C – 1972

* Designed for systems programming at Bell Labs
* Evolved from BCLP and B, but also ALGOL 68
* Powerful set of operators, but poor type checking
* Initially spread through UNIX
* Though designed as a systems language, it has been used in many application areas
* Sometimes combined with Assembly to create motherboard BIOS and other things

Programming based on logic: Prolog

* Developed by Comerauer and Roussel with help from Kowalski
* Based on formal logic
* Non-procedural
* Can be summarized as being an intelligent database system
* Comparatively inefficient

History’s Largest Design Effort: Ada

* Huge design effort, involving hundreds of people, much money, and about eight years
* Sequence of requirements (1975-1978)
* Named Ada after Ada Lovelace, the first programmer
* Evaluation
  + Contributions
    - Packages – support for data abstraction
    - Exception Handling - elaborate
    - Generic program units
    - Concurrency – through the tasking model
  + Comments
    - Competitive design
    - Included all that was then known about software engineering and language design
    - First compilers were very difficult; the first really usable compiler came nearly five years after the first language design was completed
* Ada 95 – 1988
  + Support for OOP through type derivation
  + Better control mechanisms for shared data
* Ada 2005
  + Interfaces and synchronizing interfaces

Object oriented programming: Smalltalk

* Developed at Xerox PARC
* First full implementation of an object-oriented language (data abstraction, inheritance, dynamic binding)
* Pioneered the graphical user interface design
* Promoted OOP
* ‘Xerox Alto’

Combining Imperative and Object-Oriented Programming: C++

* Developed at Bell Labs in 1980
* Evolved from C and SIMULA 67
* Facilities for object-oriented programming primarily taken from SIMULA 67
* A large and complex language, in part because it supports both procedural and OO programming
* Rapidly grew in popularity, along with OOP
* ANSI standard approved in November 1997
* Microsoft’s Version: MC++
  + Properties, delegates, interfaces, no multiple inheritance

A Related OOP Language: Objective-C

* Designed by Brad Cox in early 1980s
* C plus support for OOP based on Smalltalk
* Uses Smalltalk’s method calling syntax
* Used by Apple for systems programs
* Swift is an improved replacement for it

An Imperative-Based Object-Oriented Language: Java

* Developed at Sun in the early 1990s
  + C and C++ were not satisfactory for embedded electronic devices
* Based on C++
  + Significantly simplified (does not include struct, union, enum, pointer arithmetic, and half of the assignment coercions of C++)
  + Supports only OOP
  + Has references, but not pointers
  + Includes support for applets and a form of concurrency
* Evaluation
  + Eliminated many unsafe features of C++
  + Supports concurrency
  + Libraries for applets, GUIs, database access
  + Portable: Java Virtual Machine concept, JIT compilers
  + Widely used for Web programming
  + Use increased faster than any previous language
  + Most recent version is 13, released in September 2019

Scripting Languages for the Web

* Perl
  + Designed by Larry Wall in 1987
  + Variables are statically typed but implicitly declared
  + Three distinctive namespaces, denoted by the first character of a variable’s name
  + Powerful, yet dangerous
  + Gained widespread use for CGI programming on the web
  + Also used for a replacement for UNIX system administration language
* JavaScript
  + Began at NetScape, but later joined with Sun Microsystems
  + A client-side HTML-embedded scripting language, often used to create dynamic HTML documents
  + Purely interpreted
  + Related to Java only through similar syntax
* PHP
  + Hypertext Preprocessor, originally designed by Rasmus Lerdorf
  + A server-side HTML-embedded scripting language, often used for form processing and database access through the web
  + Purely interpreted
* Python
  + An Object-Oriented scripting language
  + Type checked but dynamically typed
  + Used for CGI programming and form processing
  + Supports lists, tuples, and hashes
* Ruby
  + Designed in Japan by Yukihiro Matsumoto
  + Began as a replacement for Perl and Python
  + A pure object-oriented scripting language
    - All data are objects
  + Most operators are implemented as methods, which can be redefined by user code
  + Purely interpreted
* Lua
  + An OO interpreted scripting language
  + Type checked but dynamically typed
  + Used for CGI programming and form processing
  + Supports lists, tuples, and hashes, all with its single data structure, the table
  + Easily extendable

The Flagship .NET Language: C#

* Part of the .NET development platform in 2000
* Based on C++, Java, and Delphi
* Includes pointers, delegates, properties, enumeration types, etc
* Is evolving rapidly

Markup/Hybrid Languages

* XSLT
  + XML, XTSL
  + Programming Constructs
* JSP
  + Java Server Pages