COMPUTER SCIENCE

DISTINGUISHED LECTURE 2015

The Oberon System on a Field-Programmable Gate Array (FPGA)

Abstract

The programming language Oberon was designed around 1988 with the intent to create a simple, yet powerful vehicle for effective teaching. Clarity of concepts, economy of design, and rigorous definition were the main goals. It was designed and implemented by (only) J. Gutknecht and N. Wirth within about 2 years, and it followed in spirit its ancestor Algol 60.

Within this time, also a modern operating system was implemented. Together with the compiler, with a text system and a graphics editor, it was described in a single, comprehensive book of 500 pages.

The book soon ran out of print. But 25 years later, requests arose to republish this work. The main obstacle was that the used, then modern microprocessor had vanished. It appeared as unavoidable to design a new compiler. We did so, but not for any popular, complex, commercial part, but for a simple design of our own, extending the project down into the realm of hardware. The decision was facilitated by the availability of configurable components, so-called Field Programmable Gate Arrays, non-existent 25 years ago.

This processor follows the principles propagated by the Reduced Instruction Set Computer movement of the 1980s, in particular the ARM. We call it the RISC. It is a 32-bit architecture with 16 main registers and some 16 instructions.

The RISC was implemented on a Spartan-3 low-cost development board, which adds 1 MByte of memory, ample for the entire Oberon System. The old disk store is represented by a small SD-card. In order to establish an entire computer, only a monitor, a keyboard, and a mouse are required.

DATE
20 January 2015
Tuesday

TIME
4:00 - 5:30 pm

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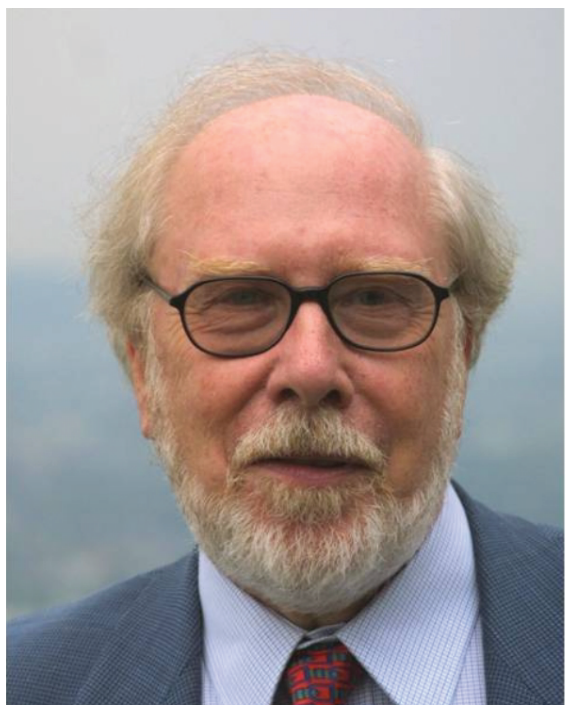

Prof. Niklaus Wirth

Turing Award Laureate

Biography

Niklaus Wirth was born in Winterthur, Switzerland, in 1934. He studied electrical engineering at ETH (Federal Institute of Technology) in Zürich, graduated in 1959, received an M.Sc. degree from Laval University in Quebec, and a Ph.D. from the University of California at Berkeley in 1963.

Wirth has been an Assistant Professor of Computer Science at Stanford University (1963-67) and, after his return to Switzerland, a Professor of Informatics at ETH from 1968 – 1999. His principal areas of contribution were programming languages and methodology, software engineering, and design of personal workstations. He has designed the programming languages Algol W (1965), Pascal (1970), Modula-2 (1979), and Oberon (1988), was involved in the methodologies of Structured Programming and Stepwise Refinement, and designed and built the workstations Lilith, with high-resolution display, mouse, and high-level language compiler in 1980, and Ceres in 1986.

He has published several text books for courses on programming, algorithms and data structures, and logical design of digital circuits. He has received many prizes and honorary doctorates, including the Turing Award (1984), the IEEE Computer Pioneer (1988), the Award for outstanding contributions to Computer Science Education (acm 1987), and the IBM Europe Science and Technology Award in 1989. (www.inf.ethz.ch/personal/wirth)

The A.M. Turing Award, sometimes referred as the "Nobel Prize" of Computing, was named in honor of Alan Mathison Turing (1912–1954) who made fundamental advances in computer architecture, algorithms, formalization of computing, and artificial intelligence. It is the annual prestigious technical award, given by the Association for Computing Machinery, for major contributions of lasting importance to computing.

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