David R. Bild

CONTACT INFORMATION

520 W Roscoe St.
Apt 2W
Chicago, IL 60657 USA

Mobile: +1-505-818-7889
Email: david@davidbild.org
Web: www.davidbild.org

INTERESTS

Focused on using technology to solve real-world problems with innovative and practical solutions. Strong background in networking and security (e.g., security protocol design, ad-hoc, mesh, and overlay network design) and a personal interest in programming languages (e.g., static typing, functional languages).

During my PhD, I worked on censorship- and surveillance-resistant communication, ad hoc networks, social network analysis, integrated circuit reliability (e.g., NBTI), and integrated circuit testing.

PHD

University of Michigan – Ann Arbor, COMPUTER SCIENCE AND ENGINEERING **Jan. 2009 – Apr. 2014**

- Dissertation: Non-Hierarchical Networks for Censorship-Resistant Personal Communication
- Advisor: Professor Robert P. Dick

MS

Northwestern University, COMPUTER ENGINEERING **Sept. 2007 – Dec. 2008**

- Thesis: Static NBTI Reduction Using Internal Node Control
- Advisor: Professor Robert P. Dick

BS

Northwestern University, COMPUTER ENGINEERING **Sept. 2003 – June 2007**

- Cum Laude

TECHNOLOGY

Programming Languages	Scala, C++, C, Python, Java, Erlang, Go, Javascript.
Development Platforms	Linux, Buildroot, Android.
DevOps	AWS, Terraform, Docker, Ansible.
Networking	IPv6, SRv6, BGP/peering.
Kernel	eBPF, drivers, nftables.
Security	SOC2, TPM2.
Data	SQL (PostgreSQL, MySQL), Elasticsearch, Hadoop.
Optimization	MILP via AMPL, CPLEX, SYMPHONY.
Hardware Design	KiCad, VHDL, Verilog.

PROFESSIONAL EXPERIENCE

Xaptum, Inc., Chicago, IL

First engineering hire after Xaptum's $2.2mm seed raise in 2016, starting as a principal engineer and eventually becoming CTO. In addition to cultivating the engineering team, I spearheaded a major pivot as we sought product-market fit, culminating in our zero-trust overlay network architecture for IoT. Wore many engineering hats over six years (pre/sales, software, network, firmware, hardware, security) and managed a diverse set of employees, contractors, partners, and customers. Helped close first paying customers and partner supplier contracts.

Xaptum's scalable zero-trust, IPv6 overlay network isolates dispersed IoT/edge devices from threats on the public Internet. Early markets include railroad, digital signage, and remote sensing/monitoring. The backbone network hosts a variety of configurable network & security services. In essence, Xaptum is a SASE (Secure Access Service Edge) for IoT.

Some engineering design highlights include:

- An extensible core network backplane using segment routing (SRv6) and eBPF.
- Zero-touch identity & credential provisioning for high-volume devices in an untrusted supply chain, using TPM2.0 secure elements, DAA (direct anonymous attestation) group signature algorithm, and a custom authentication protocol (XTT).
- A plug-n-play network card to connect an IoT gateway to the Xaptum overlay, essentially a mini-PCIe form-factor single-board Linux computer incorporating a WiFi chipset and Xaptum *enftun* tunnel client.

Chief Technology Officer **Apr. 2020 – Mar. 2022**
Vice President, Product Delivery **Apr. 2017 – Mar. 2020**

Led engineering and product: directly managed the six-person engineering team, spearheaded a significant product pivot to the current overlay network, and was the primary customer-facing technical expert for both presales and sales.

- Managed the six-person engineering team (and numerous interns).
- Successfully spearheaded a product pivot from a pub-sub to a SASE product with a renewed focus on security.

- Architected key portions of the overlay network product, reviewed API designs, reviewed pull requests (in C, C++, Erlang, Elixir, Python, Terraform).
- Developed embedded Linux firmware for router card, Erlang HTTP/SOCKS proxy server, and the public-facing "docs" webpages.
- Managed hardware design engineers (contractors), component inventory procurement, contract manufacturing, and FCC/IC certification for Xaptum's hardware products.
- Managed production network (AS395470), peering relationships, contract network engineers and NOC services.
- Led technical integration for partnerships with multiple (5) IoT gateway manufacturers.
- Pre-sales engineer for all partner and customer contracts.
- Led integration and testing for partner and customer POCs and deployments.

Principal Product Architect **Sept. 2016 – Mar. 2017**

Led the production deployment of Xaptum network & product (AS395470, Equinix colo, peering relationships, 24/7 NOC, Azure, AWS) and continued to lead performance optimization efforts. Managed POCs and pilots with early partners.

- Deployed Xaptum's production network (AS395470), managed contract network engineers, transit contracts and peering, contract NOC for 24/7 monitoring. Hands-on lead for rack-and-stack.
- Designed and deployed a high-availability architecture using anycast, VRRP, and LAG, replacing a more-expensive and less-responsive round-robin DNS-based approach.
- Designed IPv6 address allocation plan for the Xaptum network.
- Hired and managed one engineer to maintain the message broker application.
- Coordinated performance optimization efforts across the core product.
- Technical expert (aka sales engineer) for pre-sales and partner discussions and testing.

Principal Product Engineer **Jun. 2016 – Aug. 2016**

Developed and optimized a low-latency, high-throughput message broker written in C++, while also introducing a culture of software-engineering best practices.

- Modernized the C++ codebase to eliminate entire classes of crash-inducing bugs (C++98 to C++11/14, ACE to Boost ASIO).
- Replaced a byzantine home-grown build script with CMake to reduce the time-to-first-commit for new developers.
- Introduced best-practices like automated unit & integration testing, CI/CD pipelines, and code reviews, preventing outage-causing bugs from reaching production, a previously common problem.
- Added internal metrics collection, export, and display to assist with detection and diagnosis of performance issues.

Tellur, Inc., Chicago, IL

Co-founder **Jan. 2015 – Apr. 2016**

A virtual assistant for improving personal finance. Users create tasks instructing Tellur how to watch and respond to account activity: warn me when I overspend my monthly "restaurant" budget or remind me to move part of my paycheck into my IRA.

- Designed and implemented all backend APIs, task execution, notification delivery, and Intuit data integration.
- Designed the type system and language underlying the Tellur custom task builder. Assisted co-founder with front-end implementation.
- Developed a free monad-based Scala library for typesafe, composable, referentially transparent, and testable usage of the Intuit Transactions API [S6].
- Configured and maintained all AWS infrastructure (VPC, EC2, RDS, EBS) and services (S3, Cloudfront, Route53) using a combination of Cloudformation and Ansible.
- Developed a Python library for concise, composable, and programmatic declaration of Cloudformation templates [S7].
- Coordinated pre-launch security assessment with third-party security firm.

Cardcast, LLC, Chicago, IL

Co-founder **Mar. 2014 – Dec. 2020**

A multi-player card game for the Google Chromecast, including both Android and iOS sender applications (>250,000 installs) and a website for custom deck creation (>50,000 MAU).

- Developed Android "sender" application for players to interact with the Chromecast game.
- Configured and maintained all AWS infrastructure (EC2, EBS) and services (S3, Cloudfront, Route53).
- Reduced PHP+MySQL API response latencies to target levels by making judicious use of indices and denormalized views maintained by triggers.
- Prepared quarterly sales tax and annual income tax filings.

University of Michigan, EECS Dept., Ann Arbor, MI

Graduate Student Research Assistant **Jan. 2009 – Feb. 2014**

- Designed a protocol to detect Sybil attacks in ad hoc wireless networks [J1, T13]. Implemented for the Linux kernel [S9].
- Developed statistical models of user behavior in Twitter and characterized the structure of the retweet graph [J2].
- Designed a censorship-resistant ad hoc microblogging protocol [C4, C6, T16]. Implemented for Android [S11, S12].
- Designed an event-tracing tool to optimize smartphone application and platform performance [C5]. Implemented for Android [S10].
- Designed an Fmax testing method to reduce test time from linear to constant in the number of DVFS voltages [T17].

Northwestern University, EECS Dept., Evanston, IL
Research Assistant **Sept. 2007 – Dec. 2008**
- Developed an internal node control-based technique to reduce NBTI degradation in idle functional units [J3, C7].
- Developed a temperature-aware testing scheduling algorithm [C8].

Sandia National Laboratories, Albuquerque, NM
Intern **June – Sept. 2007**
Supported the design and test of an FPGA-based high-throughput data processing module for a space application:
- Developed scripts to control a module tester and automate common tests and developed a GUI to ease human control of the tester.
- Redesigned and implemented control logic for the tester's control FPGA to improve test automation capabilities.
- Designed a clock detection circuit for an FPGA.

Intern **June – Sept. 2006**
Supported design and test of an FPGA-based high-throughput data processing module for a space application:
- Designed an automated assertion-based testbench for simulation-based functional verification of a system-board containing multiple FPGAs.
- Manually validated PCB Gerber artwork against the schematic netlists.

Intern **June – Sept. 2005**
- Developed core assets (e.g., reusable software components) to support the implementation of a product-line approach to software development.
- Wrote data-verification and comparison software to support a database merger.

Northwestern University Information Technology, Evanston, IL
Student Manager **Mar. 2005 – June 2007**
- Managed a team of $\sim$13 students who provided phone-based and on-site troubleshooting for the audio-visual equipment in Northwestern's "smart" lecture halls.
- Responsibilities included training, performance evaluation, discipline, shift scheduling, and website maintenance.

Tech Support Consultant **Sept. 2004 – Feb. 2005**
- Provided phone-based and on-site support to faculty using the audio-visual equipment in Northwestern's "smart" lecture halls.
- Supported users in Northwestern's public computer labs.

Teaching Experience

University of Michigan – Ann Arbor, DEPT. OF EECS **Winter 2009**
Graduate Student Instructor, *Digital Integrated Circuits (EECS 312)*
Provided instructional support to students by conducting weekly discussion sessions, holding weekly office hours, and helping with preparation of homework and laboratory assignments.

Northwestern University, DEPT. OF EECS **Spring 2008**
Teaching Associate, *Introduction to Computer Engineering (EECS 203)*
Provided instructional support to students by administering and grading weekly laboratory assignments, conducting weekly office hours, and giving occasional lectures when the assigned instructor was unavailable.

Open Source Software

[S1] cp2130: a Python library for the Silicon Labs CP2130 USB to SPI bridge chip.
(https://github.com/drbild/cp2130/)

[S2] json2yaml: cli utilities for order-preserving conversions between json and yaml.
(https://github.com/drbild/json2yaml/)

[S3] nscala-money: a Scala wrapper for the Joda Money Java library.
(https://github.com/nscala-money/nscala-money/)

[S4] sslpsk: adds TLS-PSK support to the Python ssl package. (https://github.com/drbild/sslpsk/)

[S5] tristate: a Scala Option with both implicit and explicit None. (https://github.com/drbild/tristate/)

[S6] scintuit: async, modaic, sanely-typed Scala library for the Intuit Customer Account Data API (*unmaintained*). (https://github.com/drbild/scintuit/)

[S7] stratiform: Python library for concisely creating AWS CloudFormation JSON templates (*deprecated*). (https://github.com/drbild/stratiform/)

[S8] c2dm4j: a Java library for the Android Cloud to Device Messaging (C2DM) server api (*deprecated*). (https://github.com/drbild/c2dm4j/)

RESEARCH SOFTWARE

[S9] The Mason Test: Sybil-detection for ad hoc wireless networks. (https://github.com/EmbeddedAtUM/mason)

[S10] Panappticon: Event-based tracing to measure Android application and platform performance. (https://github.com/EmbeddedAtUM/panappticon)

[S11] 1am: Censorship-resistant microblogging for Android (formerly *Shout*). (http://1am-networks.org/)

[S12] MANES: a Mobile Ad hoc Network Emulation System. (http://whispercomm.org/manes/)

JOURNAL PUBLICATIONS

[J1] Y. Liu, **D. R. Bild**, R. P. Dick, Z. M. Mao, and D. S. Wallach, "The Mason Test: A Defense Against Sybil Attacks in Wireless Networks Without Trusted Authorities," *IEEE Trans. Mobile Computing*, 14(11):2376–2391, Nov. 2015.

[J2] **D. R. Bild**, Y. Liu, R. P. Dick, Z. M. Mao, and D. S. Wallach, "Aggregate Characterization of User Behavior in Twitter and Analysis of the Retweet Graph," *ACM Trans. Internet Technology*, 15(1):1–24, Feb. 2015.

[J3] **D. R. Bild**, G. E. Bok, and R. P. Dick, "Static NBTI Reduction Using Internal Node Control," *ACM Trans. Design Automation of Electronic Systems*, 17(4):1–30, Oct. 2012.

CONFERENCE PUBLICATIONS

[C4] Y. Liu, **D. R. Bild**, D. Adrian, G. Singh, R. P. Dick, Z. M. Mao, and D. S. Wallach, "Performance and Energy Consumption Analysis of a Delay-Tolerant Network for Censorship-Resistant Communication," *Proc. Int. Symp. on Mobile Ad Hoc Networking and Computing*, June 2015.

[C5] L. Zhang, **D. R. Bild**, R. P. Dick, Z. M. Mao, and P. Dinda, "Panappticon: Event-Based Tracing to Optimize Mobile Application and Platform Performance," *Proc. Int. Conf. Hardware/Software Codesign and System Synthesis*, Sept. 2013.

[C6] **D. R. Bild**, Y. Liu, R. P. Dick, Z. M. Mao, and D. S. Wallach, "Using Predictable Mobility Patterns to Support Scalable and Secure MANETs of Handheld Devices," *Proc. Int. Wkshp. Mobility in the Evolving Internet Architecture*, Jun. 2011.

[C7] **D. R. Bild**, G. E. Bok, and R. P. Dick, "Minimization of Static NBTI Degradation Using Internal Node Control," *Proc. Design, Automation, and Test in Europe Conf.*, Apr. 2009.

[C8] **D. R. Bild**, S. Misra, T. Chantem, P. Kumar, R. P. Dick, X. S. Hu, L. Shang, and A. Choudhary, "Temperature Aware Test Scheduling For Multiprocessor Systems-on-Chip," *Proc. Int. Conf. Computer-Aided Design*, Nov. 2008.

PATENTS

[P9] I. Guberman, **D. R. Bild**, Z. V. Beckwith, P. S. Barthur, V. Srinivasan, and R. Pasam, "Communication System and Method for Machine Data Routing", U.S. Patent 11 057 352, Jul. 6, 2021.

[P10] **D. R. Bild**, P. S. Barthur, I. Guberman, Z. V. Beckwith, G. W. Grube, M. F. DeRango, and V. Srinivasan, "Scalable and Secure Message Brokering Approach in a Communication System", U.S. Patent 10 965 653, Mar. 30, 2021.

[P11] P. S. Barthur, **D. R. Bild**, Z. V. Beckwith, G. W. Grube, and M. F. DeRango, "Virtualization with Distributed Adaptive Message Brokering," U.S. Patent 10 924 593, Feb. 16, 2021.

[P12] **D. R. Bild** and M. F. DeRango, "Enforcing Geographic Restrictions for Multitenant Overlay Networks," U.S. Patent 10 912 053, Feb. 2, 2021.

TECHNICAL REPORTS

[T13] Y. Liu, **D. R. Bild**, and R. P. Dick, "Extending Channel Comparison-based Sybil Detection to MIMO Systems," Dept. of Electrical Engineering and Computer Science, University of Michigan, Tech. Rep. CSE-TR-584-13, Nov. 2013.

THESES

[T14] **D. R. Bild**, "Non-Hierarchical Networks for Censorship-Resistant Personal Communication," Ph.D. Dissertation, Dept. of Electrical Engineering and Computer Science, University of Michigan, Ann Arbor, MI, USA, Apr. 2014.

[T15] **D. R. Bild**, "Static NBTI Reduction Using Internal Node Control," Master's Thesis, Dept. of Electrical Engineering and Computer Science, Northwestern University, Dec. 2008.

PAPERS IN PREPARATION

[T16] **D. R. Bild**, Y. Liu, R. P. Dick, Z. M. Mao, and D. S. Wallach, "Performance Analysis of Location Profile Routing".

[T17] **D. R. Bild**, R. P. Dick, and S. Prejean, "F_{max} Testing for Integrated Circuits Supporting Dynamic Voltage and Frequency Scaling".

TALKS

[1] Erlang & Elixir Factory, San Francisco, California, *Life on the Edge: Scaling the Internet for IoT*, Mar. 23, 2017.

[2] Erlang & Elixir Factory, San Francisco, California, *Anonymous Attestation for IoT Security*, with Z. V. Beckwith, Mar. 23, 2017

[3] Intel Corporation, Santa Clara, California, *Temperature-Aware Test Scheduling for Multiprocessor Systems-on-Chip*, Nov. 11, 2008.

AD HOC REVIEWER

ACM Transactions on Embedded Computing (TECS).
ACM Transactions on Design Automation of Electronic Systems (TODAES).
IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems (TCAD).
IEEE Transactions on VLSI Systems (TVLSI).
IEEE Wireless Communication Letters (WCL).
Social Network Analysis and Mining (SNAM).
Asia and South Pacific Design Automation Conference (ASPDAC).
Design, Automation, & Test in Europe Conference (DATE).
Design Automation Conference (DAC).
International Conference on Computer-Aided Design (ICCAD).
Conference on Computer and Communications Security (CCS).

HONORS AND AWARDS

Cabell Endowment Fellowship, Northwestern University, Evanston, IL.	**2007–2008**
Dean's List, Northwestern University, Evanston, IL.	**2004–2007**
National Merit Scholar.	**2003–2007**
Tau Beta Pi Engineering Honor Society.	**2005**
Eta Kappa Nu ECE Honor Society.	**2005**
Eagle Scout, Boy Scouts of America.	**2003**
Mathcounts National Competition, represented New Mexico.	**1999**

PROFESSIONAL SOCIETIES

Institute of Electrical and Electronics Engineers (IEEE).	**2008–present**
Association for Computing Machinery (ACM).	**2006–present**
Order of the Engineer.	**2007**

COMMUNITY INVOLVEMENT

Chicago Public Schools Student Science Fair, *Judge*. **2015–present**