

# Curriculum Vitæ

Perry Kundert, Researcher +1-780-970-8148

## BSc, Computer science.

**University of Calgary, '84-'89, FT.** Focussed on Computer Graphics, Computational Geometry, and specialized in event-driven real-time programming. Employed by the university as a Tutorial Assistant after my first year, teaching undergraduate programming. Also employed by a professor, for whom I wrote my 3rd graphical computer “window system”, controlling advanced visualization hardware.

In the subsequent decades, my specialization has been in the R&D of highly reliable industrial control and monitoring systems. Extensive and deep C++ (20+ years), Python (10+ years) and useful Javascript, Rust, and WASM knowledge, developing and deploying complex, decentralized, geographically distributed and remotely managed systems. Experience with containerization, and its benefits and limits.

Embedded systems and electronics is also a passion, and I can work effectively in any R&D environment, from an oscilloscope, soldering iron and assembly language, to reverse-engineering protocols using a network traffic monitor, developing a Linux kernel module for new hardware, or building, testing and advancing existing systems using anything from emacs over ssh, to a modern IDE.

## Developer, HP “RTAP” (SCADA System)

**Hewlett Packard Corporation, '89-'96, FT.** Industrial monitoring and control software system design and implementation. Lead designer and implementer of the HP RTAP Alarm System, which is still considered “State of the Art”, 15 years after completion. The system is still in wide use throughout the world today, controlling (for example) the world’s largest fluids pipeline.

A key design feature is the use of DFAs -- Deterministic Finite Automata -- to model the various “alarms” provided in typical control systems, and then using that platform to allow control system designers to create their own custom state machine definitions to describe cause-and-effect machines of virtually unlimited complexity. Using thousands of these simple and reliable logical machines, robust distributed monitoring, decision and response systems can be created.

## Regional Vice President

**Primerica Financial, '96-'01, FT.** Sales and research of financial products and training & mentoring new full-time financial counselling and sales staff. After several years, however, I began to miss the excitement and stimulation of Research and Development, so we retired from the business and transitioned our team into another successful office.

### Computer “Science”...

*is still in its infancy. Most techniques presently employed in software development could at best be considered “Crafts”, with occasional glimpses of what might pass as “Engineering Discipline”. I was fortunate to have entered the field while it was most vibrant, in the 80s and 90s. The explosion of Linux opened vistas of large scale computation to small enterprises, and then Git moved software development from the Cathedral to the Bazaar. Now, robust and powerful computational, AI and communication resources make it possible to build systems in ways unimaginable just a short time ago.*

Education & Skills

Research & Development

## System Architect, LiveWIRE (Communications)

**Enbridge Pipelines Inc., '02-'09, FT.** As the scale and complexity of their pipeline system increased, Enbridge had outgrown their “primary/backup” switched communications scheme (a design still considered “industry standard”). I designed a robust communications protocol using advanced loss encoding and error correction (Reed-Solomon based, as used for deep-space communications systems). The resultant system automatically handles massive failure and corruption across multiple communications links, while maintaining real-time monitoring and control for the system operators in multiple control centres simultaneously. Results were published in an industry periodical.

Simultaneously with the protocol development, a firmware, OS and custom software stack was developed for a custom solid-state RTU (Remote Terminal Unit), to interface with all field equipment and coordinate all available communications channels using the new protocol. Several software development techniques used (and several “industry standard” techniques which were avoided...) resulted in a defect rate delivered into production of less than 1 defect per 10,000 lines of code. These units have continued to run reliably for years at a time, in hundreds of remote and rugged installations. Most importantly, due to continuous upgrades throughout the system, the software was designed to be extremely robust in the face of remotely initiated upgrades and configuration changes.

## Designer, Solar & Geothermal Systems

**Various, '09-'17, FT/PT.** I have designed and built custom Solar, Geothermal and bulk heat storage systems for efficient residential heating and cooling. One of the most interesting systems includes a 1,500 gallon insulated bulk tank (an ex- milk storage tank) installed in the basement, with custom computer controlled pumping and heat exchanger mechanisms to coordinate the efficient collection and storage of low-grade heat for later use.

More recently, application of research results such as Fanger’s equations for thermal comfort to heating/chilling control systems have the potential to yield significant energy savings and improvements in comfort to residents of large institutional and multi-tenant buildings.

This research has produced some important results and some exciting prospects for industry-changing R&D and commercialization, with patentable technology likely to result...

## Integrator, Industrial Control Systems

**Various, '09-'17 FT/PT.** Designed, managed development and implementation and supervised commissioning of plant communications, controls systems and software. Developed a flexible foundation for implementing industrial PLC monitoring and controls, with soft real-time monitoring and control via standards-compliant web browsers, running on NEMA-4x rugged touch-screen embedded PCs. Designed, implemented, deployed and

### *What? No Thermostats?*

*Throughout recent history, home comfort control has been dominated by the Thermostat... with mixed results. This entire home is instrumented with robust high precision temperature sensors in floors, walls and ceilings. The custom solid-state control system continuously runs a real-time thermodynamic simulation of the home, to predict and react to internal and external temperature and humidity changes. The result is a room-by-room custom heating and cooling plan that optimizes perceived skin-temperature thermal gain and loss, instead of just controlling the air temperature -- it controls for what you “feel” like when the windows and walls are heated and cooled by external environmental changes, instead of just always trying to keep air temperature constant.*

commissioned communications and high/low voltage industrial control and monitoring systems in industrial settings.

I have developed a general-purpose state-machine based binary protocol parser foundation in Python, and successfully implemented key sections of the Rockwell EtherNet/IP CIP Controller protocol using it.

Several commercial products have been developed and are presently available on the market using the results of this R&D, including the most capable [Python EtherNet/IP CIP protocol parser](#) presently available, the fastest [general-purpose Reed-Solomon FEC](#) (Forward Error Correction) and [error-correcting geolocation coding](#) implementation presently available in C++ and Javascript.

### *The PLC Protocol Dilemma*

*Certain PLC vendors have achieved unprecedented market penetration and growth in industrial control, with protocols that can only be most charitably described as "questionably useful". While providing great utility to the integrator through highly developed PC-based configuration software, the protocol's complexity and lack of internal consistency makes correct implementation almost impossible, calling into question the code running in safety-critical installations world-wide. The recent Stuxnet attack, and revelation of dozens of attack vectors "fixed" in recent patches validates our concerns. We expect more headline-making events to come...*

## **Digital Signal Processing for Aerial Meter Reading Platform**

**clearGRID Ltd, '17-'22, FT.** Developed a real-time software-defined-radio signal processing platform, for large-scale aerial meter reading of gas, electric and water meters. Developed in C++, and capable of processing 25msps of 2x16-bit I/Q signal data in real-time on stock Intel/ARM CPU platforms. Extensive use of high-thruput multi-threaded C++ and Intel AVX and Arm NEON intrinsics for accelerating processing of the signal data.

## **Distributed Consensus, BFT, CAP Theory and Cryptocurrency**

**Personal & Holo Ltd, '91-'23 FT/PT.** For almost 30 years, a personal research topic has been the application of distributed consensus algorithms to parallel processing. From Lamport's Timestamps through Vector Clocks, these attempts met with failure. Global lock-step consistency appeared to be a pipe-dream, but has become a foundational principle of virtually every modern cryptocurrency — even though CAP theory prohibits the idea.

I joined the Holo projects and did R&D on [Holochain's](#) pioneering "Agent-centric" distributed systems model, with potential aggregate capacity of billions of transactions per second — *even during network partitions*. I developed prototype Rust (WASM) and Javascript implementations of the core transaction engine for Holo's *Holo-Fuel* cryptocurrency, in close collaboration with the core Holochain team, which is now about to enter public Beta testing. I developed a powerful [SLIP-39 cryptocurrency wallet security App](#). I'm also proficient in [EVM contract development, verification and testing using Solidity](#), and understand the [constraints of global-consensus platforms](#). I have [long experience](#) simulating, [testing and modelling](#) novel cryptocurrency systems.

## **Critical Vulnerability Mitigation**

**Computronix Inc, '24 FT.** Analyzed, implemented and tested mitigations to serious security issues in a widely used collaboration product. The mitigation has been deployed successfully to cities and states globally.

## **Wireless communication and remote monitoring**

**Zinger Rentals, '23-Present PT/FT.** Developed, integrated and deployed a system for provisioning remote oilfield sites with satellite internet, wireless communications and AI-monitored video surveillance. This product is widely deployed to oilfield sites in Alberta.