

# Gregory Martin Pfeil

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language design & implementation • total functional programming • agile development

Energetic, enthusiastic, and capable of providing the quality implied by the title of engineer, I am knowledgeable in language design and have a wide base of experience. I enjoy designing and building new tools for programmers and users that align with their particular domain and needs. These are often languages and libraries, but have also developed significant applications on many platforms. A strong and flexible part of any team, I am willing to take on less glamorous work to make sure the end result is of the highest possible quality.

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## Programming Experience

*Senior Software Engineer* – **Electric Coin Company** (Aug. 2022–June 2023)

- contributed to a cutting-edge cryptocurrency based on **zero-knowledge proofs** [[Zcash](#)];
- implemented and helped define improvements to the protocol, including a proportional fee algorithm [[ZIPs](#)];
- unified the internals of various **API** calls, making them behave more consistently across the **API**;
- improved reliability of the software by modularizing and increasing sharing between systems that have communication channels in common;
- added a **Nix** build to replace Bitcoin-inherited “reproducible” build system; and
- eliminated thousands of lines of **C++** code via modern abstraction (sum types, etc. rather than pointers and inheritance).

*Senior Software Engineer* – **Kittyhawk** (Oct. 2019–Apr. 2022)

- acted as tech lead of “tools” team, providing flight simulators, compilation tooling, etc.;
- led migration of various software systems;
- implemented & extended Conal Elliott’s **Compiling to Categories** paper, then used that to implement a Haskell to C compiler that propagated various guarantees (e.g., bit-wise identical results with the original Haskell, provable in-bounds access, etc.) [[Categorifier](#)];
- generalized Andy Gill’s **observable sharing** to support graphs with multiple roots, generalized folds, and type-indexed structures; and
- massively simplified existing **GUI** system to be more robust and consistent.

*Staff Software Engineer* – **Formation** (Sep. 2017–Oct. 2019)

- served as technical lead for both a functional team and one of the company’s production systems;
- conceived and authored a graph evaluator that could efficiently find every valid solution by taking advantage of **Haskell**’s semantics [[Workflow Engine](#)];
- received a “**RSPCT**” award, which “recognizes Formation team members who have gone above and beyond” (nominations are made by employees, with final selection by the leadership team);
- contributed to the **Dhall** compiler, including dependent types, universe tower, and universe polymorphism; and
- wrote a total recursion scheme library in **Dhall** [[Dada](#)].

*Backend Engineer* – **SlamData, Inc.** (June 2014–July 2017)

- was the first hire at the company;
- implemented an expression-based **SQL** compiler with extensions for **NoSQL** operations [[Quasar](#)];
- designed a flexible **compiler IR** that adapts to the capabilities of various backends;

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## Personal Accomplishments

- maintain many **Libre & Open Source** projects on **GitHub** and elsewhere, some with over 1,000 stars or hundreds of forks;
- developed an algebraic model of software failures & implemented libraries in multiple languages [[Beautiful Failures](#)];
- designed a total language that uses fixed-points for recursion [[Fix](#)];
- presented talks on category theory, compiler design, and recursion schemes at various conferences, some available on **YouTube**;
- wrote a cryptographic primitives library in **Idris**;
- created a family of languages based on various process calculi, implemented in **Common Lisp & Haskell** [[Kilns](#)];
- created an **avalanche risk mapping service**, which applies avalanche risk reports to maps, taking into account slope and aspect;
- acted as wearable computing domain expert for **NASA**’s Error Proof Flight Deck; and
- designed & built a personal wearable computer (in 1998).

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## Education

**James Madison University** (Aug. 1996–Nov. 1999)

- studied Music Composition & Computer Science and
- taught programming (Perl, CGI) workshops in the Computer Science department.

## Citizenship

- United States

- implemented multiple compiler backends, including **MongoDB**, **Spark**, & **JavaScript**;
- mentored other developers in advanced **functional programming** techniques;
- contributed to the **Scala** compiler & many Open Source libraries; and
- created a generalized recursion scheme library for **Scala** [[Matryoshka](#)].

*Senior Software Engineer – Clozure Associates* (Dec. 2007–June 2014)

- converted a prototype musical composition tool to a production-quality product [[Opusmodus](#)];
- contributed to the implementation of programming languages in **Haskell** for DARPA-backed computer security project, including compilation to an experimental hardware architecture and created applications to demonstrate novel security features like **information flow control** [[CRASH-SAFE](#)];
- developed data model and performed overall system optimizations on the correlation engine of a high-level network intrusion system;
- performed benchmarking and optimization of a large-scale airline reservation system [[ITA](#)];
- designed and implemented a financial term sheet simulator for the Evolvable Law project at Harvard's Berkman Center for Internet & Society;
- developed iOS applications for various clients, including a rebrandable news & information distribution system and a prototype assistive communications application for people with disabilities; and
- developed best-selling educational iOS games in **Objective-C** for toddlers [[Learning Touch](#)].

*Software Development Engineer 2 – Amazon.com* (Sep. 2004–Dec. 2007)

- conceived, designed, and developed a **declarative logic** system written in **Common Lisp** to simplify Website features while improving parallelism and performance [[Product Discovery Service](#)];
- revamped a **C++** content-scheduling system to add a **feedback-based learning** component, and to make it modular so third-parties could schedule new content [[Upsell Cart](#)];
- performed Weblab (A/B testing) experiments, acting as analyst in interpreting the data;
- personally responsible for millions of dollars in gross profit (as measured by Amazon's Weblab system);
- spearheaded skunkworks effort to support **Lisp** development; and
- wrote a generic structured-data retrieval service in **C++** to replace parsing of BDB values on the Web servers.

*Founder, Partner – Valent Solutions Inc.* (Dec. 2002–July 2004)

- performed custom application development for clients in disparate domains;
- managed projects of varying scale in **C++**, **Java**, and other languages for multiple clients, including managing customer expectations and project time lines.

*Senior Software Engineer – XML Global Research* (Nov. 1999–Dec. 2002)

- developed an ebXML Messaging engine;
- designed and developed a tracking system for stolen property in **Java**, used by a number of police forces, including the Vancouver Police Dept.;
- was brought in to assist on a native XML database written in **Java** [[GoXML DB](#)]; and
- designed and developed an XML-based context-sensitive **search engine**, prototyped in **Perl**, and productionized in **C++** [[GoXML Search](#)].