

From Ideas to Practice

25 Feb 2021

- (1) System F to Java
- (2) type soundness to Java
- (3) garbage collection to Java
- (4) delimited continuations to JS/JS*
- (5) intermediate rep. for imp. compilers
- (6) program verification & semantics
- (8) discussion

delimited constructions to JSLs

1974 run in BcPL/os

1984 } MF in "511"

1988 } APL "prompt"

1990 shift & reset

1992 N variants: Queinac,
Hids & Dybuig, Filinski

2007 reconcile cell/c w/ "prompt"

2010 JSLs *

26-36 years

System F to Java generics

1974 System F; λ

1984 structural subtyping; \exists

1985 Cardelli-Wegman

1989 F sub; recursion

1995 Pizza implemented

1998 GJ for compatibility

2001 Java release;
2005 wide-spread use

27 years

type soundness in production

1978 the idea; basically PCF

1980 references; failed proof

1986 SML/NJ

1987 Co-induction proof

1991/4 Subject-red. proof

1995 Java, but casts

first PL design w/
explicit goal of soundness

17 years

automatic mem. mgmt. (gc)

1963 lisp at MIT

1973 Smalltalk

1970s generational collection

1986 "conservative" gc

1991 Zorn: when conservative collection is faster than a good programmer

1995 Java w/ "conservative" gc

2000 Java w/ "preemptive" gc

32 - 37 years

Compiler representation (imperative)

1960 flow charts (before)

1973 data-flow analysis

1980 data-flow graph

1985 Program-dependence graph (PDG)

... → 1990 sem. PDG vs SSA
↑ ↑
theory comp. algo.

... 1995 FORTRAN ret. compilers

... → 2005 LLVM

15 years; 33 years

Program Verification for Security

~1960s VDM ?

1968 Floyd Hoare : WP, SP

1972/6 LCF, Nqthm, Typed Lisp

1981 verified Pascal compiler

1993 CL Inc. ACL2
verified HW/SW stack:
processor, "OS", compiler

2005 Comp Cert

2010 secure Linux kernel

is it practical?

Discussion

- ① examples from your own readings
- ② is there a difference between user-facing innovations & internal ones?
- ③ Why decades?
- ④ PhD students: do you have patience?