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Mohammed Abu-Hadhoud

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# Compilation

- .NET applications are written in the C#, F#, or Visual Basic programming language. Code is compiled into a language-agnostic Common Intermediate Language (CIL). Compiled code is stored in assemblies—files with a .dll or .exe file extension.

- When an app runs, the CLR takes the assembly and uses a just-in-time compiler (JIT) to turn it into machine code that can execute on the specific architecture of the computer it is running on.

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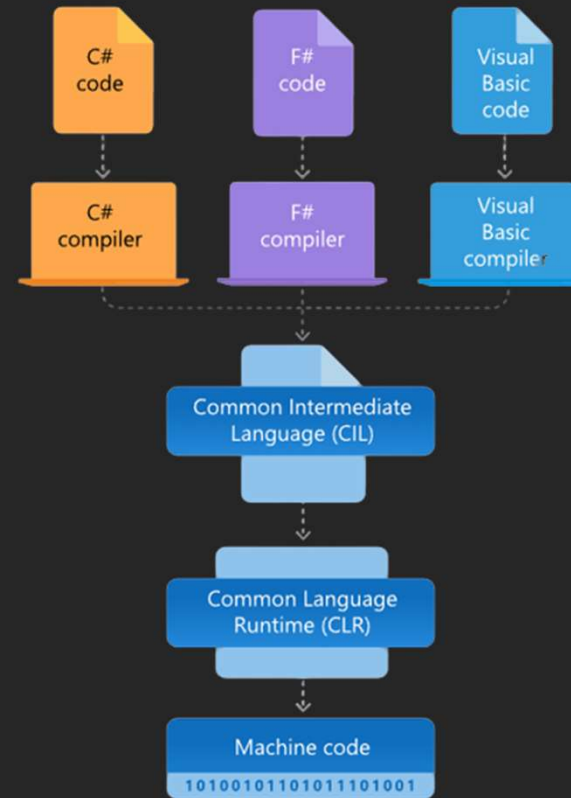
# Compilation

In .NET, the compilation process occurs in two stages:

1. just-in-time (JIT) compilation.

2. ahead-of-time (AOT) compilation.

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# JIT: JUST In Time Compilation.

- Just-in-Time (JIT) Compilation: During the execution of a .NET application, the CLR performs JIT compilation of the application's Intermediate Language (IL) code into machine code. The JIT compiler translates the IL code into native machine code for the target platform on which the application is running. This allows the application to take advantage of the full performance of the target platform's hardware. The JIT compiler only compiles the methods that are actually executed, so applications start up quickly, and unused code is never compiled.

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# AOT: Ahead of Time Compilation.

- AOT stands for Ahead-of-Time, which is a method of compiling .NET code into machine-readable code that can be executed directly by the computer's processor, without requiring an interpreter or just-in-time (JIT) compilation. This approach can lead to faster start times and better performance compared to JIT-compiled code.

- AOT-compiled .NET code is often used in scenarios where performance and startup time are critical, such as in mobile or embedded devices, or in cloud environments where instances are frequently restarted. The AOT-compiled code is optimized for the specific architecture and can take advantage of hardware features such as instruction set extensions and hardware acceleration.

- In .NET, AOT-compilation is usually performed using the Native Image Generator (Ngen.exe) tool, which creates a native image from an existing .NET assembly. The native image can then be deployed and executed on the target machine, without requiring the .NET runtime to be installed.

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Thank You

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