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Technical Profile (iOS):
JOHN HEEREMA, Ph.D.

Experience

Dr. Heerema is a senior leader with over a quarter century of practical experience. His expertise combines leadership with deep technical knowledge. This profile focuses on his software development skills, with particular emphasis on mobile devices using iOS.

For more details, please visit https://www.Andromeda.ab.ca

Special Skills

Leadership

Dr. Heerema excels in the coordination of teams with several dozen members. One of his strengths is establishing effective communication between multiple companies, departments, and work groups within an enterprise.

Fiscal responsibility

Managed projects with total values of up to $80M, delivering projects on budget and on time.

Software

Dr. Heerema is a software development expert, with deep experience in both leadership and technical roles. He is also a world authority in computational auditory scene analysis.

Resource industry

Dr. Heerema has worked in Canada's resource industry for several decades in leadership and technical capacities.

Application Areas

Software for Mobile Devices

John is an iOS development expert, with expertise in the Swift programming language, SwiftUI, database management, complex graphics, and digital signal processing. His focus is on delivering well-designed, easy to use high-end systems.

Digital Signal Processing and Control

Dr. Heerema conducts joint time-frequency domain analysis of complex real-time signals, such as those involved in machinery control, vibration analysis, and audio-frequency signal analysis.

Pipelines

Has taken on roles in Project Management, design, and development of software for both engineering and IT, including turbocompressor performance monitoring, vibration analysis, pipeline leak detection, and electronic flow measurement.

Educational Games

Develops games and real-time performance feedback to improve real-world skills.

Software Development

- iOS development of sophisticated mobile device applications, using Swift, SwiftUI, Combine (Apple's version of RxSwift), Objective C, vector processing, database development, complex graphics, e-commerce, and real-time audio analysis.
- Java development, including software for instrumentation control and data acquisition for airborne LIDAR / GPS, user interfaces, and digital signal processing.
- C# development for embedded software and user interface development
- C/C++ development for airborne LIDAR / GPS laser coverage calculations, and real-time GIS-based position and attitude solutions. C++ development of gas thermodynamics equation of state calculations. C++ joint time/frequency signal analysis.
- An authority on the LabVIEW development environment, with over 30 years of experience in using LabVIEW for instrumentation control and user interfaces, reactive programming, real-time commodity trading and risk analysis, and turbocompressor performance measurement.
- Development of websites for both conventional and embedded servers using JavaScript, CSS and HTML.

Keywords

- iOS, Swift, Swift UI, Combine, Reactive, Database, DSP
- Project Management
- Test Driven Development (TDD)
- C, C++, C#, Java, JavaScript, CSS, HTML, UNIX, LINUX
- Mathematica, AI, Embedded, DSP, LabVIEW, GIS, GPS, LIDAR, Reactive
- Pipeline, Instrumentation, ETRM, Vibration, EFM, Audio

Awards

- Our "Booze Cruise" driving game received national attention for it's entertaining approach to educating drivers about the effects of alcohol on driving. We received a first place award for it at the FuturePlay 2007 competition, and it was later purchased by the U.S. Department of Defense.
- Led a project to create the world's first commodity market for electrical reserves, 2000-2001
- APEGGA "Summit" award, 1994 (one of two senior members of the team associated with this corporate award)

Education

- PhD (Computational Auditory Scene Analysis), University of Calgary.
- MSc (Digital Signal Processing), University of Calgary, GPA of 4.0.
- BSc (Computer Science and Pure Mathematics), University of Calgary.

This group of projects involved software development for mobile iOS devices.

iOS Development

Beat-It Drums

April 2020 – Jan 2021

Tools Used: iOS, Swift, Swift UI, Combine

I was retained by drumming expert Bob Everett to create an iOS app for teaching drumming. If his name sounds familiar, it may be because his son, Shawn Everett, is a six time Grammy award winner as the recording engineer for groups such as *The Killers*, *Alabama Shakes*, and *The War on Drugs*.

Bob's idea was to replace traditional drum notation with something more intuitive: a bit like a video game. Vertical lines represent items in a drum kit. Symbols on those lines represent ways of striking the drum kit item (for example, a rim shot, or a symbol crash).

The drum score drops down the screen at the song's tempo, and you make each sound at the moment when its symbol hits the "play line". The user can pick which lesson to work on, and what tempo to play at. Icons representing the player's hands and feet flash when they are to be used.

Each bar of music is a different colour, and the number of beats per bar varies with the time signature of the music.

Dr. Heerema, who has many years of experience in iOS app development, used the declarative Swift UI language to build the user interface, and Swift for the application itself. The drum sounds, recorded at the Banff Centre for the Performing Arts, are played with sub-millisecond timing precision. The Combine reactive framework is used to send event messages to various components of the user interface, such as the hand and foot icons.

It can be found on the Apple App Store as Beat-It Drums 1.

Visual Music

Client: Andromeda 2014 - Present

Tools Used: iOS, Swift, Objective C, SIMD vector processing

Developed iOS software to perform complex analysis of audio signals, and show the results in a way that intuitively helps non-technical musicians to improve their playing and singing skills.

The joint time-frequency digital signal processing algorithms developed during John's doctoral research are currently the best in the world for perceptual pitch analysis. The algorithms are highly optimized for mobile devices, and the user interface is intuitive and responsive.

Software development started with Objective C, but when the Swift language was announced in 2014, software development switched to the new Swift language, using the first beta version available to developers. The language has changed significantly over the years, so the code base has continuously evolved to take advantage of new Swift and iOS features.

The software is primarily written in Swift, with some bridging to Objective C for features not available in Swift. It also makes extensive use of vector-optimized assembly language libraries for data analysis function.

Most of the user interface is developed using storyboards and flexible layout rules that allow it to adapt to different device sizes and orientations. Custom user interface view

controllers are used for more advanced user interface features. The user interface adapts to various device sizes and orientations.

The application makes use of an on-device database to provide persistent storage and user interface continuity. The application provides sophisticated graphing with support for navigation gestures such as pinch and zoom.

In keeping with the principals of test-driven-development, a set of automated unit tests was developed in concert with the main application. These unit tests can be run to confirm correct program operation after refactoring operations.

The tools and techniques used for this software are applicable to a wide variety of mobile applications, including advanced financial analysis.

User Survey Client: Andromeda 2016

Tools Used: iOS, Swift

Developed an iOS application that presents a series of tests, and with the user's informed consent, sends the results to a central location for analysis. The user responds to each task by moving sliders and tapping buttons.

The tools and techniques developed for this project are applicable to a variety of user experience surveys.

Game Development Client: University of Calgary, US Department of Defence 2006-2007

Tools Used: OpenGL, Game Engine development

Our "Booze Cruise" driving game received national attention for it's entertaining approach to educating drivers about the effects of alcohol on driving. We received a first place award for it at the FuturePlay 2007 competition, and it was later purchased by the U.S. Department of Defense.

The player navigates a maze under the simulated influence of alcohol. Scores are awarded for completion speed, and deducted for driving errors.

Technologies: OpenGL, C++, Game engine.

Notable Projects

This group of projects involved software development and software project management.

Airborne Instrumentation Client: LiDAR Services International 2005 - 2010

Tools Used: C++, Java, LabVIEW

Developed a suite of software to control the instrumentation used for airborne LIDAR operations. The software controls still and video cameras, fibre optic gyroscopes, differential GPS, and scanning lasers. Developed algorithms for real-time camera positioning, beam coverage analysis, and displays for LIDAR operators.

The software also provides a pilot display that shows the planned mission trajectory and the actual ground coverage for the laser scanner and camera.

A suite of automated tests is used to confirm correct algorithm operations.

Portable Gas Chromatograph Client: Ametek Process Instruments 2018 - 2022

Tools Used: C#, Windows CE

Developed embedded software for a mobile gas chromatograph. The software controls the device, and provides an on-board graphical user interface.

Control and Visualization Client: Ametek Process Instruments 2010 – 2022

Tools Used: LabVIEW, C#, JavaScript

Retained by a major instrumentation manufacturer (Ametek) to develop the configuration and data analysis software for its line of gas spectroscopy analyzers the (99xx and 9xx series). In addition to applications for desktop and laptop computers, Dr. Heerema developed embedded websites for data analysis, analyzer configuration and operation.

Flow Computer Validation Clients: Andromeda, TC Energy 1999 – Present

Tools Used: C++, LabVIEW

Developed a system for automatically testing and verifying the operation of custody-transfer gas measurement computers. Simulates meter station devices such as gas chromatographs, differential pressure transducers, and temperature sensors. Simulates arbitrary conditions, calculates expected results, and polls devices under test in real time to determine their accuracy and responsiveness. Retained by a major pipeline to evaluate a new generation of flow computers.

Performance Testing Clients: Andromeda, TC Energy, TGN 1999 – Present

Tools Used: C++, LabVIEW, data acquisition and signal conditioning

Created software and hardware to measure the real-time performance of gas pipeline turbo-compressors. The system is used by pipelines in North and South America to determine the actual capacity and efficiency of compression units. It is also used to troubleshoot compression and vibration issues, and to create wheel maps for use by pipeline Gas Control.

Magnetic Bearing Research Client: Novacorp International 1988-1994

Tools Used: LabVIEW, C++, MatLab, Mathematica, 68332 and 56002 assembly, signal analysis, predictive control, and large turbocompressors.

Software architect for several generations of high-speed magnetic bearing control and data analysis systems. One of these systems was the recipient of the 1994 APEGGA "summit" award for achievement. Another was featured as the cover story for an issue of "International Turbomachinery".

This group of projects involved project and vendor management.

Notable Projects

ETRM Selection

Retained by a major energy company to evaluate and select a product for its regulated and unregulated Energy Trading activities, and to select appropriate risk management tools.

Coordinated vendor presentations, product evaluation, and integration paths with the existing risk management toolset.

Technologies: Commercial ETRM products 2006

Commodity Trading & Risk Management

Retained by the Transmission Administrator (TA) for Alberta, as the Project Manager for an initiative to trade electrical reserves on a commodities exchange. This project was successfully completed on time, in the very dynamic business environment of initial electrical deregulation

The initial scope was to identify requirements, and to obtain buy-in from all of the affected companies and departments. Following this, a project was raised, and Mr. Heerema recruited a team to develop systems to support on-line trading, risk management, demand forecasting, compliance monitoring, financial settlement, and asset substitution.

The on-line trading component of the system tracks the TA's real-time position, and ranks incoming bids and offers for the traders, based on price and risk (in this case the risks being managed are cost, the dynamic probability of reserve deployment, and the geographical proximity of assets to the projected demand). The system can communicate with multiple exchange floors via secure XML links that transmit bids, offers, and trades. Dispatch instructions are sent to the System Controller.

The system forecasts demand using past history and a weather forecast feed from Environment Canada, and provides Alberta's most accurate electrical load forecasts. It also monitors the performance of reserve providers using SCADA telemetry, and allows reserve providers to nominate assets via a secure web interface.

Oct 2000 - Sept 2001

Integration Coordinator

Retained as the Integration Coordinator for TransCanada Pipeline's "Best of Breed" Program Management Office (PMO).

This $80M programme replaced SAP with a suite of applications from various vendors, and functionally integrated them. Responsible for setting integration testing standards, identifying test team leaders, coordinating infrastructure development, resolving integration issues, establishing Change Management practices, and acting as the Change Coordinator.

Coordinated a small staff within the PMO, and several dozen test leaders and testers in seven Best of Breed projects.

Reported to the PMO and to the programme steering committee. This program was successfully implemented on time.

Technologies: Enterprise 1000 server, Java, Web, Sybase, Oracle, XML, Forte Fusion, etc.
Mid 1999 - Sept 2000

Integration Architect

Acted as a system architect and project manager for integration projects in a second phase of the "Best of Breed" program for TransCanada Pipelines.

Technologies: these were the first projects in that company to use XML, Java, and Forte Fusion for system integration. Mid 1999 - Sept 2000

Integration

Coordinated system integration and acceptance activities for a new COTS measurement system at a large pipeline company.

Technologies: XML, SOAP, JAVA, Web services, OaSys, Database Spring and summer, 2003

Mission-Critical Testing

Acted as the Team Leader responsible for Year-2000 testing of the systems identified as "Mission Critical" for TransCanada Pipelines., focusing on the Gas Measurement & Accounting areas.

Coordinated the activities of over 60 people, to create an isolated network of computer systems, develop test plans, execute them, and resolve issues.

Mid 1998 - Mid 1999, at 50%

Vendor Management

Planned an upgrade to all flow computers in the TransCanada measurement system.

Acted as TransCanada's technical representative during the development project, responsible for coordinating and approving vendor activities. Developed project execution, and quality assurance standards for the vendor.

Although the vendor was initially reluctant to follow the standards and procedures, they ultimately acknowledged that the system could not have been built on time without them.

Early 1998 - Mid 1999 at 50%

Product Visioning

Retained by a major flow computer manufacturer to vision and coordinate development of a new generation of flow measurement computers.

2009-2011

Notable Projects (best practices)

This group of projects predominately involved management consulting, education, and project management.

Policies and Procedures

Initiated a project for the Yukon Territorial Government to develop practices, policies, and procedures for oil and gas licensing activities in the territory.

Management Consulting Summer and Fall, 2002

Quality Assurance Audit

Retained by the Pipeline Software Division of an international pipeline, to perform a Quality Assurance Audit of one of its major product lines. The major recommendations of the audit were all implemented.

Standards development	1992

Chronologically

For those who prefer a reverse-chronological project list, here is a partial list of clients and projects:

Ametek Process Instruments	2010-2022
Beat-It Drums – iOS development	2020-2021
University of Calgary PhD Programme & post-doctoral research	2010-2019
Gas Chromatograph and other Instrumentation development	2011-2021
TransCanada (multiple projects / multiple departments)	1984-2013
Cameron	2009-2011
LiDAR Services International (airborne instrumentation and pilot interface)	2005-2011
University of Calgary MSc Programme	2005-2008
Enbridge (ETRM)	2006-2009
Beta Equipment	2004-2005
Duke Energy (COTS gas measurement)	2003
Transmission Administrator for Alberta	2000-2001

Personal

Dr. Heerema is an avid photographer and Photoshop expert. He specializes in very large canvas prints of the Canadian landscape, and ski photography. He enjoys reading, music, biking, cooking, and hanging out with his kids (www.heerema.ca).

He designed and built his home to minimize its environmental footprint (R-2000 building practices, and minimal site impact).

He has climbed the highest peaks in North and South America, is a high-level cross-country ski instructor, serves on the Board of Directors for the Canadian Association of Nordic Ski Instructors, and is president of CANSI Mountain region. He built a harpsichord, has taught at the University of Calgary, and has done volunteer work overseas for a medical NGO.