# *Curriculum Vitae et Studiorum*

## David J. Bacon

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## Contact and Personal Data

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| Web | setl.org |
| Date of Birth | December 24, 1955 |
| Citizenship | Canadian |

## Education

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| Ph.D. Computer Science | New York University, 2000 [2] |
| M.Sc. Computer Science | University of Toronto, 1985 [1] |
| B.Sc. Computing Science | University of Alberta (Edmonton), 1977 |

## Strengths and Skills

- Broad computer science knowledge

- Simulation, modelling, and rapid prototyping

- Concurrency, IPC, and all things POSIX, QNX, and other Unix

- High- and low-level programming languages

- Network configuration and security

- Virtual machines and containers

- Real-time and embedded systems

- Data processing (it's all about the mappings)

## Weaknesses and Deficiencies

- Highly allergic to Windows

## Employment History (in reverse order)

### Contractor (Oct 2018–May 2019, Oct 2019–Aug 2020), Wabtec

- Design and implementation of the infrastructure layer of GE Transportation's new Modular Control Architecture (MCA) for locomotive control.

- Provision of ARCNET services for MCA by a Linux server (based the above infrastructure) that uses a kernel device driver and reuses code from a QNX device driver. Also an unsolicited contribution I call "Virtual Arcnet" which uses UDP over a Docker network to simulate real arcnets and thereby support full testing of applications.

- Realization of all serial-line (HDLC and UART, synchronous and asynchronous) protocols (ACP, LSI, etc.) for MCA, interfaced as a DDS service, and again based on legacy code and my new infrastructure layer.

### Contractor (Jan 2016–Dec 2016), GE Transportation

- NetBSD kernel programming to emulate HP-UX running on a virtual M68000 to support a crucial legacy build system

- VPN-like virtualization of NFS and other TCP/IP services over secure networks (bit of a technical lark, this)

### Lead Software Engineer (Mar 2012–May 2015), GE Transportation

- Real-time locomotive control software and build system development for GE's Common Control Architecture (CCA), first as a contractor through Jan 2013 and then as a full-time permanent employee

### Research Assistant (Feb 2008–Aug 2010), UCCS

- Research on vision and navigation algorithms for micro-UAVs

- Implementation of a clock synchronization method for ZigBee mesh networks

- Investigation of a novel way to control a CMOS camera shutter to facilitate motion deblurring

## Contractor (Aug 2006–Dec 2007), GE Transportation

- Real-time control software for diesel-electric locomotive systems

- Educating GE employees on concurrency in general and on the QNX operating system in particular

## Field Applications Engineer (Aug 2001–Mar 2006), QNX

- Technical and sales support for the QNX Neutrino real-time operating system

- Seminars, presentations, some software development

## Member of Technical Staff (Feb 2000–Jun 2001), Lucent

- Specified, designed, prototyped, and helped implement an integrated development environment (IDE) for LUxWORKS, a proprietary software tool for building and debugging embedded systems containing multiple DSP cores and microcontrollers

## Instructor/Researcher (Dec 1995–May 2000), Lehigh U

- Under the titles Visiting Professor, Temporary Professor, and then Adjunct Professor (Jan 1999–May 2000), taught the following courses for the Electrical Engineering and Computer Science (EECS) department:

  - Programming Languages (junior)
  - Assembly Language Programming (junior)
  - Network Programming (senior)
  - Advanced Operating Systems (graduate)

- Under the titles Research Associate and then Research Engineer (Dec 1995–Dec 1998):

  - Designed and developed a distributed system for multi-client, Web-based pan/tilt/zoom camera control and streaming video

- Taught the junior-level Assembly Language Programming and graduate-level Advanced Operating Systems courses cited above
- Conducted independent research in robotics, programming languages, real-time systems and networks
- Designed and implemented the hardware and software to control PWM-based robotic actuators, with Web interface and management GUI
- Made significant extensions to the SETL programming language

## Research Scientist (Sep 1994–Nov 1995), NYU

- Consulted, designed, and programmed for the Pad++ "ZUI" (Zooming User Interface) project [7], in collaboration with Drs. Ben Bederson, Ken Perlin, and Jim Hollan

- Embedded the KPL, STk, and SETL programming languages as alternatives to Tcl/Tk and C++ in the Pad++ system

- Created several demonstration applications

## Chief Software Engineer (Jun 1991–May 1994), NYU

- Designed and implemented The Muse, a full real-time music sequencer featuring variable pitch and harmony screen, in accordance with the "Music as a Motivator for Mathematics and Science" program conceived by Dr. Jack Schwartz, administered through the Fund for New York Public Education, and sponsored by IBM

- Provided support for the teachers and students using this program

- Coordinated with Dr. Schwartz and the writer of the associated curriculum materials on documentation, setup and use

- Designed and implemented a translator of SETL to C++ that allowed C++ code to be embedded in SETL programs

- Made numerous SETL language and compiler enhancements

## Research Associate (Oct 1988–Aug 1990), UMCP/NIST

At the Center for Advanced Research in Biotechnology (CARB), with Dr. John Moult:

- Independent research in protein structural modeling and energetics

- Solid and interactive 3D graphics

- Systems programming and support

- Scientific applications programming

- SETL compiler and run-time system (in C)

- Package for the visualization and manipulation of early-stage X-ray "area detector" data [9]

- Algorithm for "docking" large molecules and ligands [6]

- Partial prediction of protein structures from their sequences [8]

- Faster 3D graphics algorithms [4, 10]

## Programmer-Analyst (Jan 1980–Aug 1984, Sep 1985–Sep 1988), U of A

- Independent research in molecular biology and protein modeling

- Assistance to Dr. Wayne Anderson in X-ray crystallographic studies of proteins and protein-DNA interactions

- Graphics

- Statistics

- Systems programming

- A database extension language ("E3") for associative and hierarchical data manipulation in Fortran, C, and Algol 68 programs

- Algorithm for the alignment of multiple protein amino acid sequences [3]

- A new dynamic memory allocation method [1]

- Graphics package ("RASTER3D") for showing molecules as solids [4, 5]

- Algorithm for locating heavy atom sites using information from crystallographic "difference Patterson" maps

- Efficient, robust line communications protocol

- Mathematical typesetting program

- Implementation of a "phased translation" search function [11] for use in protein X-ray crystallography

- Prototype SETL compiler (coded in SPITBOL)

### Member of Scientific Staff (Jul 1977–Jun 1979), BNR

- Design and development of PBX telephone system control software

- Technical writing

- SL-1 compiler support

- Several new features added to the SL-1 PBX

- Microfiche listing package

- Entire system software of a standalone Call Detail Recording computer serving many PBX machines

- Design of a message-passing, real-time operating system and call processing monitor for the Electronic Key Telephone System (EKTS)

### Research Assistant (May 1976–May 1977), U of A

- Design and implementation of a medium-scale adaptive database system

- Empirical study of some algorithms for detecting negative cycles in directed graphs

## Professional Interests

Within computer science, my main interests are:

- Programming languages, particularly SETL [12]

- Networks and distributed computing

- Software architecture, engineering, and design patterns

- Scientific programming and analysis

- Signal processing

- Operating systems

- Virtualization

- Real-time systems and control

- Compilers

- Algorithms

- Data structures

- Complex data processing

## Hobbies and Other Interests

Hang gliding, violin, and anything my wife feels like doing.

## Publications and Other Literature Cited

Refereed articles co-authored by David Bacon are indicated by an asterisk (*).

[1] David J. Bacon. Dynamic storage allocation. Master's thesis, University of Toronto, September 1985.

[2] David J. Bacon. *SETL for Internet Data Processing*. PhD thesis, New York University, January 2000. Defended 9 Dec 1999. No changes requested by dissertation committee. Available on-line in typeset form (PostScript, DVI, and PDF formats) and hypertext (with links into the on-line "library" documentation of my implementation of the SETL programming language) at http://www.cs.nyu.edu/bacon/phd-thesis/.

[3] *David J. Bacon and Wayne F. Anderson. Multiple sequence alignment. *J. Mol. Biol.*, 191:153–161, 1986.

[4] *David J. Bacon and Wayne F. Anderson. A fast algorithm for rendering space-filling molecule pictures. *J. Mol. Graphics*, 6:219–220, 1988. Abstract of paper presented at the Seventh Annual Meeting of the Molecular Graphics Society, San Francisco, 10–12 August 1988.

[5] David J. Bacon and Wayne F. Anderson. A fast algorithm for rendering solid objects and shadows, and its application in making pictures of molecules. Unpublished manuscript, 1991.

[6] *David J. Bacon and John Moult. Docking by least-squares fitting of molecular surface patterns. *J. Mol. Biol.*, 225:849–858, 1992.

[7] *B. Bederson, J. Hollan, K. Perlin, J. Meyer, D. Bacon, and G. Furnas. Pad++: A zoomable graphical sketchpad for exploring alternate interface physics. *Journal of Visual Languages and Computing*, 7:3–31, 1996.

[8] *Krzysztof Fidelis, Peter S. Stern, David J. Bacon, and John Moult. Comparison of systematic search and database methods for constructing segments of protein structure. *Protein Engineering*, 7:953–960, 1994.

[9] *Irene Kaplan, David J. Bacon, Osnat Herzberg, and Gary L. Gilliland. XENVIEW - an interactive program to display and analyze electronic area detector data. *J. Appl. Cryst.*, 24:196, 1991.

[10] *Ethan A. Merritt and David J. Bacon. Raster3D: Photorealistic molecular graphics. In *Methods in Enzymology*, volume 277, pages 505–524. Academic Press, San Diego, CA, 1997.

[11] R.J. Read and A.J. Schierbeek. A phased translation function. *J. Appl. Cryst.*, 21:490–495, 1988.

[12] J.T. Schwartz, R.B.K. Dewar, E. Dubinsky, and E. Schonberg. *Programming with Sets: An Introduction to SETL*. Springer-Verlag, New York, NY, 1986.