

Mark C. Reynolds

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Summary. C, C++, Objective C, Java, Matlab. Python, Unix/Linux/Windows/MacOS. Operating systems, virtual machines, embedded/systems programming, formal methods, language and protocol design, device/network security, network programming and algorithm development.

Education

PhD - Computer Science – Boston University (Feb 2012)

MS – Mathematics, Massachusetts Institute of Technology (1981)

BS - Physics, Massachusetts Institute of Technology (1978)

Experience

Boston University (11/11 – present) Research Associate. Significantly extended the Bochs virtual machine to support a virtual SPI bus, and a fully virtualized BIOS device. Created OS and TPM modules for securely analyzing memory data structures. Developed real-time analysis modules for netflow records, and integrated these modules into a suite of complementary analysis tools. Created a specification-based set of antivirus applications using the Alloy and Isabelle formal modeling tools. Created a website that allows end-user interaction with the antivirus tools using Python.

Boston Childrens Hospital (9/12 – present) Visiting Scientist (FNNDSC). Created MRI processing software for imaging an entire fetus or uterus. Used the ITK toolkit to provide deformable registration to remove motion blur in multiple regions within the scanned images. Demonstrated that the reconstructed image has higher information density than traditional rigid reconstruction approaches. Developed a software model of an infusion pump, including pharmacokinetic/pharmacodynamic interactions with a virtual patient. Created a formal model using UPPAAL to insure that prescribed dosage restrictions are strictly enforced.

BBN Technologies, Cambridge, MA Senior Software Engineer, Intelligence Technologies (4/04 – 11/11)

Software development lead for a PKI project for BGP filter generation. Performed requirements analysis, design, architecture specification, and was also a principle developer for X509 certificate processing, cryptographic verification and the database interface. Participated in successful effort to secure a follow-on contract from DHS for further work on the Resource PKI. Implemented a series of applied cryptographic algorithms on the Trusted Platform Module (TPM). Created network packet analysis modules for several layer two protocols. Developed Windows and Linux network device drivers and performed a variety of low-level systems and network programming tasks. Implemented a device driver for an Ethernet card under Linux; also participated in creating a smartcard interface stack, including a Java-based top end, C-based middleware and a USB driver on the Solaris OS. Lead a variety of business development activities for classified and unclassified programs. Designed and implemented a messaging architecture using ASN.1 for a heterogeneous distributed data collection system. Peer reviewed academic papers in a variety of security subdisciplines. Created a botnet defense architecture with both host-based and network-based components. Implemented a video-game based military training communication subsystem using DLL injection.

Adaptive Optics Associates, Cambridge, MA Software Group Leader (2/97 - 4/04)

Designed and implemented a multithreaded network library for a barcode scanning application. Created image compression library for a SHARC processor board. Created an XML-based bug/feature tracking tool using C#, .NET and SQL Server. Developed a networked camera control application for an embedded microprocessor. Created a multi-dimensional curve fitting routine for optical FLIR data. Wrote a Win2k service for control of a UPS, created a client library and an ActiveX control interface. Developed a heuristic OpenGL GUI builder tool in C++. Created a complete UDP/IP stack, including a chip-level Lance Ethernet device driver, for a raw operating system; wrote an emulator under W95/NT using Visual C++. Wrote a thread scheduler for an embedded processor, and created a Java front end for control/status. Created a decompiler for a specialized fiber-optic communication protocol and wrote an asynchronous pluggable module to enable web browsing the output. Created an NDIS intermediate driver for a private security policy under Win2K/XP. Designed and implemented a Unix IMAP client. Created a behavioral simulator supporting dynamic module loading and reprogrammable interconnects using a software bus. Wrote an output filter for Matlab to convert simulations to QuickTime movies. Built HC11 and Verilog modules for a single board communication processor. Developed optical signal processing algorithms for speckle removal in C++ on the Macintosh. Implemented novel shape recognition and polygon fitting software for an optical test station.

Principal Software Engineer (2/93 -2/97)

Project leader for distributed heterogeneous real-time multi-sensor image processing system. Designed and implemented NST, an object-based programming language, in C. NST supports dynamic object creation, type definition and multiprocessor method execution/interpretation, as well as multithreaded access. Performed language design, specification and implementation. Created C, C++, Tcl/Tk and Java APIs for NST. Wrote corresponding object request broker. Wrote UNIX device driver for a large memory board, and implemented a virtual memory system on top of it. Created complete emulation of VMS mailboxes under UNIX. Developed multiple object tracking software for 3D animation and motion capture applications using C++ and Inventor on the SGI.

Language Engineering Corp., Belmont, MA. Director of Software Development (7/91 - 2/93)

Managed five software engineers at a small commercial startup. MT product was delivered on time simultaneously on three UNIX platforms and the Macintosh. Developed bilingual English/Japanese dictionary database system supporting concurrency, automatic checkpointing, version history and error recovery using RPC, Sun threads, C and C++. Created rule-based topological transformation software using C and Lisp. Wrote Motif/X tool for sentence structure parsing. Created a dictionary query/search language, and wrote a compiler/interpreter for it. Wrote an internationalized XView tool for automatic query and question/answer generation for creation of Japanese dictionary. Wrote a network boot server using low-level IP calls. Designed a user-space STREAMS module emulator.

United Technologies Optical Systems, Cambridge, MA. Senior Scientist, Software (10/87 - 6/91)

Senior contributor and division-wide lead engineer for software. Designed a CPU board using multiple i860 and i960 processors; wrote i860 boot ROM and interrupt processing code; invented a new type of external cache. Principal investigator for next generation compiler/image processor technology IR&D project. Created a real-time multitasking supervisor in Ada. Designed, implemented and debugged numerous UNIX device drivers under Ultrix, Sun-OS and System V. Added customized features to UNIX operating system, including modifications to signal handling and migration of user processes entirely to system space. Created a network resource server using TCP and UDP. Wrote shared memory libraries and created a multiprocessing I/O and job control system. Designed a microcode RPC mechanism permitting remote execution of microcode functions from C. Directed three engineering teams preparing commercial proposals. Wrote image processing applications using X Windows for data reduction and conversion; also created a mainframe data conversion and accounting interface system

Adaptive Optics Associates, Cambridge, MA. Director of Engineering (6/85 - 9/87)

Directed, managed and coordinated the development of digital and analog hardware, software and microcode for advanced signal processors for electro-optic applications. Participated in marketing, proposals, and strategic planning. Managed a seven million dollar, multi-year program to develop a highly parallel image-processing computer; also managed three other major programs. Directed seven groups with more than forty engineers. Created image processing, simulation and data reduction software in C. Designed and coded a rule-based bitslice processor debugging tool in Lisp. Designed and implemented a systolic processing board using the NCR GAPP for digital image reconstruction. Lead engineer on the design for the next generation adaptive optics processor technology. In 1987 United Technologies Optical Systems acquired Adaptive Optics Associates.

Senior Systems Engineer (5/83 - 6/85).

Designed and implemented several large-scale signal processing systems using AMD2900 family bitslice modules. Wrote a network windowing package, a system call trace facility, a microcode assembler, and a symbolic communications utility in C. Designed an abstract data type/object specification language and created a code generator for it using lex and yacc. Implemented a microcode compiler for a simple subset of C. Designed, built and debugged a TMS320 signal processing board for DSP applications, and wrote a TMS assembler and linker for it. Wrote imaging applications and created mathematical functions library in microcode.

General Videotex Corporation, Cambridge, MA. Director of Marketing (5/81 - 6/83)

Developed marketing plans for OEMs and VARs in startup videotext firm. Created database access code and communications modules for on-line encyclopedia. Wrote and debugged fast file system interface in Macro-11 under VMS. Developed gateway software to connect to external services providers using Fortran. Created user interface and forms management software for interactive users.

Bernier and Associates, Inc., Topsfield, M. EDP consultant (7/80 - 10/82)

Consulted on process modeling, factory automation and resource management methodologies for technology modernization to government contractors. Prepared system models using IDEF0 and IDEF1, wrote proposals, reports and documentation. Taught structured design and modeling courses.

Northeastern University, Boston, MA. Assistant Professor of Mathematics (9/78 - 6/80)

Taught pure and applied mathematics courses at undergraduate and graduate level.

Birkhauser Boston, Inc., Cambridge, MA. Translator (8/78 - 10/83)

Translated Russian books and journal articles into English.

Academic Press, New York, NY. Editor (9/77 - 8/82)

Edited the journals "Advances in Mathematics" and "Advances in Applied Mathematics".

Publications and Patents

"Privacy Preservation of Measurement Functions on Hashed Text", Journal of Information Systems Security, to appear

"Modeling the Java Bytecode Verifier", Science of Computer Programming, Mar 2011.

"A High Performance Software Architecture for a Secure Internet Routing PKI", M. Reynolds and S. Kent, DHS CATCH 2009

"Validation Algorithms for a Secure Internet Routing PKI", D. Montana and M. Reynolds, in: "Public Key Infrastructure: The 5th European PKI Workshop", Springer LNCS 5057, pp 17-30 (2008)

“Lightweight Modeling of Java Virtual Machine Security Constraints”, in “Abstract State Machine, Alloy, B and Z: Second International Conference”, Springer LNCS 5977 (2010)

Object Oriented Programming in Java, Mark C. Reynolds, Macmillan Computer Publishing, NY, NY, 1998.

Special Edition Using JavaScript, Mark C. Reynolds and J. Hunycutt, Macmillan Computer Publishing, NY, NY, 1997.

“Cypress Adventure”, a special computer animation installation at “Digital Bayou,” SIGGRAPH 96.

Client/Server Programming using RPC and DCE, David Gunter, Steve Burnett, Mark C. Reynolds; Macmillan Computer Publishing, NY, NY, 1996.

Advanced Reconstructor Development Concepts, Mark C. Reynolds, Rome Air Development Center, Rome, NY, 1987.

Science, Computers and People (From the Tree of Mathematics), Mark C. Reynolds, G.-C. Rota, editors; Birkhauser-Boston, MA, 1986.

The Mathematics and Philosophy of George Polya (3 volumes), Mark C. Reynolds, R.M. Shortt, editors; M.I.T. Press, Cambridge, MA, 1985.

Singularities of Differential Maps, Vol I., V.I. Arnold, S.M.Gusein-Zade, A.N. Varchenko; M.C. Reynolds, translator, Birkhauser, Boston, 1985.

U.S. Patent 5,119,323 "Numerical Processing of Optical Wavefront Data"

U.S. Patent 5,889,550 " 3D Camera Tracking System"

U.S. Air Force “Certificate of Recognition” 1997

Boston University IGNITION award 2012, “Software Inspection and Certification System”