripting languages.
    - Developed Answer Set Programming (lparse) parser.

  - Co-led ECB/Verizon Wireless engagement.
    - Delivered prototype wireless plan recommendation system.

  - Established Joint Study Agreement W0752348 with UT professor Calvin Lin for research into knowledge base analyses.

  - Primary author of IBM Technical Report RC24595, "Using Reasoning Threads in Enhanced Semantic Networks."

  - Technologies learned: JSR 223, Jython. lparse/smodels.

- **(2005-2006) Senior Software Engineer, IBM Watson Research, Hawthorne, NY**
  Project: IBM Semantic Engine (SE)
  - Led SE migration effort to Eclipse (~100K of IBM and 3rd party code)**.** SE uses semantic network knowledge bases to develop conversational recommendation systems.

  - Developed new Eclipse authoring tools.
    - Designed and coded SE authoring platform infrastructure.

- Designed/implemented new tools for integrated authoring environment, including SE editor, SE Explorer, validators and related components.
- Designed/implemented SE API.
- Improved natural language processing, formula execution, and semantic network representation.

- Contributed to pilot projects and customer engagements.
  - Led initial delivery of SE application to IBM.com sales team.
  - Key participant in HSBC pilot project.
  - Co-led IBM Canada telecommunication recommendation system.
  - Key participant in IBM Attach Connector integration project.
  - Managed deployment and test activities for customer deliveries.

- Investigated knowledge scalability problems.
  - Explored fundamental knowledge base scalability problems, including change impact analysis and KB consistency checking.
  - Applied static analysis to semantic networks, which included CNF formula conversion, DIMACS encoding, and SAT solver integration into SE.
  - Co-developed test case comparison prototype.

- Improved SE performance and serviceability.
  - Analyzed and removed SE performance bottlenecks, including a 60% improvement in KB load/save performance.
  - Implemented multi-platform, I18N-enabled, logging/tracing facility.

- Technologies learned: DIMACS, SAT4J.

- **(2004) Advisory Software Engineer, IBM Watson Research, Hawthorne, NY**
  Project: HopiXForms
  - Prototyped the use of standards-compliant XForms in a web application generator. Proposed a new project to explore future directions for IBM's MDAT product (described in next section).

  - Led a team of 3 in the design and development of HopiXForms, a next generation web application generator for pervasive applications. This work led to a patent filing (YOR9-2004-0556-US1) in the area of editor support for generated source code.

  - Implemented the HopiXForms's backend, including the code generator (Java, XHTML, Struts and J2EE) and the runtime library that executes on web servers.

  - Primary author of "*Using XForms to Simplify Web Programming*" research paper presented at 2005 World-Wide Web Conference in Chiba, Japan.

  - Technologies learned: W3C XForms, Apache Xmlbeans, Struts, the Eclipse JDT framework.

- **(2002-2003) Advisory Software Engineer, IBM Watson Research, Hawthorne, NY**
  Project: Multi-Device Authoring Technology (MDAT)
  - Led team of 6 in the design and development of the View Specializer component of the Multi-Device Authoring Technology (MDAT) application. MDAT became generally available as part of the IBM WebSphere Everywhere Toolkit v5.0.1 product on 8/16/04.

    The View Specializer subsystem is the main code generation engine responsible for creating device-specific web pages from a device-neutral representation. As the key designer, I wrote the interface documentation and implemented a significant portion

of the View Specializer code.

- Designed and implemented the View Specializer Extensibility Facility, which allows MDAT users to define new markup languages and new device-to-language mappings. Developed an extension to the Xerces XML parser.

- Proposed a way to dynamically incorporate new device profiles into MDAT. This work led to patent 7,392,324 issued in the area of data synchronization in loosely coupled systems.

- Contributed to the design of a common Web Diagram Editor, which led to patent application 20050229153 in the area of graph specializations.

- Consulted on Rapid Voice-Application Development Environment (Raven) project. This work included a patent application 20060095892 in the area of embedding control flow information at different levels of granularity.

- Filed a patent application 20060080393 concerning enhancements to e-mail systems.

- Technologies learned: J2EE servlets, Voice XML.

- **(1993-1997) Advisory Software Engineer, IBM Watson Research, Hawthorne, NY**
  Project: Clinical Information System (CIS)
  - Member of the core design team for a multi-year, large-scale Clinical Information System (CIS) for a national health care provider. At its height, over 50 developers were employed across three sites.

    CIS provided electronic patient charting for the customer's Denver region, which consisted of approximately 15 sites that served several hundred thousand patients. Besides my role as a developer, I also gathered requirements, provided education, and supported the customer's production environment, all of which required direct, frequent contact with the customer.

  - Co-developed the distributed ***Workflow Manager*** (WFM) subsystem for CIS. WFM controlled the flow of clinical data in CIS and allowed the customer to define and enforce its business and clinical processes. WFM interfaced with clinical workstations and with a heterogeneous group of approximately 10 ancillary systems, such as lab, pharmacy, radiology, and appointment scheduling systems.

  - For scalability and availability, WFM ran on multiple AIX servers with each installation hosting 10 or more cooperating WFM processes. For high performance, WFM managed its own shared memory database that implemented transaction processing, multi-server synchronization, check-pointing, and fail-safe recovery.

  - Concentrated on the networking aspects of WFM, including a guaranteed notification delivery facility (disclosure YO8970175). The communication interface provided different levels of service for different classes of clients.

  - Developed APIs for secure communication, directory services, semaphore, logging, and tracing that were used throughout CIS. Managed the hardware and software development environment, which consisted of approximately 8 AIX servers.

  - Technologies learned: AIX, OS/2, C++, Sybase, GSS security APIs, TCP/IP, UNIX pipes, and Java Native Interface.

- **(1989-1992) Staff Programmer, IBM Poughkeepsie, NY**
  Projects: Remote Support Facility (RSF), Distributed IPC (DIPC)
  - Led team of 5 in developing the Remote Support Facility for future 390 processor controllers.

    The Remote Support Facility (RSF) provides the automatic "call home" capability for IBM mainframe computers when they detect that parts or service are needed. RSF is part of the processor controller, which is an auxiliary computer that is packaged with a mainframe to monitor the health of the mainframe. As team lead, I was responsible for designing and developing a new RSF facility that ran on smaller, cheaper, OS/2-based processor controllers.

    RSF's design included a configuration manager for communication options, a BISYNC device driver that managed the line protocol on sessions with IBM's RETAIN system, and a NetBIOS networking API. This NetBIOS API was also used by other processor controller applications. I implemented parts of the configuration manager and the complete NetBIOS API.

  - Invented and implemented the Distributed Inter-Process Communication (DIPC) facility, which extended OS/2 queues across local area networks. The DIPC disclosure (PO8910323) was published and I received an informal award.

  - Technologies learned: OS/2, C, NetBIOS, BISYNC protocol.

- **(1986-1989) Senior Associate Programmer, IBM White Plains, NY**
  Project: Multi-Dimensional Analysis and Reporting System (MARS)
  - Led team of 8 in developing the APL2-based MARS financial planning system.

    MARS provided IBM forecasters and financial planners with a multi-dimensional spreadsheet application that allowed users to define spreadsheets with up to 17 dimensions. MARS supported advanced features such as the ability to dynamically view data from any dimension; the ability to dynamically add and remove dimensions; keystroke record and playback; and the ability to compare subsets of two spreadsheets side-by-side. MARS was used for budgeting and financial forecasting by IBM divisions, groups and corporate headquarters.

    Received an informal award for leading the MARS design, implementation and support effort. My responsibilities included assigning programming tasks to IBM and contract developers, gathering requirements, interfacing with (internal) customers, writing design documents, developing code, and supporting customers during their planning cycles.

  - Technologies learned: VM/390, APL2, various APL2 auxiliary processors, REXX, XEDIT, SQL/DS, GDDM graphics, and the VMAS report generator.

Academic Research (1997-2002)

Working with Professor Calvin Lin at the University of Texas at Austin, my doctoral research focused on the areas of Programming Languages and Software Engineering. My motivation was—and still is—to reduce the difficulty and cost of software development while at the same time increasing software quality. Much of the difficulty in programming software systems comes from the complex interactions and interdependencies in code. These interdependencies increase costs by making code hard to understand, hard to change, and hard to reuse.

My dissertation focused on increasing code modularity by using *mixin* generic types to build applications from reusable software components. Mixins are types whose supertypes are

specified parametrically. First, I addressed issues of language definition and integration. I showed how mixins can be integrated into a modern programming language to support a methodology of incremental software construction. I identified novel language and compiler features that make programming with mixins convenient and efficient. Second, I addressed issues of implementation and evaluation. I implemented a critical subset of mixin language support in a compiler. I then used my compiler to show (1) that mixins increase code reuse compared to current technologies, (2) that application development and maintenance can be simplified using mixins, and (3) that novel language features simplify mixin programming.

Publications

- **"Using XForms to Simplify Web Programming,"** by R. Cardone, D. Soroker and A. Tiwari, *World-Wide Web Conference*, 2005.

- **"An Authoring Technology for Multi-Device Web Applications,"** by G. Banavar, L. Bergman, R. Cardone, V. Chevalier, Y. Gaeremynck, F. Giraud, S. Hirose, M. Hori, F. Kitayama, G. Kondoh, A. Kundu, K. Ono, A. Schade, D. Soroker, K. Winz, *IEEE Pervasive Computing* magazine, vol. 3, no. 3, July/September 2004.

- **"Using Mixin Technology to Improve Modularity,"** by Richard Cardone and Calvin Lin, Chapter 33, *Aspect-Oriented Software Development*, Addison-Wesley, 2004, edited by Filman, Elrad, Clarke and Askit.

- **"Language and Compiler Support for Mixin Programming,"** Ph.D. dissertation, Richard Cardone, the University of Texas at Austin, 2002.

- **"Using Mixins to Build Flexible Widgets,"** by Richard Cardone, Adam Brown, Sean McDirmid and Calvin Lin, *Conference on Aspect-Oriented Software Development* (AOSD), 2002.

- **"Comparing Frameworks and Layered Refinement,"** by Richard Cardone and Calvin Lin, *International Conference on Software Engineering* (ICSE), 2001.

- **"Object-Oriented Frameworks and Product-Lines,"** by Don Batory, Richard Cardone and Yannis Smaragdakis, *The First Software Product-Line Conference* (SPLC1), 2000.

Technical Reports

- **"Using Reasoning Threads in Enhanced Semantic Networks"** by Richard Cardone, Rangachari Anand, Xuan Lui, Leora Morgenstern, Erik Mueller, Doug Riecken, Calvin Lin. IBM Research TR RC24595, 2008.

- **"Investigating Early-Stage Design of User Interfaces for Cross-Device Web Applications,"** by James Lin, James A. Landay, Lawrence D. Bergman, Guruduth Banavar, Danny Soroker, Richard J. Cardone. IBM Research TR RJ10377, 2006.

- **"Investigating Early-Stage Design of Multi-Device Web Applications,"** by Lawrence Bergman, Guruduth S. Banavar, Danny Soroker, Richard J. Cardone. IBM Research TR RC22594, 2002.

- **"Embedded Workflow Manager System Design Overview,"** by Guy Hochgesang, Richard Cardone, Houtan Aghili. IBM Research TR RC20869, 1997.

Patents Issued

- **Method to Support Consistent Snapshots of Dynamic, Heterogeneously-Managed Data** (7,392,324, 8,005,986), issued June 2008 and Aug. 2011, with Andreas Schade, Reto Hermann and William Trautman.

- **Providing an Embedded Complete Controller Specification through Explicit Controller Overlays** (7,765,522), issued July, 2010, with Juan Manuel (primary), Guruduth Banavar, Danny Soroker.

- **Method and System for Verifying Election Results** (8,145,520), issued March 2012 with Michael Halcrow.

- **Method for Generating Anonymous Trusted Assertions** (7,996,891), issued Aug. 2011, with Michael Halcrow (primary), Bernard Landman, Kent Yoder.

- **Method and Apparatus for Utilizing Portable E-Mail Addresses** (8,230,027), issued July 2012, with Steven Mastrianni and Alpana Tiwari.

Patents Pending

- **Prescription Engagement in a Medical Information Handling System** (Appl. # 14200227) filed Mar. 2014, with Danny Chu (primary), Jay Holtz and David Smith.

- **Dynamically Optimizing Client Queries to Read-Mostly Servers** (Docket# 016295-4523) filed Oct. 2012, with Muhammad Yousaf (primary) and Swathi Gangisetty.

- **A method of application design based on diagram specialization** (20050229153), filed Apr. 2004, with Gary Johnston (primary), Danny Soroker, Guru Banavar, Timothy Wilson, and Shinichi Hirose.

- **Using E-mail Documents to Create and Update Address Lists** (20060080393), filed Oct. 2004, with Norman Cohen and Danny Soroker.

- **Editor Support for Modifying Generated Code** (20060150150), filed Jan. 2005, with Alpana Tiwari (primary) and Danny Soroker.

- **System and Method for Unique Labeling of Animation Display States in Electronic Slide Presentations** (20070226625), filed Mar. 2006, with Bhavani Iyer and Rose Williams.

- **Electronic Voting Using a Trusted Computing Platform,** Docket # YOR9-2007-0531, filed Sept. 2007, with Michael Halcrow, Bernard Landman, Kent Yoder.

- **Paper-Free Verifiable Electronic Voting,** Docket # YOR9-2007-0507, filed Sept. 2007, with Michael Halcrow, Bernard Landman, Kent Yoder.

Disclosures Rated “File”

- **Method and System for Ballot Composition,** Docket # YOR8-2008-0404, with Doug Riecken.

Disclosures Rated “Publish” or “Recognized”

- **Method for Hierarchical XML Specialization**, disclosure YOR8-2005-0142, 2005, with Danny Soroker (primary) and Alpana Tiwari.

- **Guaranteed Delivery of Event Notifications across Wide Area Networks**, disclosure YO8970175, 1997, with Guy Hochgesang.

- **Dynamically Networked OS/2 Queues**, disclosure PO8910323, 1991.

Professional Membership

- Association for Computing Machinery (ACM); Special Interest Group on Software Engineering (SIGSOFT).
- Institute of Electrical and Electronics Engineers (IEEE).

DOD Security Clearance (expired 2013)