

# GABRIEL M. BEDDINGFIELD

34132 SUSAN TER — FREMONT, CA 94555  
MOBILE (214) 516-9170 — E-MAIL GABRBEDD@GMAIL.COM

---

I am a flexible software engineer with 12+ years of proven experience in embedded, real-time, multi-threaded, and audio applications.

## WORK HISTORY

---

### ***Google (Nest) [Sr. Software Engineer, 1/2015-3/2023]***

*Held several device firmware roles as Team Lead (firmware architect, middleware architect) and Individual Contributor (platform engineer). Specifically worked on Nest's cameras, thermostats, and security system.*

As individual contributor for an unreleased product:

- Architected the main control daemon for the device, routing requests received over an application-specific USB protocol to domain-specific handlers. [C++, Linux]
- Architected the splitting of the main daemon into two parts to improve boot time from 30s to 4s. Also architected the IPC that the two daemons used to communicate. [C++, Linux, sockets, Android init]
- Worked with vendor to resolve bugs and quirks of the USB Device Controller (UDC). [Linux]

As middleware team lead for Nest Thermostat:

- Designed and implemented a statically allocated asynchronous message passing API for use in FreeRTOS (no malloc!). [C++, FreeRTOS, concurrency]
- Organized and improved the unit testing efforts. [C++]
- Lead a team to implement a software simulator (i.e. device code compiled for x86\_64 Linux for faster development and unit tests). The simulator integrated 70% of the code that ships on the device. [C++, FreeRTOS, Python, Docker, Linux]
- Lead a team to implement a web service to make the simulator available through a browser for use by customer support agents. [Python, PostgreSQL, Docker, Sanic, Google Cloud, VNC, Vue, Typescript, Websockets]
- Dockerized the SDK/build, including moving legacy projects from Ubuntu 14.04 (EOL) to 18.04. [Python, Docker]

As platform engineer on Nest Secure:

- Refactored the hierarchical “wake lock” systems to improve reliability and handle various edge conditions. [C++, Linux kernel, concurrency]
- System tuning, measurement, and analysis in order to meet the systems battery life goals. [Linux tracing, custom tracing, cross-team collaboration]
- Solve and contribute to impossibly hard bugs (both user-space and kernel-space), which were often crashes with corrupted backtraces. [C++, ARM assembly, concurrency, code inspection]
- Solved NTP/time sync issues with device that was triggered by power management. [Linux kernel, custom tooling, NTP]

As camera software team lead (Nest Cam IQ):

- Designed and implemented an asynchronous message-passing API using Folly Futures and Executors as the basis for the event loop. [C++, Brillo, concurrency]
- Designed and implemented a “composable” event loop framework, allowing several event looping contexts to share the same thread but seemingly be in isolation. (Kind

of the opposite of thread pools.) [C++, concurrency, poll, epoll]

- Designed and implemented a finite state machine engine that integrated into the above event loop. [C++]
- Promoted a culture of “writing tests first.” [GoogleTest]
- Prototyped several and evaluated several language options (C++, C, Java, Clojure, Rust, Scala, and Go) and worked with team to select one.
- Drove OS selection by coordinating with all major stakeholders and navigating between Android, Yocto, and Brillo.

### **Amazon (Lab126) [Sr. Software Engineer, 4/2013-1/2015]**

Responsible for Amazon Echo device firmware, including board support, Bluetooth, audio, local ASR (Automatic Speech Recognition) integration, and system software (e.g. init system).

- Achieved target UX latencies by implementing CPU priorities on different processes using Linux CGroups. (This system has high CPU contention.) [Cgroups cpu and memory controllers, cgrulesengd, Linux tracing]
- Met deadlines on a “late” feature: a Bluetooth-connected remote control. Designed software to handle receipt of HID events, voice data, and OTA/DFU of remote firmware. This included the design and implementation of a custom Bluetooth protocol/profile. [BlueZ, C++, DBus, glib, gdbus-codegen]
- Implemented reliable boot-up and daemon restart by designing and implementing the migration from SysV Init to Upstart.
- Implemented project-wide unit test infrastructure, including discovery and a test runner. [GoogleTest]
- Lead a team to implement a read-only root filesystem. The change was deployed via OTA with a high reliability to thousands of test units. [OpenEmbedded, bitbake, shell scripting, Upstart]

### **Wolfson Microelectronics [Sr. Software FAE, 1/2013-3/2013]**

Responsible for integrating Wolfson codecs into customer platforms, focusing mostly on the Linux driver and enabling features.

### **Texas Instruments [Embedded Software Engineer, 8/2011-1/2013]**

OMAP Core Android Audio team, responsible for Linux audio drivers and Android framework adaptations.

- Reduced video jitter and allowed larger audio buffers by developing a synthetic clocking algorithm, dubbed “the time interpolator.” (Larger audio buffers use less power.) [C++, Linux tracing]
- Improved testing/verification methodologies by writing the omap-audio-tool, an audio engineering Swiss Army knife. It helped to quickly find audio driver defects for OMAP4 and OMAP5, and also improved communication during support requests. [C, ALSA, tinysalsa]
- Earned reputation for solving difficult, cross-domain bugs quickly.
- Freely shared knowledge and new techniques with team members, improving overall team productivity.

### **Trinity Audio Group [Lead OS Developer, 4/2010-8/2011]**

Their main product, Indamixx, was a custom Linux OS for Pro Audio work. It is based on Ubuntu and distributed via netbooks, laptops, USB sticks, and digital downloads.

- Bootstrapped transition to MeeGo including hardware adaptations, private repository

maintenance, and beta program. [Python, git, MeeGo tooling]

- Backported kernel, libdrm, and Xorg drivers to Ubuntu/Jaunty to support the new Intel Atom N450 Pineview processors. [Debian Packaging, bash, apt, pbuilder, git]
- Implemented a secured apt repository, complete with archive key signing. [apt, Apache, GPG]
- Optimized the Mixxx IIR filters through SIMD intrinsics to improve run-time performance on 32-bit CPU. [C++, Intel SIMD intrinsics, KCacheGrind]

### ***Stewart Systems [Plano TX, Mechanical Engineer, 8/2004-8/2011]***

Stewart Systems ([www.stewart-systems.com](http://www.stewart-systems.com)) manufactures conveyors and equipment for high-volume bread and bun production (e.g. 1000 buns/minute). Customers include Flowers, Bimbo, and Sara Lee.

- Saved 2,600 man-hours/year writing a Google-like desktop application to fetch drawings. [C++, Qt, SQLite, Python, regular expressions]
- Saved 350 man-hours/year by automating the creation of job-specific BOM's and engineering documentation. [Excel, VBA, XML]
- Saved 600 man-hours/year by writing scripts to check BOM's before release. [Python, COM, SQL, XML, XSLT, Access]

### ***APW Wyott [Dallas TX, Project Engineer, 10/1999-7/2004]***

APW Wyott ([www.apwwyott.com](http://www.apwwyott.com)) is a foodservice equipment manufacturer (toasters, holding drawers, etc). Customers include KFC, Taco Bell, Chili's.

- Solved product defect by modeling platen heating. [C++]
- Increased productivity with sheet metal bend calculator. [Excel]

### ***SASIB/Stewart Systems [Plano TX, Mech. Engineer, 7/1997-10/1999]***

Same as Stewart Systems (above). Primarily worked on conveyORIZED bread proofers.

## **PATENTS**

---

Peirsol, Kurt Wesley; Beddingfield, Gabriel; 2020; Pre-wakeword speech processing; U.S. Patent 10,643,606; Filed January 24, 2019 and issued May 5, 2020.

Peirsol, Kurt Wesley; Beddingfield, Gabriel; 2020; Pre-wakeword speech processing; U.S. Patent 10,192,546; Filed March 30, 2015 and issued January 29, 2019.

Kingdon, Charles J.; Beddingfield, Gabriel Michael; 2007; Apparatus and method for a chain motivated toaster with vertically aligned rollers; U.S. Patent 7,285,755; Filed August 6, 2004 and issued October 23, 2007.

Kingdon, Charles J.; Beddingfield, Gabriel Michael; 2007; Apparatus and method for a chain motivated toaster with vertically aligned rollers; U.S. Patent 7,285,754; Filed May 21, 2004 and issued October 23, 2007.

## **OPEN-SOURCE PROJECTS**

---

Hydrogen (drum machine), <http://hydrogen-music.org/> [2008-2009]

- Solved tricky, multi-threaded, real-time bugs for the 0.9.4 release (e.g. Hydrogen would get disconnected from JACK for taking too long in the audio callback) [C++, Doxygen for generating call graphs]
- Implemented Docbook/XML/POXML translation solution for the user manuals.

Stretchplayer, <http://riggable.com/stretchplayer/> [2010-2014]

A small media player that allows you to change the tempo of a song without changing its pitch, but also allows you to transpose the key of the song. (A “personal” project release)

Jack MIDI Clock, [https://www.teuton.org/~gabriel/jack\\_midi\\_clock/](https://www.teuton.org/~gabriel/jack_midi_clock/) [2009-2015]

A small utility to send MIDI clock pulses that are synchronized to the JACK transport (e.g. to synchronize the LFO or arpeggiator on a hardware synth). (A “personal” project release)

InConcert, <https://www.teuton.org/~gabriel/InConcert/> [2008-2010]

An experiment to make the JACK Transport slave to a tap-tempo input. (A “personal” project release)

JACK Transport Audit, [https://www.teuton.org/~gabriel/jack\\_transport\\_audit/](https://www.teuton.org/~gabriel/jack_transport_audit/) [2008-2010]

A development tool for testing code that needs to work with the JACK Transport. For example, it can verify that the program acting as Transport Master is doing its job correctly. It was originally written while debugging an issue with Hydrogen. (A “personal” project release)

## **EDUCATION**

---

B.S. Mechanical Engineering, U. of Tennessee (Knoxville), 1997