CS2136: Paradigms of Computation

Class 02: History of Programming Languages (continued from last time)

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Where Were We By 1960?

- Fortran was well established for science and engineering work.
- COBOL was just getting started.
- LISP was just at MIT.
- Algol was just on paper.
- All systems programming was done in assembler.
- Most commercial programming was done in now-obsolete proprietary languages.
Some outgrowths from the ’50s

- Fortran was extended and standardized.
- COBOL became very widely used; it was the first standardized language on multiple platforms.
- Burroughs adopted Algol as its systems programming language.
- LISP became widely used in AI (Artificial Intelligence) work.
1960s II

- 1964: BASIC
- “Beginner’s All-Purpose Symbolic Instruction Code”
- John Kemeny and Thomas Kurtz (Dartmouth)
- Runnable from terminals on time-sharing systems; built-in editor
- Good error checking
- Line numbers
- No parameters or local variables
- Originally compiled; mostly interpreted
1960s III

1965: PL/I
“Programming Language One”
First ran on IBM System/360 series.
Structured like Algol
Numeric power of Fortran
Data processing power of COBOL
Data structures, generic functions
Suitable for systems programming
Supports multi-tasking
1960s IV

- 1962: Simula I
- “Simulation Language”
- Ole-Johan Dahl (Norway)
- Inherent multi-tasking
- Led to...
1960s V

- 1967: Simula 67
- A general-purpose language
- The first language with objects, classes, and subclasses
1960s VI

- 1968-1969: Pascal
- Niklaus Wirth (ETH, Zurich)
- Modeled after Algol
- No GOTO
- Very strongly typed
- Procedures nested inside each other
- Designed for teaching programming
1960s VII

Where Were We By 1970?

- COBOL was the most widely used language, especially in business.
- Fortran was the most widely used language for science and engineering.
- Almost no one had heard of Simula or Pascal.
- Most systems programming was still being done in assembly language.
1970s

- Some outgrowths from the ’60s
  - Timesharing became common.
  - Minicomputers became common.
  - COBOL and Fortran kept rolling along.
  - The need for structured programming techniques started to be recognized.
1970s II

Some developments

- 1971: Microprocessor invented
- 1974-1975: First microcomputers
- 1975: Microsoft BASIC for the Altair by Bill Gates, Paul Allen
- 1977: Apple II, Commodore PET, and Radio Shack TRS-80 introduced, all running BASIC.
- ARPA net and Usenet founded.
1970s III

- 1972: Prolog
- “Programming in Logic”
- Philippe Roussel (France)
- Based on rules, facts, and queries.
1970s IV

- 1973: C
- Successor to B, which was stripped-down BCPL.
- Ken Thompson (Bell Labs)
- High-level constructs and low-level power
- Very suitable for systems programming
  - Unix was written as 20K lines of C plus 1K lines of assembler.
1970s V (C continued)

Features

- Structured like Algol
- Data structures
- Pointers
- Call by value or reference
- Name scope:
  - Local
  - Global (named)
  - Static (within a source file)
1970s VI

- 1978: UCSD Pascal for the Apple II
- Compiled into p-code, the machine language of an ideal machine.
- The p-code was then interpreted.
- Interpreters were developed for several other platforms.
- A microprocessor was eventually designed to run p-code.
1970s VII

- 1974-1978: Ada
- Named after Ada Augusta.
- Instigated by the Department of Defense
- Jean Ichbiah (France)
- Designed for systems programming, especially embedded systems.
- Inspired by PL/I and Pascal.
1970s VIII

- 1972-1980: Smalltalk
- Alan Kay, Adele Goldberg (Xerox PARC)
- Graphics-rich
  - GUI
  - Fonts
- Object-oriented
  - Everything is an object
  - Objects communicate through messages
1970s IX

- c. 1972: HAL/S
- Intermetrics
- Systems programming language for the Space Shuttle.
- Inspired by PL/I
- Variables included units, e.g. x inches.
1970s X

- 1974: Scheme
- Gerald Sussman & Guy Steele at MIT
- Variant of LISP, with lexical scoping.
  - Original LISP had only global variables.
  - Simpler than LISP.
Where Were We in 1980?

- COBOL and Fortran were still rolling along.
  - “I don’t know what the programming language of the year 2000 will look like, but it will be called Fortran.” – E. Dijkstra, 1975.

- LISP being used in AI research and specialized applications.
  - e.g. Implementing “toy” languages.

- BASIC had spawned a new generation of amateur and professional programmers.
Where Were We in 1980? II

- Prolog was the basis for the Japanese “Fifth Generation” project.
- Some Pascal was being taught.
- Some people were excited about Unix / C.
- Most systems programming was still being done in assembly language.
1980s

- Some outgrowths from the ’70s
  - Minicomputers and timesharing became common at colleges and some companies.
    - Most access through hard-copy terminals at computer centers
  - Workstations running Unix spread into graphics, science, and engineering.
  - LANs spread.
  - ARPAnet became Internet and reached many colleges and high-tech companies.
1980s II

Some more outgrowths from the ’70s

- Personal computers spread in business and at home.
- Word processing, spreadsheets, etc. reduced the need for programming.
- BBSs and on-line services
- Many beginning students learned Pascal.
- Many advanced students learned C.
- Structured analysis and design began.
- COBOL and Fortran kept rolling along.
1980s III

- 1979-1983: C++
- Originally thought of as “C with classes”.
- Bjarne Stroustrup (Bell Labs)
- First widely-accepted object-oriented language.
- First implemented as a pre-processor for the C compiler.
- All the power of C, plus objects.
Where Were We in 1990?

- COBOL and Fortran were starting to flag.
- LISP and Scheme were being widely taught, but not widely used.
- BASIC was the most widely used language in the world.
- C was the most popular systems programming language.
- The Japanese “Fifth Generation” project had failed.
Where Were We in 1990? II

- Unix workstations were widely used at colleges and high-tech companies.
- Almost every company had at least some PCs.
- Larger companies had LANs.
- Some people had home PCs.
- Almost every college and high-tech company had Usenet, but only some had direct Internet connections.
1990s

- Some outgrowths from the ’80s
  - PCs became ubiquitous at work, school, and home.
  - The Internet became widely commercially available.
  - GUIs became ubiquitous.
  - The World Wide Web became ubiquitous.
  - Object-oriented analysis, design, and programming spread.
1990s II

z “Hypertext Markup Language”
z Tim Berners-Lee (CERN)
z A markup language, not a programming language.
z Marks features of a document, not how it must be displayed.
1990s III

- 1991-1995: Java
- James Gosling (Sun)
- Started as “Oak” for running set-top boxes.
- Applications or Applets
- Object-oriented
1990s IV (Java continued)

- Garbage collection
- Compiled into “byte code”, then interpreted.
  - Microprocessors now available.
- Graphical, lots of libraries, multi-tasking, networking
- Portable
  - “Write once, run anywhere”
1990s V

- Growth of frameworks
  - Pre-written skeletons of programs
  - Faster development
  - Libraries for GUI, multi-tasking, etc.

- Emphasis on cross-platform development
  - Operating systems
  - Hardware
  - PC, game console, cell phone
1990s VI

Languages for the Web:
- Java applets and servlets
- Scripting languages, e.g. PERL.
  - CGI or Apache module
  - Simple but powerful.
- Languages within Web pages
  - Server-side includes
  - PHP
Who knows what people in the next decade will consider the important languages of the ’90s?

...or of the 20th Century?
Where Are We In 2004?

- PCs are ubiquitous at home, school, and work.
- The Internet and Web are ubiquitous.
- LANs are almost everywhere people have multiple computers.
- MS-Windows is ubiquitous.
- Unix still strong, Linux growing.
Where Are We In 2004? II

- C and C++ are the most widely used systems programming languages.
- Java is exploding.
- Most students learning C / C++ or Java.
- Increasing interest in Scheme.
- COBOL, 4GLs, and Java are used for business.
Where Are We In 2004? III

- Fortran is the main language on supercomputers.
  - C++ is growing.
  - Object-Oriented Fortran 2000.
- Scripting languages growing, especially on Web servers.
- Object-Oriented COBOL?
Where Are We In 2004? IV

- Microsoft .NET
  - Multiple languages
    - C++
    - C#
    - Visual Basic
    - COBOL
    - Fortran
    - Eiffel
  - Common virtual machine
  - Web services
Where Are We In 2004? V

Who knows what people in the future will consider the important languages of this current decade?

...or of the 21st Century?
Next Time

- An introduction to Logic Programming and Prolog