Java: An overview

CSC02A2

Outline

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Programming Languages

Programming language categories I

Low-level language - Machine code

- Hardware specific.
- Purely numerical (binary numbers represented both data and instructions)

```
10111010111010100100101100100101
01010111010010101101010111010101
10100101011110101101010001011101
11101110110100110011101010100100
```

Low-level language - Assembly Language

- Hardware specific.
- Machine code instructions are represented by alphanumeric identifiers.
- Easier to use than pure machine code.
- Needs to be assembled (compiled) into machine code prior to execution.

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Programming language categories II

High-level languages - General

- Allows high level programming paradigms (structured programming, object orientation etc.)

High-level languages - Compiled

- Possible to write portable code (back end of compiler can often target multiple platforms)
- Textual source code is compiled into object code and then linked to form executables.

High-level languages - Interpreted

- Source code is parsed (read-in) and then directly executed by a software system referred to as an interpreter.
- Heavy performance penalty
- Forces distribution of source code.

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Programming language categories III

High-level languages - Byte code interpreted

- Source form is translated into a machine independent compiled form (byte code or p-code) which is then executed by a software implemented virtual machine.
- Virtual machine provides a single target platform, thereby promoting portability.
- Virtual machine adds a performance overhead as it interprets the byte code.
- Source code need not be distributed, although reverse engineering is possible.

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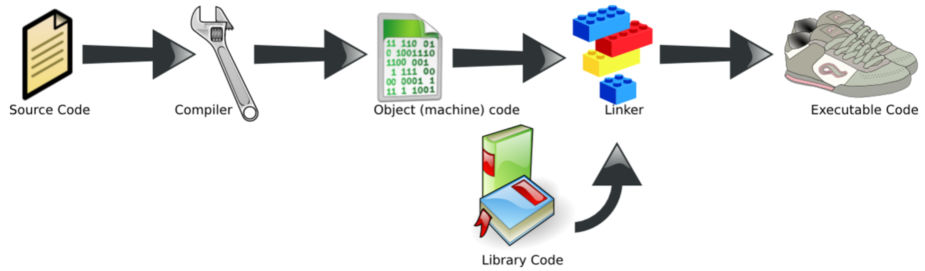
Conventional Compilation



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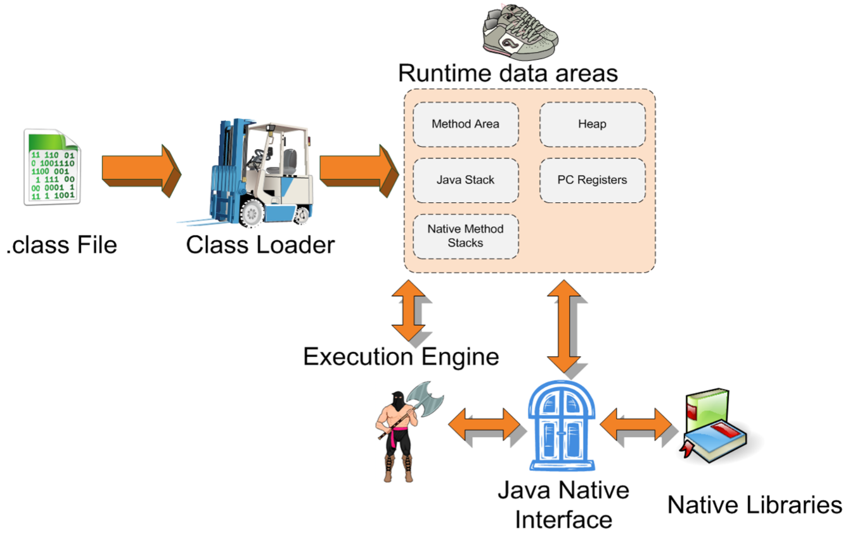
JVM Architecture



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Java Technologies

Design Goals of the Java Language

- Simple, object oriented, and familiar.
- Robust and secure.
- Architecture neutral and portable.
- High performance.
- Interpreted, threaded and dynamic.

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Java Features

Object orientation
: Divides programs into separate objects encapsulating both behaviour and data.

Robust
: Errors in programs rarely cause system crashes. Pre-runtime error detection.

Secure
: Protection against untrusted code via sandboxing.

Distributed
: Designed to run on computer networks. Language and library support.

Platform independence
: Portability across all machines for which the java runtime environment exists.

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Java Editions

- Java Standard Edition (SE) – The primary Java release. Suitable for most application development.
- Java Enterprise Edition (EE) – Used in large scale corporate environments. Adds capabilities such as:
    - EJB (Enterprise Java Beans – Java Components)
    - XML streams
    - Persistence (long term object storage)
    - Various packages related to interfacing with the enterprise messaging system.
- Java Micro Edition (ME) – Used to write software for mobile phones, set-top boxes, cards and other embedded devices.

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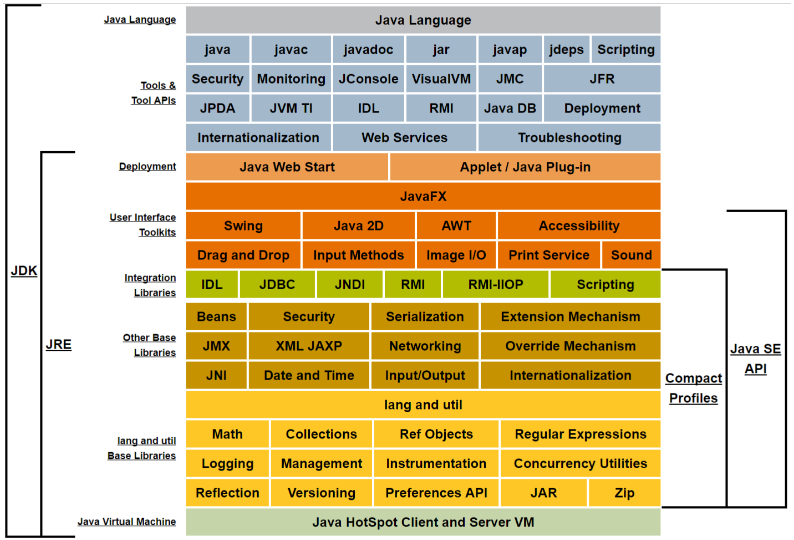
Java SE at a glance



Java and C++ compared

Differences between Java and C++ I

Pre-processor

C++	Java
• Include header statements • Define macros	• No pre-processor available

Data Structures

C++	Java
• Structs (records) • Unions • Classes	• Classes • Enumerations • Interfaces

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Differences between Java and C++ II

Domains and Visibility

C++	Java
• Code grouped in namespaces	• Code grouped in packages
• Public	• Public
• Private	• Private
• Protected	• Protected
• Friend	• Package

Pointers

C++

- Programmer must handle pointer manipulation
- Objects passed by reference or by value

Java

- Pointer manipulation done by compiler
- All objects act as pointers
- Only passed by reference

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Differences between Java and C++ III

Primative Data Types

C++	Java
• Size of data types are machine specific	• Size of primitive data types fixed

Garbage Collection

C++	Java
• Programmer must remember to free memory	• Automatic garbage collection • No ***`delete`*** available

Exception Handling

C++	Java
• No forced exception handling	• Very strict rules on exception handling

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Differences between Java and C++ IV

Inheritance

C++

- Class can inherit methods from more than one class.

Java

- No multiple inheritance.
- Class can be derived from at most one base class.
- Interface implementation used to simulate multiple inheritance

Operator Overloading

C++

- Operator overloading supported

Java

- No operator overloading (some limited exceptions).

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Differences between Java and C++ V

Interface

C++

- Pure abstract base class.

Java

- Equivalent to C++ class which only contains, pure-virtual functions.
- Class that realises interface must provide implementation.

Object Allocation

C++

- Objects may be Stack or Heap allocated.

Java

- Objects only Heap allocated.

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Differences between Java and C++ VI

Multithreading

C++	Java
• Thread capabilities were added in later third-party libraries. • No single standard.	• Built in multi-threading • Standard class libraries were designed to be able to handle threads. • ***synchronized*** keyword.

Strings and Arrays

C++	Java
• string, char*. • Arrays implemented using pointers.	• String (immutable) and StringBuffer classes. • Arrays as Objects (some restrictions).

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