Understanding C#
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Understanding C#

- History of C#
  - Java
- Parts of the system
  - .NET
History of C#: Java

• Java created in 1995
  • “write once, run anywhere”
  • By James Gosling at Sun Microsystems (now a subsidiary of Oracle Corporation)
  • Nothing to do with “JavaScript”

• The parts of Java
  • Java language syntax
  • Compiler (SDK)
  • Java Virtual Machine (JVM) and Runtime Environment (JRE)
  • Class libraries (SDK)
History of C#: Java

• Was originally designed to run on set-top boxes (first named “Oak”)

• Original goals:
  • It should be "simple, object oriented, and familiar"
  • It should be "robust and secure"
  • It should be "architecture neutral and portable"
  • It should execute with "high performance"
  • It should be "interpreted, threaded, and dynamic"

• Java released as open source in 2006

• One of the most influential languages, ever
History of C#: Java

- Applets
  - Programs designed to run in the browser
- Java Server Pages (JSP)
  - Server-side programs (not in the browser)
- Graphics toolkits
  - Abstract Windowing Toolkit (AWT); Swing, includes “themes”; Java2D, Java3D, etc.
- Bytecodes
  - Java program compiles to JVM “binaries”
- Just In Time Compilation (JIT)
History of C#: Java
History of C#: Java

• What went wrong?
  • Sun tried to tightly control Java
    – How can we make money from it?
  • The JVM could have been so much more
    – 100's of languages now run on the JVM, including Jython, Groovy, JRuby, NetLogo, etc.
    – But no commonality, no shared core between these
• Microsoft
  – NIH: “not invented here”
History of C#

- Announced in July 2000, as part of .NET
- .NET mirrors Java
  - CLR – Common Language Runtime (like JRE)
  - .NET – virtual machine (like JVM)
  - BCL - Base Class Library (like Java Libraries)
- Beyond Java
  - Can use C code (through “unsafe”)
  - CLI - Common Language Infrastructure
  - CTS – Common Type System
Family of Languages

- C# - the meat and potatoes
- VisualBasic.NET
  - For beginners, now object-oriented
- J# - Java syntax, not a MS focus
- F# - functional language, like Lisp or Scheme
  ```fsharp
  let rec factorial n =
      match n with
      | 0 -> 1
      | _ -> n * factorial (n - 1)
  
  These are all compiled
Compiling C#

C# code -> Compiler
VB.NET code -> Compiler
J# code -> Compiler

Common Language Infrastructure

Common Intermediate Language

.NET compatible languages compile to a second platform-neutral language called Common Intermediate Language (CIL).

Common Language Runtime

The platform-specific Common Language Runtime (CLR) compiles CIL to machine-readable code that can be executed on the current platform.

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.NET meets Python

- MS develops IronPython
  - Hires developer of Jython, Jim Hugunin
  - No compilation, dynamic
  - Realizes that infrastructure could work for other “scripting languages”
- Develops the Dynamic Language Runtime (DLR)
- Creates layers for shared language development (IronRuby)
Other .NET-related Technologies

- Mono – free implementation of many .NET technologies
- Silverlight – CLR to run in the browser. Competes with Flash and HTML5.
  - Moonlight is Mono's version
- WinForms – Graphical Toolkit (a wrapper around WIN32 libraries)
- Windows Presentation Foundation (WPF)
- ASP.NET – Active Server Pages
- ADO.NET – ActiveX Data Objects for relational databases
Sidebar: Java@BMC

- Bryn Mawr College, one of the first places to use Java in education (1994 – 2006)
- Students wrote applets, which were visible to others via the web
- 2007 switched to Python
  - Easier to write first programs
  - Connection to other libraries
  - Cross platform
- 2010 BMC creates Pyjama, allows “Python Applets”