

Java Technicalities

From a C/C++ Programmer's View

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About Author

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- 隨手書寫生活
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About Slide

- 專題程式開發介紹相關簡報第二彈，陸續有其他介紹
- 感謝李春良老師專題指導，使得這一系列簡報得以誕生
- 感謝 Josh Ko (Joshsoft) 在主題與技術上的指導與協助(還有英文)
XD

But ...

- 想了很多天還是不知道自己要講什麼 XD
- 亂講好了 XD

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Josh Ko and yen3's Talking

yen3: 要講 Java 耶, 我已經不知道要說什麼了...Orz

Josh Ko: XD

yen3: 不然我講怎麼用 Java 寫 Functional Programming 好了 XD

Josh Ko: 不太好, Java 太 OO 了 XD

Everything is an Object.

Thinking in Java 4/e

Programming

By Compiler

- Compiled Programming language
- Interpreted Programming language (Script Programming Language)

By Machine

- Imperative Programming (Turing Machine)
- Functional Programming (λ -calculus)

By Model

- Procedural Programming
- Object-Based Programming (Abstract Data Type)
- Object-Oriented Programming
- Generic Programming

TIOBE Programming Community Index for March 2009

TIOBE Programming Community Index for March 2009



March Headline: All time high for JavaScript, all time low for Perl

The TIOBE Programming Community index gives an indication of the popularity of programming languages. The index is updated once a month. The ratings are based on the number of skilled engineers world-wide, courses and third party vendors. The popular search engines Google, MSN, Yahoo!, and YouTube are used to calculate the ratings. Observe that the TIOBE index is not about the *best* programming language or the language in which *most lines of code* have been written.

The index can be used to check whether your programming skills are still up to date or to make a strategic decision about what programming language should be adopted when starting to build a new software system. The definition of the TIOBE index can be found [here](#).

Position Mar 2009	Position Mar 2008	Delta in Position	Programming Language	Ratings Mar 2009	Delta Mar 2008	Status
1	1	=	Java	19.797%	-1.69%	A
2	2	=	C	15.862%	+1.00%	A
3	5	↑↑	C++	10.357%	+1.08%	A
4	4	=	PHP	9.485%	-0.41%	A
5	3	↓↓	(Visual) Basic	8.285%	-3.32%	A
6	7	↑	Python	5.185%	+0.42%	A


About Java

- James Gosling, 1995, Sun Microsystems
- a pure Object-Oriented Programming Language
- Everything is an object.
- Java Virtual Machine and Just-In-Time Compiler XD
- Java SE, Java EE, Java ME
- The language has already been developed for over 10 years and become a complete programming language.
- So, What do we know from Java ?

Library

- Muti-Threading Programming – `java.util.concurrent.*`
- GUI Programming – `javax.swing.*`
- Socket Programming – `java.net.*`
- Generic Container – `java.util.*` (just for some classes) ¹
- I/O – `java.io.*` (It is a good OO design example.)²
- balabala

¹In C++, Generic Container is more interesting than Java.

²In C++, I/O Library is also designed by OO paradigm. 

Java I/O

- In Unix/Unix-like, everything is a file.
- Java I/O Library is a pure OO paradigm example, and C++ is too.
- You can get an overview by `java.io.*` hierarchy tree.³ It will help you to understand how to write I/O codes.
- Be as possible as to use super classes to write codes.

³<http://java.sun.com/j2se/1.4.2/docs/api/java/io/package-tree.html>

For Example – class `java.io.OutputStream` and class `java.io.Writer`

- class `java.io.OutputStream`
 - class `java.io.ByteArrayOutputStream`
 - class `java.io.FileOutputStream`
 - class `java.io.FilterOutputStream`
 - class `java.io.BufferedOutputStream`
 - class `java.io.DataOutputStream` (implements `java.io.DataOutput`)
 - class `java.io.PrintStream`
- class `java.io.Writer`
 - class `java.io.BufferedWriter`
 - class `java.io.CharArrayWriter`
 - class `java.io.FilterWriter`
 - class `java.io.OutputStreamWriter`
 - class `java.io.FileWriter`
 - class `java.io.PipedWriter`
 - class `java.io.PrintWriter`
 - class `java.io.StringWriter`

Socket Programming

- Socket Programming is the same as writing to files because we consider socket as a file stream.
- use “Buffered I/O” (ex: `class java.io.BufferedWriter`, `class java.io.BufferedReader`)
- We have to be care about the message's format.(fixed format or XML formt)
- Please don't use “\n” as a meessage's end!
- Please remember “Base64” format when you send binary messages.⁴
- Reference: [yen3's blog – 有關 File I/O 的兩三事](#) (1) 不算開始的開始, (2) Binary File, (3) XML

⁴<http://en.wikipedia.org/wiki/Base64>

Type

Java has two different types.

- primitive type: int, char, double, balabala
- pointer type: class type(user-defined type)

We know that Java doesn't have "pointers"

- Java has "new", but no "delete" keyword.
- What is Garbage Collection?
- What is Java's memory management mechanism? (It's an important factor about Java's program efficiency.)

String Type

- String has build-in type's interface with pointer type's implementation.
- String vs. StringBuilder
- What does the language do in background?
- Java's String uses UTF-8 as default encoding.
- Let's talk about an example.

Type-Casting

- Java is strongly-typed programming language.
- `void*` vs. `java.lang.Object`
- In Java, every class inherits from `java.lang.Object`. It means we can cast an object to `java.lang.Object` type and cast again to other arbitrary class type .
- Compiler doesn't check the situation because it seems legal from the syntactical perspective.
- You have to check the situation by yourself.

Thinking about The Problems

- What is a “type”?
- What is a “object”?
- OO is claimed to be closer to human thoughts. However, is it true ?
- Object vs `java.lang.Object`
- Why doesn't Java support “Operator Overloading”?
“Operator Overloading is syntax sugar. You don't know how efficient you cost in using.”

Class and Object

A Class has ...

- data member (Data) – Record States
- member function(Method)

A Class has three modes

- `public` – interface
- `private` – implements
- `protected` – for some reasons XD

We have to pay attention to two keywords, but the slide doesn't mention.

- `static`
- `final`

Class

There are several kinds of classes.

- Normal Class – There's nothing to say. XD
- Interface – Think about multiple-inheritance.
- anonymous Class – Think about the relationship about function pointer and call-back function.

Back to C — Function Pointer

- Von Neumann's Model says program can be saved in memory.
- If we ruled the function's interface, we can show difference functionality by replacing functions rely on function pointer.

For Example: C' stdlib.h — qsort() prototype

```
void qsort(void* base, size_t n, size_t size,  
          int (*cmp)(const void*, const void*));  
          /* function pointer */
```

Back to C++ — Function Object

- The most difference between Function Object and Function Pointer is Function Object has own states(variable).
- Implementation: Class with Operator Overloading “()”
- If we implemented function object with template. It starts the Generic Programming’s first step.

For Example: C++ — Function Object

```
template<typename T> class Less{  
public:  
    bool operator()(const T& x, const T& y){ return x < y;}  
}
```

λ Function (Lambda Function)

- base on *lambda*-expressions from Functional Programming,.
- no side-effect function.
- an unnamed function for temporary uses
- Haskell naïve support
- C++'s support: Boost::lambda

For Example: C++ — Boost::lambda

```
std::sort(v.begin(), v.end(),
          std::greater<iterator_traits(v.begin())::value_type>());
std::sort(v.begin(), v.end(), *_1 > *_2);
```

Call-Back Function — Anonymous Class with Interface

- What is “Call-Back Function”?
- How does JavaScript support the Call-Back Function?
- Class-Based vs Prototype-Based
- Java uses anonymous class and interface(`Runnable`) to support call-back property.

For Example: Java — anonymous class with interface

```
Thread newTask = new Thread(new Runnable(){  
    public void run(){ System.out.println("Hello World!"); } });
```

Interface and Abstract Class

- `interface` and `abstract` are keywords.
- Interface and abstract classes provide a more structured way to separate interface from implementation.
- In begin, we always have no idea to use them.
- It's show time to use "Refactoring".
- We can extract to super class, abstract class, or interface from the same functionality classes.
- Button-Up Design vs Top-Down Design

Object-Oriented Class

- For efficient reason, C++ default member function mode is `non-virtual`, but Java is not.
- Please read the relational books to get more details about Java's Class.
- The feature is implemented by function pointer table.
- Think about the relation of RTTI and function pointer table.
- How to Design Class? Traditional OO Design vs eXtreme Programming⁵

⁵We will discuss the issue next week.

Generic in Java

- Let's ignore the topic.
- We can discuss the topic if we have a basic knowledge for C++ Generic Programming.
- C++'s STL is made from some Functional Programming concepts.
- Java's Generic is made by Java OO method.
- In fact, Java's Generic is still a OO paradigm.
- You can play the paradigm using Haskell. It's more interesting than C++ and Java. XD

Exception

- What is a “Exception”?
- “GOTO Considered Harmful.”⁶
- Think about the relation between “goto” and “exceptions”.
- We have to know program execute the exception block means low efficiency.
- But we couldn't ignore writing exception when using some library(ex: I/O, Socket, Thread)

⁶Edsger W. Dijkstra, Turing Award 1972

Conclusion

- We go through Java from different parts, especially from C/C++.
- Java is a noun-kingdom XD XD. (What do you think about when seeing “`ArrayIndexOutOfBoundsException`” first time?)
- Please love “Eclipse IDE” when developing Java programs. XD
- Let’s expect the interesting issue next week . XD

Do you have any problem ?

I am glad you have listened the slide from staring to now. XD

Reference — Website

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- *Eclipse.org* – <http://www.eclipse.org>
- *C++ Boost Library* – <http://www.boost.org>
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- *Effective C++ 3/e: 55 Specific Ways to Improve Your Programs and Designs*, Scott Meyers, ISBN: 0321334876
- *Generic Programming and the STL: Using and Extending the C++ Standard Template Library*, Matthew H. Austern, ISBN: 0201309564