Stephen Heitmann

Senior Software Architect and Engineer, Innovator, Entrepreneur

Specializing in Mobile Web, Telematics, DBMS, Ruby, Javascript, C/C++, Rails and Titanium

"Continuous attention to technical excellence and good design enhances agility." – Manifesto for Agile Software Development
"Good Design is Good Business" – Thomas J. Watson, former Chairman, IBM Corporation.

Overview

Research & Innovation

Generalizing specialist; excellent complex pattern identification and problem definition skills, concept development, early identification and use of emerging technologies, long track record of innovative problem solving. Prefer hard challenges or developing new territory to easy accomplishments

Software Engineering, Systems Architecture Design

Extensive experience with requirements and functional specifications, architectural design, implementation and testing—including interoperability between computers and devices. Early, successful evangelist of corporate adoption of standard software engineering practices (Tektronix). Adept use of systems analysis, applied mathematics, algorithm design, data-flow modeling. Experience in object-oriented design/programming; patterns and frameworks; and some experience using Agile, Scrum and BDD methods.

Software Development, Domain Experience

Serious about developing high-quality software, especially with Ruby and C++. Quickly learn and apply new technologies. 30^{+} years', diverse, deep development experience in multimedia information and communication systems, telematics and computer telephony, speech recognition, information retrieval and search engines, backend databases, and Internet technologies.

Since 2000, Web, mobile, and cryptographic application development. Extensive experience with multi-threaded and multi-process backend servers, C/C++, Ruby, PHP, Javascript, CSS, HTML, SQL, and several APIs and frameworks on Android, Linux, Unix, Windows, OS/2 or Ctask platforms. Experienced with LANs, WANs, WiFi, routers, Apache, Mongrel, Tomcat, MySQL, Oracle, real-time and embedded development, user-interface design, media conversion, content analysis, web-scraping, and automated agents.

Product Development, Project and Small Business Management

Successfully brought multiple software products to market; founded and managed two profitable software companies, Data Dynamics, Inc. and CogniLink, Inc. Effective as hands-on chief architect and project manager, including hiring and managing employees and contractors. 20 plus years' experience producing business plans, including business analyses, market analyses, competitive analyses, strategic marketing plans, financial projections and detailed "use of funds" budgets, risk assessments, and contingency plans for small software businesses.

Communication, Collaboration

Outstanding written, verbal communication skills. Positive "can-do" attitude. Good inter-personal communication, negotiation, conflict management skills. "Bi-lingual" in both technical and business communication. Experienced in preparing and giving presentations to non-technical business people; working closely with investors, legal counsel, marketing and sales; and understanding and meeting the needs of customers.

Technical Detail

Domain Experience

30+ years' experience, including:

- 2 years — **Location-based services** (overlap w/telematics)
- 2 years — **Encryption** and **encryption key management** (overlap w/mobile, web, telematics)
- 3 - 12 years — **Web applications**
- 11 years — **Mobile applications** (overlap w/telematics)
- 20 years — **Telematics,** Computer Telephony, Unified Messaging, IVR, Fax, Voice, E mail, Speech Recognition, TTS
- 30+ years — **Mathematics**–numerical methods, statistics
- 30+ years — **Information retrieval**, automated indexing, content management (CMS), automatic content extraction, data mining. Current interest: Using ZDDs for compression and rapid search of polyhierarchical thesauri for information retrieval apps; see http://tinyurl.com/bzcec9

Platforms and Frameworks

Experience with multi-threaded and multi-processing applications, threads, mutexes

- Learning — **Titanium**, cross-platform framework for Smartphones, Tablets.
- 1 month — **Android** (installed JRuby to enable using Ruby and Ruby on Rails with Java)
- 1 year — **Ferret**, Lucene
- 3+ years — **Ruby on Rails;** transitioning to Rails 3.0
- 3 years — **LAMP**
- 3 years — **ORM backend**—Active Record
- 20+ years — **MySQL, Oracle, SQLite—10+ years combined. Other:** Berkeley DB, DB/2, FoxPro, Paradox; some Microsoft SQL Server, Access,
- 10 - 30 years — **Linux, Windows, Unix, OS/2, Ctask. S**ome **Cisco IOS**

Languages

- Learning — **Erlang** for mobile telephony**, Clojure** for developing parallel algorithms for applications on multi-core CPUs. **Erector, Sass, CSS3, HTML4**
- 1 year — **Watir, Rspec**
- 2 years — **Matlab**
- 3+ years — **JRuby, Ruby**
- 3 – 6+ years — **PHP, DOM, Javascript, CSS driven "tableless" HTML**
- 20-30+ years — **C/C++, SQL**, cron scripts, bash, regular expressions, sed, daemons, tcpserver. Experience with more than 20 programming and scripting languages, including Matlab, Awk. TCL, FORTRAN (12 years), Pascal (12 years) and various assembly languages.
- Some **XML, VoiceXML, SOAP, Java.**
- Reading familiarity with **Python, SWIG, C#, and voiceXML 2.0** (contributed to the **voiceXML 1.0** telephony spec)**.**

Other APIs, Frameworks and Components

- **Internet and Web***:* Libcurl, tcpserver, sockets, Apache, Mongrel, Tomcat, Warble, WiFI routers (D-Link, Linksys, Belkin, Cisco)
- **Network Protocols:** HTTP(S), FTP, SMTP, IMAP, POP, TCP/IP, PPP, RS232, SIP, and T1; application experience with CDMA, GSM, Ethernet 802.1xx
- **Telephony:** IBM Websphere Voice Response, Fax and Custom Server APIs, IBM Websphere Voice Server; Dialogic API (voice, fax, speech, switching), IBM ViaVoice Telephony Speech Recognition and TTS APIs, CBXs (Harris VoiceFrame and Rolm)
- **Specialized hardware and applied electronics:** stepping motors, laser trimmers
- **Reliability:** Mirrored disks, automated failover, automated notification of system problem by phone or email

IDEs and Tools

Eclipse, Aptana, Titanium Studio, Komodo, Zend, MS Visual C++), MFC, Watir, cygwin, gcc and Gnu tools, SourceSafe, CVS, SVN, Git, Purify, Bounds Checker; OpenOffice, MS-Office, CaliberRM, Visio, Corel Draw. Gimp, ScanSoft, Magix.

Education

1968-1972 **University of California, Davis.** B.S., Mathematics, emphasis on Analysis, including Numerical Analysis and Statistics. 12 units of graduate-level mathematics; nearly all undergraduate requirements completed for a B.S.E.E.; and 30 of 36 units toward M.S.E.E. in Computer Science, emphasis on Information Systems. Undergraduate and graduate courses in Artificial Intelligence included two years contributing to the development of COKO, one of the first successful computer chess players.

1966-1968 **American River College.** A.A., Applied Electronics

1978 Certificate, Yourdon Course in Software Engineering Methodologies (Structured Analysis and Design)

1992-Present Currently preparing for Titanium certification. Other self-study: Genetic Algorithms/Machine Learning, Cognitive Science, Information Retrieval (on-going since 1969), and ZDDs (Zero-suppressed Decision Diagrams)

Detailed Work History

Independent Projects, 1/2009 – Present

- Preparing Unwired Media Corporation as a vehicle to develop and market Titanium-based apps for Android/Smartphone and Tablet markets, with primary focus on "best of breed" (currently, Samsung). Preparation includes business and initial product planning, obtaining Titanium certification, transitioning to Rails 3.0 architecture and tools, and learning new CSS3 and HTML4 capabilities, especially for mobile apps.
- Developed RMLS database query project (using JRuby), which automatically logs on to RMLS Web site using combined Ruby Gems Watir and uri, emits HTTP request, parses returned HTML for specific data fields and saves to a MySQL database.
- Conceived a new approach energy-efficient heating, storing, and delivering hot water for residential use. Designed a prototype system and preparing to enter the California CleanTech Open competition.
- Work promoting and defending Green Energy markets and technology. Examples: http://www.ponderable-possibilities.com/

Software development using: Ruby, JRuby, Ruby on Rails, Watir, Erector, Sass, Titanium, MySQL, Android, Linux, Aptana, GIT**.**

Independent Contractor, 11/2006—1/2009

Senior Software Engineer/Telematics, **Mercedes Benz Research & Development, North America, Palo Alto, CA, 3/2008-1/2009**

Researched, specified, designed and implemented the Automated Vehicle Advisory (AVA) prototype for Chrysler Corporation. Responsible for Telematics market research and competitive assessment of 20+ service providers and OEMS. Prepared proposals and presentations. With proposal accepted, completed Web UI specification, system architecture and schema design, and implemented a working Chrysler prototype. AVA system digests Chrysler vehicle log data and automatically provides vehicle owner with a succinct, clear assessment—in simple language and visuals—of vehicle health, performance, and service requirements, as well as advice to improve "eco-driving" skills. Also provides vehicle owner with information in simple language about DTCs, CO2 emissions, fuel efficiency, city/highway driving—and more—from vehicle data log. MBRDNA requested an expanded proposal for a more comprehensive Daimler AG project, which was suspended due to the economic crisis affecting the auto industry.

Software development using: Active Record, Ruby, JRuby (with background processing), Ruby on Rails (used adapters to read DB/2 and write MySQL backend RDBMSes), SQL, ORM, HTML, CSS, MySQL, some DB/2, Warble, Tomcat, Mongrel, Windows XP, Eclipse/Aptana IDE.

Chief Architect, **Stumptown Publishing (startup), Portland, OR, 11/2006-11/2007**

Startup planned to compete with services similar to http://www.yelp.com/ or http://www.local.com/. Charged with producing "an incrementally innovative search engine that produces improved search results." Conceived, designed, and developed an information retrieval search engine and thesaurus core to support nearest-location services for use with both desktop and mobile platforms. Efficiently synchronized with backend self-referential RDBMS tree structure and designed to accommodate polyhierarchies. Used geocoding for nearest-location retrieval. Search engine development included incremental innovations.

The founder of the company funded development from his realtor sales. When his sales revenues began to drop at the onset of the 2007 housing implosion (and recession), he decided to stop funding development.

Software development using: Active Record, Ruby, Ruby on Rails, several Ruby Gems, Ferret, SQL, ORM, Javascript, HTML, CSS, DOM, MySQL, Mongrel, Linux, Eclipse/Aptana IDE, Dynamic DNS.

Senior Software Developer, Dotster, Inc., Vancouver, WA, 6/2005-10/2006

One of the largest of the Domain Registrars, Dotster competes with GoDaddy. The company maintains a large-scale Web capability, with numerous Web servers co-located in several centers in the U.S. accessing the secured backend Oracle RDBMS server in Vancouver, WA. Worked on a variety of Web site feature enhancements in PHP, produced specialized tools and custom SQL queries and reports for Customer Support and Marketing, and developed various backend projects in "C", PHP or SQL.

Work products included:

- Created and developed new method for interactive domain-name database search, finding all similar names among 90,000,000 domain names and returning a list of similar names in less than 3 seconds. Radically reduced the disk space used by the existing method, eliminating the need to purchase $25,000 in new RAID hardware.
- Developed software in "C" to automatically generate customer-specific HTML-formatted newsletters, notices and advertisements delivered by email.
- Developed a Webloyalty "Rewards Offer" system—a secure subscription capability for Internet product purchasers that required transmission of personal credit card data via HTTPS to servers in N.Y. Included end-to-end encryption capability, exceeding PCI requirements and improving Webloyalty's security capability for all of their clients.
- Developed SQL Injection Prevention, pattern recognizers and code to automatically convert browser-originated SQL queries to "SQL injection-proof" form. Developed software in PHP to automatically re-factor more than 4,000 MySQL_query SQL statements, in a PHP code base of more than 100,000 lines, to comply with PCI requirements for SQL Injection Prevention.
- Developed software in PHP to automatically re-factor 100,000 lines of PHP code to instrument it for detecting and reporting error return codes—resulting in detection of more than 30 statements that were daily generating dozens of previously undetected errors (~74,000 cumulative, over three months).
- Developed an automated auditing and exception reporting system that scheduled daily FTP transfer of several million domain registration reports from Network Solutions and extracted data fields for comparison with domain records in a backend Oracle RDBMS.
- Designed and implemented a "framework" that gave Customer Support or Marketing staff a do-it-yourself capability for making code modifications at will to meet advertising specials or exceptions. Reduced need for dedicated developer resources.
- Wrote C programs using SOAP & XML that implemented the SiteGalore API version 10.0. Implemented the complete API specification, which enabled Dotster to offer the SiteGalore service to its customers via an outsourced web development company in India—used libcurl and interoperated with an HTTP server. http://www.sitegalore.com/company.htm
- As part of establishing a development and test system independent of the production system, evaluated and selected tools for integrated PHP, C and Java development, remote debugging, source control and documentation.
- Passed the certification test to enable Dotster to be a ".pro" TLD registrar.

Software development using: C, PHP, Java, SQL, Bash script, sed, awk, HTML, SOAP, PGP & GPG encryption, Linux, Eclipse, Oracle/SQL, Zend, Komodo (PHP IDE), MySQL, Berkeley DB and PHPDocumentor.

Chief Architect, Unwired Media Corporation (start-up), Portland, OR, 11/2003-12/2004

Invented a more secure and versatile version of the PEN-2002 encryption key management method (see **Amercom Technology Group** below). Also for use in the mobile environment, version 2, unlike the PEN-2002 version, is additionally designed for use in an embedded device, non-Internet connected real-time MANETs, web applications, Internet email, or Enterprise-scale networked desktops. Completed the design specifications and a product specification for a COM add-in for the Outlook email client.

Based on Websphere Voice Server, implemented a working prototype for the One Number Anywhere mobile service. This service provides a personal 800 number to mobile subscribers and enables callers to reach the subscribers at multiple cell, landline or voicemail addresses. Subscribers can define call redirection by time and date, Caller ID, blocked Caller ID and other criteria. The subscriber can use the same personal number to make secure and private calls, local or long distance, or to hear voice mail or e-mail via synthetic speech.

Independent Contractor, Portland, OR, 7/2001-5/2005

Systems Analyst, Qsent, Inc. 11/2004

Four-week contract to produce a requirements/use-case specification of a system expansion to enable support of the Wireless 411 Directory. Used Visio and CaliberRM, and applied knowledge of FTP, TCP, T1 and encryption methods.

Chief Architect, co-founder, Amercom Technology Group (start-up), 5/2002-8/2003

Designed and developed PEN-2002 for the *private and secure* mobile market. PEN-2002 is a standalone encrypted email client for person-to-person message exchange via the Internet or directly connected modems, both cell and landline. PEN 2002 was completed and thoroughly tested with all Windows versions, except Win/CE. Invented and implemented the first version of an encryption-key management method for PEN-2002 devices. PEN-2002 and mail stores resided on a USB-enabled flash memory drive, including the biometric *Trek Thumdrive*. Because of this product, ATG was one of eight Oregon companies selected (from 42 applicants) to be a member of the Oregon Regional Alliance for Information and Network Security (RAINS) http://tinyurl.com/2vvfz3, with support from Senator Ron Wyden, and was scheduled to receive funding from the then newly passed Homeland Security Bill. The funding never materialized, and ATG ultimately failed due to lack of funds.

Software development using: Windows /9x, /NT, /2000, /XP, /CE, MFC, Visual C++, GUI, Subversion, RS-232, TCP/IP, SMTP, POP, modem control, encryption (Blowfish) key management.

Software New Business Consultant, Ease Software, 7/2001-5/2002

Ease Software was a software-contracting firm, for many years recognized among Oregon's "Top 10" companies to work for. Guided Ease Software in expanding their business base with Websphere Speech Server and Websphere Voice Response, and to develop expertise with the IBM Websphere family of speech, Web and telephony products. Brought together Ease engineers and IBM training to help realize this proposal. Explored business opportunities in the location-based services, "intelligent presence," and privacy and security markets. This resulted in incorporating Amercom Technology Group, originally as a subsidiary of Ease Software.

General Computer and Internet Support, 9/2002 – 6/2005

Focused on Windows platforms. Fabricated custom PCs; installed and configured hardware and software; resolved hardware, OS, driver or application problems; installed and configured all types of application software; set up ISP access, browser and email clients; set up WiFi routers; interfaced computer CD/DVDs to home stereo/TVs; enabled cash register serial transfer of “Z tape” data to Quickbooks, among many other applications and problems. Provided general instruction on use of computers or application software. Example of a challenging task: Restored a bootable Windows 2000 hard drive configured with a driver for an incompatible IDE adapter, where the original motherboard had been damaged.

Systems Engineer/Contractor, IBM Thomas J. Watson Research Center, Hawthorne, N.Y., 1999–2001

Contributed to developing the Mobile Assistant system, based exclusively on Natural Language Understanding (NLU) and Text To Speech (TTS) technology. Mobile Assistant conversationally interacts with a variety of handheld pervasive devices so users can send and receive email (read to user via TTS), voice mail, and fax; access selected Web sites, personal calendar, address book, and to-do lists; schedule meetings, make phone calls, and take messages. NLU enables a user to speak arbitrary phrases within a particular domain, eliminating the need to learn a rigid interface. Summary: http://tinyurl.com/34x77f ; 5 min. demo: http://tinyurl.com/3tuhwvw

Selected Contributions:

- Transitioned the MA system from a prototype that supported 2-4 callers per host to a scalable system for use by large service providers supporting thousands of callers.

- Developed the telephony, speech recognition and TTS frontend to the MA using IBM's Websphere Voice Response (WVR) and ViaVoice products. Implemented asynchronous TTS and recognition processes that can be terminated by speech or DTMF interrupts from MA. Enabled WVR to function with the Language Model.
- Specified and implemented a baseline test system that used speech converted to text as input and then automatically compared actual with expected results.
- Implemented a research vehicle to support a study of user response to synthetic speech mixed with human speech (GUI produced using Visual Studio) http://tinyurl.com/ycuhbgg
- Extended WVR's capabilities by developing a TTS server and enhancing its database functions. Worked directly with IBM Hursley to add asynchronous process capability that enabled execution of other tasks, while speech recognition was performed by the server.
- Significantly improved TTS response time by pre-synthesizing text sequences for common phrases, static prompts and static responses. Each TTS sequence was indexed with a statistically unique hash of the text sequence. By concatenating a mix of pre-synthesized text and real time TTS, response time was reduced to less than 1 second (down from 3-12 seconds). This enabled using IBM's most sophisticated—but CPU-intensive—human-sounding TTS technology.
- Developed a "connect me" conferencing capability. Because only spoken requests were used, the request to end the conference had to be differentiated from verbal conference dialog. This capability was used to enable human conferences among 5 people and to connect one person to the automated NLU-based Sabre airline reservation system (demoed to DARPA).
- Produced a "proof of concept" capability to connect to a predefined website using an experimental voiceXML browser, scrape text fields from the page (e.g. weather forecast), and use TTS to play the information.

Successfully demonstrated the Websphere version of the Mobile Assistant to DARPA. For innovative contributions, included in IBM group patent no. 6771756, *System and Method To Facilitate Team Communication.*

Independent of the MA project, reviewed the pre-publication specifications for voiceXML version 1.0 and recommended several significant telephony enhancements. Prepared and presented introductory WAP tutorial.

Software development using: NT, Linux, multithreaded programming methods, MS Visual C++, MFC, SourceSafe, CVS, Dialogic, BNF, TCL and learning Aculab, NMS, Notes, WAP, voiceXML, Lotus Notes, fax server and Rolm PBX.

Chief Architect/Project Manager, Founder, CogniLink, Inc. (formerly CogniSoft, Inc.), Portland, OR, 1998–1999

CogniSoft transitioned to a "dot com" company and changed its name to CogniLink. Our business plan specified staged market development in three market arenas:

- Tailored Web Browsing,
- Desktop Internet, PSTN phone, and/or Cellular Mobile Conferencing, and
- Mobile Internet Unified Messaging.

To describe the combined market arenas CogniLink coined the term "Internet E-business Service Provider", which is identical in function to what is now known as Cloud Computing. This new idea and capability was characterized with the slogan, "Move information, not hardware" (because hardware servers no longer needed to be installed and maintained at the customer site in order to have access to these services).

Our initial priority was Tailored Web Browsing. In that effort, architected and implemented the Tailored Web Browsing routed service, which enables special interest groups, parents or employers to determine the type of information that can be accessed on the Web by researchers, children or employees. The Tailored Web Browsing routed service combined products from Net Partners, Content Technology and Web Trends, using "pipes" and transforms written in C/C++.

For system testing, produced an ISP Internet access infrastructure with automated failover, system monitoring and event notification; programmed the TSU, Cisco access server and router; and configured Radius server, firewalls, DNS, email and Web servers. All of these operated in public, DMZ and private subnets on an Ethernet LAN.

The Tailored Web Service was implemented and operational, with initial sales effort underway to Electric Lightwave and Advanced Radio Telecom. Unfortunately, CogniLink's private investor pulled out in March, 1999, for personal reasons prior to achieving any sustaining service contract.

Senior Software Engineer, Envoy Global, Portland, OR, 1994–1997

Responsible for developing automated back-end telecommunications systems, with large-scale database processing of over 10,000,000 records per month, including automated downloading, distribution, processing, and reporting of US West SMDRs, IXC CDRs, and MCI CDRs. Co-developed the Guest Call Management System that guaranteed final long-distance billing within 30 minutes of last call. Proposed and designed a fax-to-email delivery service with Supra Corp. Contributed to an Internet desktop and voice distance learning system, including Ascend Max 4004 programming, firewall selection and programming, IVR front-end design for conference scheduling, and a user management and security system that bridged multiple service providers.

Established a revenue-sharing partnership with CogniSoft, Inc., to build custom Unilink applications for customers, including Warner Brothers and the Washington State Lottery.

Software development using: C++, OS/2, Ctask, pipes, TCP/IP, DB/2, FoxPro, T1, Harris VoiceFrame switch, Cisco routers, mirrored disks, automated failover, Web and email servers, Borland C++ IDE. All software development used C, Visual Basic or FoxPro on OS/2, Unix, NT or MS-DOS platforms.

Chief Architect/Project Manager, Founder, CogniSoft, Inc., Portland, OR, 1990–1998

Unilink, an integrated, multi-media, Unified Messaging and Information Distribution System for customized multi-threaded telephony applications, supporting from four to several thousand phone lines and interfacing with most databases. Using Intel and Dialogic hardware and a multi-tasking operating system, combined voice, fax, email, interactive voice response (IVR), faxback, virtual number, "find me", an EZ-Link batch email interface, and automatic message switch. With an API and a C++ class library, interfacing with RDBMs, Unilink was programmable, enabling a mix of capabilities and user interfaces, including ASR voice control and non-English languages.

Software development using: C++, Ctask, OS/2, Paradox RDBMS, FoxPro RDBMS, Dialogic API, Netfinity, Borland C++ IDE, Dialogic hardware for T1, ASR, and DSP for inbound modem, fax or voice detection.

Custom Unilink implementations included:

- **Sound Response (formerly Nextlink Interactive, now *XO*).** Sound Response's first version of the Call Relay service for storing and forwarding voice messages. Using the service, callers receiving a busy signal or no answer could record a message and specify a phone number. The Call Relay service then automatically called the number until the message could be delivered. The caller could specify the frequency of call re-try and message aging.
- **Washington State Lottery Information Service.** A phone-based editing system to enable lottery staff to record and later modify daily winning numbers, advertising, or entry dates. Callers made a menu selection to hear winning numbers for Lotto, Keno, Daily Game, or Quinto. Collected billing data was transferred to a database and reporting system. Routinely handled 400,000 calls per month and peak calls of up to 21,000 calls per hour, for more than two years.
- **Bureau of Land Management.** Automated registration system. Callers filled out a form with voice or telephone keypad entries. Keypad entries were converted to voice, and completed forms were then sent to one or more voice mailboxes (depending on the number of keyword categories specified). Callers could also leave voicemail. Included pause, reverse, and fast-forward features for transcription operators to use to convert the voice form to text database entry.
- **Warner Brothers.** Scheduled fax store and delivery system. Customers filled out a purchase order in a gift catalog and faxed directly to the Unilink system. Faxes were stored until 1:00 A.M. when they are automatically delivered in batch by fax to Warner Brothers' offices. Warner Brothers' staff had access to a fax mailbox to enable on-demand delivery or redirection of collected faxes.
- **TCT, Germany.** Email text delivery system. Implemented the EZ-Link batch email protocol so that email text could be received on a PC by modem or delivered to a fax machine. Clients specified the fax redirection

number over the phone using a touchtone keypad or by speaking the phone number. Unilink's speech capability was operational in late 1991, shortly after Dialogic released its Beta hardware to CogniSoft. Speech recognition was necessary because only 10% of phones in Germany supported touchtone (DTMF).

- **Carpenter's Union Social Security Number Collection.** Phone-based data collection system, whereby out-of-work carpenters entered their social security numbers by phone keypad. Collected numbers were stored in ASCII format and automatically forwarded by modem to the union database.
- **Go-Fax Telephone Debit Card System.** Debit card delivery by fax. Credit card data was captured by telephone keypad entry. After credit verification (a third-party service), a telephone long-distance debit card was delivered by fax, along with merged advertising material produced with any graphics/paint program.
- **Pharmfax IVR + Faxback Pharmaceutical Drug Information System.** Pharmaceutical IVR system. Designed a voice menu to provide access to information on pharmaceuticals; callers used the telephone keypad to make selections, which were then printed on a fax machine at the pharmacy counter.
- **Never-Busy Fax Service.** Automated fax queuing and delivery. When the destination fax machine was busy, the fax was automatically redirected to a fax mailbox. When the fax machine became available, the fax was automatically delivered.

Senior Software Engineer, Atlas Telecom, Portland, OR, 1989–1990

Contributed to the development and support of proprietary international fax store-and-forward electronic mail services and systems.

Software development using: Sequent Symmetry, Dynix **(**Unix modified for parallel processing), Unify RDBMS, SQL and C.

Chief Architect/Project Manager, Founder, Data Dynamics, Inc., Portland, OR, 1980–1989

Designed and implemented GENIE (GENeral Information Environment), an advanced interactive email, conferencing, and information system that featured seamless integration of all software and hardware components, uniform information management, transaction processing, virtual network interface, virtual host interface, virtual device interfaces, and multiple user interfaces. This system, developed in Pascal and C, supported custom applications from 1983 through 1989.

Designed and implemented ELF (not an acronym, but a name for the GENIE product mix)—an email object that could be connected to any editor for message composition and any database or file system for message storage and retrieval.

Invented an information manager for the GENIE system. This defined a set of orthogonal functions for seamlessly unifying relational DBMS, information retrieval, hypertext, word-processing primitives and virtual memory.

Completed a general-purpose user interface architecture for the GENIE system. Most user interfaces have the same internal structure, regardless of the virtuality presented to the user. This architecture enabled rapid development of user interface processors through the use of standard functional modules.

Software development using: Pascal, C, assembly language, CDC NOS, NOS/BE

Custom GENIE implementations included:

- **Tektronix.** A manufacturing QA tracking and customer communication system. Tektronix' customers could contact support groups for specific product problems directly. Problem reports and responses were easily tracked and QA stats more easily collected.
- **California State University, Sacramento.** A distance-learning, conferencing and email system that enabled students to participate in classes while off campus and to obtain assistance from professors via email or "FAQ"-style topic groups.
- **Imperial College of London, England.** Braille-based email and desktop conferencing system for use by a deaf and blind mathematics student.

- **South African Government.** An email, information, and directory system used by South African embassies for non-Internet worldwide email communication, for locating thousands of government and research personnel, and for providing news and other information to all embassy staff.
- **Other implementations.** Customized email, conferencing, and information systems for the National Bureau of Standards, several California State University campuses, Bell Telephone of Pennsylvania, Control Data Corporation, Atomic Energy of Canada, General Motors, McDonnell Douglas, Grumman, and over 20 other customers.

Software Research Engineer, Computer Research and Instructor, Tektronix, Portland, OR, 1973–1981

Software Research Engineer III, Computer Research Group, Tektronix Laboratories, 1977–1979.
Responsible for planning and implementing research projects, managing two software engineers, and designing and implementing advanced application software. Below is a partial list of the many projects completed.

- Participated in the Stanford Research Institute (SRI) Industrial Automation (Robotics) Program.
- Developed a flat panel display simulator (FLAPS) for testing layout geometry.
- Designed and implemented TeKCom, a sophisticated integrated system that combined email, conferencing, personal filing, and text editing. Although it was intended only as a research vehicle to study computer-mediated communication and to better understand how to produce integrated software for the Professional Support System, it was used at Tektronix through at least 1985. TekCom provided several desirable features that have yet to be included in current-day (circa 2010) email clients.
- Completed a study of managerial and professional work requirements, which formed the basis for the Professional Support System (PSS) product proposal. The PSS was an early GroupWare system that included support for collaborative work, video conferencing, email, publishing, modeling, and scheduling. The PSS was intended as a "building block" open architecture system and consisted of four major elements:
  1. A laptop type portable workstation; with a high-res flat panel color CRT; use virtual touch-sensitive keypads using an EL flat CRT; include a built-in printer; and support video conferencing).
  2. Incorporation of Tek's GPIB (IEEE 488) digital instruments.
  3. Incorporation of software modules for specialized customer requirements, including instrument applications.
  4. A virtual environment wherein GPIB instruments and software functions, including data or information flows, were seamlessly integrated and manipulated via a uniform user interface.

Part-time Instructor, Tektronix Education and Training, 1977–1981. Planned, developed and taught classes in Software Engineering, Pascal programming, and creative problem-solving. Software Engineering curriculum included problem definition, requirements and functional specifications, data modeling, design, testing methods, and best practices.

Software Research Engineer II, Hybrid Circuits Engineering, Tektronix Laboratories, 1975–1977. Invented and developed a general-purpose first-order optimizer for trimming hybrid circuits with an ESI laser system. This was the first optimizer of its type in the world. Also developed two successful special-purpose optimizers using statistical techniques to trim hybrid circuits. These statistical methods could be construed as a precursor to a neural net. I sampled five (5) key points on the initial output signal and statistically correlated these with the amount of resistance and capacitance that needed to be removed from the circuit to produce a square wave output. The program needed to be "trained" by manually trimming 300 hybrids to collect the resulting data—and then I used the program to do the trimming. The program continued to learn heuristically by comparing the results of its "decisions" and deciding whether to include the new datum in the statistical database. The statistical optimizers reduced the trim time from 4-5 *minutes* to 12 *seconds.*

Created a component database management system and automated component test procedures using Tektest. Wrote Pascal programs for mathematical filtering and curve-fitting to analyze digitized signals. Developed curve-fitting techniques using orthogonal polynomials and Chebychev economization to compensate for the slowness and limited 16-bit word length of the DEC PDP 11/34. Established a method for linking Pascal procedures to Tektest programs (this enabled productivity gains over using assembly language to create special-purpose Tektest functions). Developed drivers that enabled connection of Tek and Fluke programmable instruments to

the ESI Pascal-based laser-control computer (this software was used in-house and by ESI). Responsible for project management and programmer supervision. Published "Step-Response Active Laser Trimming of Thick Film Five-Input Amplifier," in Proceedings of the International Society of Hybrid Microelectronics, October, 1976.

Software Product Specialist, Marketing, Information Display Devices, 1974–1975. Provided software and technical support for all Tektronix IDD computer graphics peripheral products. Researched and specified areas of market potential for IDD products. Evaluated technical aspects of new product proposals and contributed to market feasibility studies for them. Proposed new hardware and software products, including several microprocessor systems.

Regional Systems Analyst, Marketing, Information Display Devices, 1973–1974. Provided customers with proposals for computer graphics equipment configurations, software support (including developing special-purpose systems), and correction of technical problems. Taught customer training classes. Participated in the implementation of the national "G.E. Mailbox" electronic mail system for use by Tek sales offices. Developed Tek's first microprocessor-based system using the Intel 8008 to enter and edit graphic images by freehand, store them and later retrieve them for display or modification. This system was built for NAFEC to evaluate a nationwide route-dependent weather information system for pilot flight planning. Its success led to the early use of microprocessors in Tektronix products.

Other accomplishments at Tektronix:

- In 1978, proposed to company officers the corporate-wide use of electronic mail and computer conferencing at Tektronix to facilitate customer training via “distance learning,” support telework and reduce associated parking and facilities costs, and generally increase productivity. Tektronix began corporate use of electronic mail in 1982.
- Proposed Tektronix R&D funding in 1977 to learn how to separate the user interface from the application, how to design and implement “user friendly” interfaces, and how to construct independent user interface processors that support speech, touch, and video-enabled user interfaces. Years later, these ideas emerged in the marketplace as “UIM” methods, SDKs and products.
- Developed and taught the first Pascal and Software Engineering classes for the Tektronix Educational Program.
- Developed FLAPS (Flat Panel Simulator), an advanced display simulator using high-resolution computer graphics. Resulted in a substantial reduction in time and cost of flat panel R&D and in prototype manufacturing costs.
- Proposed a raster graphics display architecture based on list-processing and expandable parallel computing elements. Although Tektronix did not build devices based on this architecture, RAMTEK in Palo Alto, CA, introduced a successful graphics terminal in 1978 that used the same architecture.
- First to encourage the use of Pascal at Tektronix. Proposed that Pascal replace TEKTEST used with system testing products. Pascal was adopted for this purpose in 1978 and became a popular language at Tektronix before C became the industry preference. Also developed drivers that enabled use of Tek’s digital instruments with ESI’s Pascal-based laser trim equipment. ESI adopted these drivers to enhance their laser trim product features.
- Proposed a desktop computer using bit-slice technology, dynamic graphics, and application software packages to replace the 4051. The Tektronix 4054 incorporating these features was introduced in 1979.
- In 1973, designed and implemented an electronic mail system for Tektronix’ sales offices. This was implemented on the GE Timesharing service. This system later became “GE Mail”.
- Proposed the “virtual bit-map” technique to enable graphics features in the Tektronix 4023 terminal. This technique was used in the 4025 terminal introduced in 1978.

Analyst Programmer, Health Management Systems, Sacramento, California, 1972–1973

Participated in the development of the State of California Medi-Cal eligibility and accounting system for medical services billing. Wrote COBOL programs to detect exception records, i.e. applications from people who didn't meet eligibility requirements, over-billing, or form fill-out errors.

Part-time Instructor, California State University, Sacramento, CA, Computer Science Department, 1971–1973

Specified, developed and instructed classes in computer graphics. Hired because of my innovative work in computer graphics at U.C. Davis. This was the first such course offered at any West Coast university and among the first in the U.S. Also taught classes in FORTRAN and Computers and Society.

Analyst/Programmer, University of California, Davis, 1968–1972

Developed software to support research at the University of California (U.C. Computer Center, U.C. Medical School, and Department of Environmental Toxicology). Also researched and developed computer graphics which, by 1969, resulted in establishing required transforms, data structures, graphic input/output methods, and interactive techniques, including the use of icons, windows, and direct-manipulation interfaces. Created a graphics language and a graphics database management system, which was applied to computer-aided instruction, computer art, and modeling systems. This innovative work in graphics was the basis of my masters' thesis and resulted in an invitation from the Department Chair at California State University, Sacramento, to teach Computer Graphics.

Systems Analyst, Department of Environmental Toxicology, 1971–1972. Worked with an interdisciplinary team to perform a case study for the Environmental Protection Agency (EPA) on the mobility of pesticides. Designed and developed a rapid-access database management system, including automated data exception detection, that would accommodate an additional 1,000,000 agricultural records per year. Mathematical modeling programs (written by others) retrieved data directly from this database using logical expressions. My system parsed these expressions and returned the resulting data to the calling programs. This system also included an English natural language-like interactive query language and record display that I developed for use by researchers accessing the database via timesharing terminals. The case study and modeling system was used by the California State Legislature to make decisions regarding the regulation of pesticide use. Received "high commendation" from the EPA for technical performance.

Part-time (full-time summer) Programmer, U.C. Computer Center and Medical School, 1968–1971. Worked on a variety of faculty or graduate research projects involving modeling, graphics, statistics, numerical analysis, signal processing and database management. Frequently required developing software to read and process data acquired from measurement instrumentation. Project highlights include 1) using a PDP 8 to electrically stimulate a frog's leg muscle under program control and then capture the resulting digitized electrical signal from the muscle; 2) processing gas chromatograph output of chimpanzee urine samples to learn about circadian rhythms and the best time to administer pharmaceutical drugs (this involved the use of Cosinor Analysis—a technique for fitting cosines to data samples); and 3) statistical analysis of results from tests intended to determine the existence of telepathy and psychokinesis.

Freelance Programming, 1966–1968

Wrote several programs for faculty, including solving simultaneous linear equations, tabulating test scores from an optical scanner, printing lab inventory reports, and the computer simulation of a rat learning to run through a maze.

References and writing samples—including white papers, specifications, documents and past business plans—available on request and under NDA