Java: Introduction and Overview

Originals of slides and source code for examples: http://courses.coreservlets.com/Course-Materials/java.html
Also see Java 8 tutorial: http://www.coreservlets.com/java-8-tutorial/ and many other Java EE tutorials: http://www.coreservlets.com/
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Developed and taught by well-known author and developer. At public venues or onsite at *your* location.

For customized Java-related training at your organization, email hall@coreservlets.com

Marty is also available for consulting and development support

Taught by lead author of *Core Servlets & JSP*, co-author of *Core JSF* (4th Ed), & this tutorial. Available at public venues, or customized versions can be held on-site at your organization.

- Courses developed and taught by Marty Hall
  - JSF 2.2, PrimeFaces, servlets/JSP, Ajax, JavaScript, jQuery, Android, Java 7 or 8 programming, GWT, custom mix of topics
  - Courses available in any state or country. Maryland/DC area companies can also choose afternoon/evening courses.
- Courses developed and taught by coreservlets.com experts (edited by Marty)
  - Spring MVC, Core Spring, Hibernate/JPA, Hadoop, HTML5, RESTful Web Services

  Contact hall@coreservlets.com for details

Topics in This Section

- **Truths / Myths About Java**
  - Java is Web-enabled?
  - Java is safe?
  - Java is cross-platform?
  - Java is simple?
  - Java is powerful?
  - Java is popular?
- **Java versions and application areas**
  - Standard edition
  - Enterprise edition
  - Micro edition (and Android Edition)

Overview of the Java Language

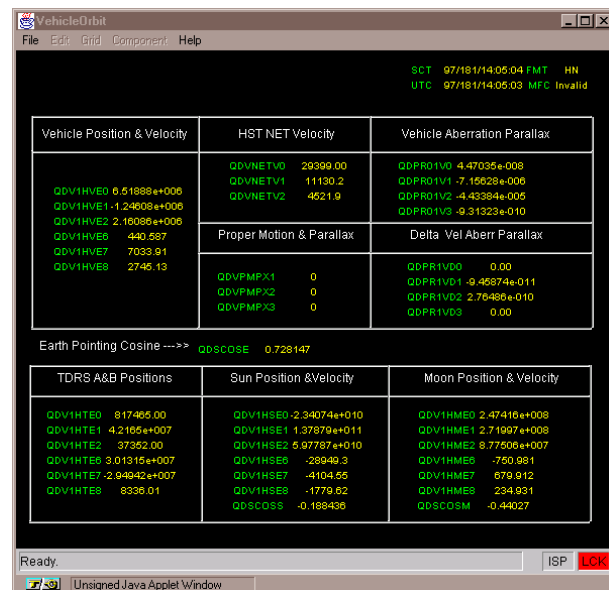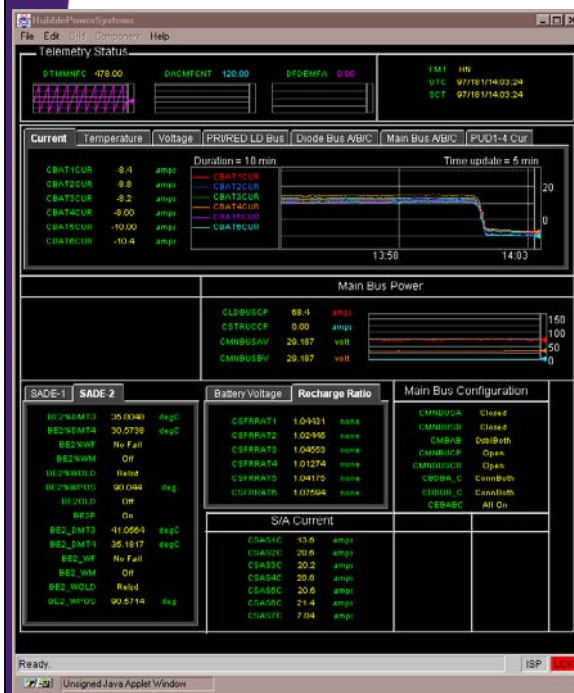# Java is Web-Enabled?

- **Truth: Web browsers can run Java "applets"**
  - The Web can be used for *software* delivery and *execution*, not just *document* delivery and *display*
  - No more installation or updates; just a bookmark
  - Large, complex applets best suited for intranets. Fits the APL model better than the WWW at large.

- **Truth: Java's network library is easy to use**
  - Ordinary mortals can do socket programming
  - Standard distributed object protocol and DBMS API

Hubble Space Telescope Monitoring:
"NASA Goddard's Most Successful SW Project *Ever*."

Java is Web-Enabled?

- **Myth:** Java is *only* for the Web
  - Java "applets" run in Web pages
  - Java "applications" run stand-alone
  - Current usage (roughly)
    - Client (applet): 5%
    - Desktop (application): 10%
    - Mobile (Android/Blackberry): 25%
    - Server (JSF/servlets/JSP/Hadoop): 60%

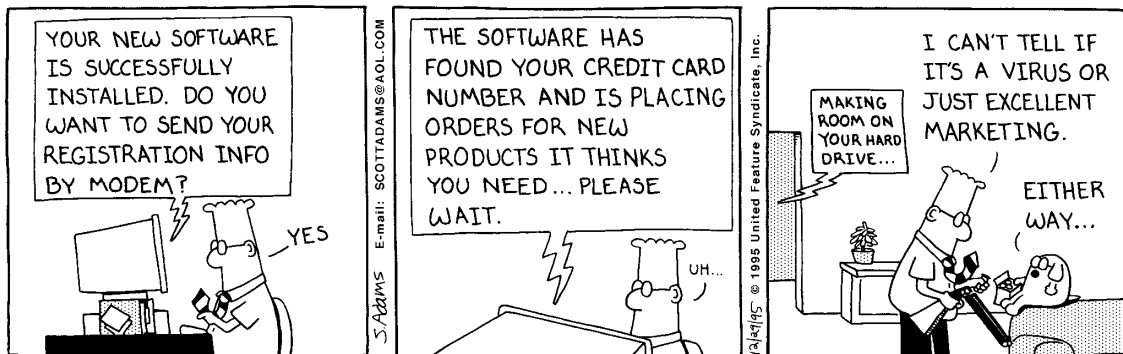# Strike Coordination Planner (APL/PPSD)   [Unclassified]

Java is Safe?

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- **JAVA: Just Another Virus Architecture?**
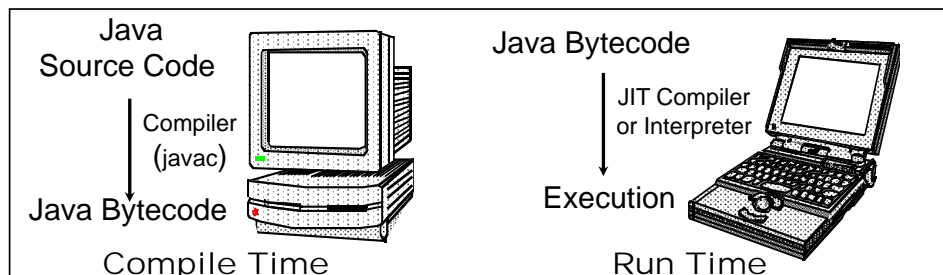

Java is Safe?

- **Truth: Restrictions on permissible operations can be enforced**
  - No "raw" memory manipulation (directly or indirectly).
    - Thus, it is easy to identify prohibited operations.
  - Applets, by default, prohibited from:
    - Reading from the local disk
    - Writing to the local disk
    - Executing local programs
    - Opening network connections other than to the HTTP server that the applet came from
    - Discovering private info about user (username, directories, OS patch level, applications installed, etc.).

Java is Safe?

- **Myth: Applets cannot harm your computer**
  - Denial of service
  - Browser misconfiguration
  - Implementation bugs
- **Myth: Java is too restricted to be useful**
  - Restrictions apply only to applets, not regular Java programs
  - Digital signatures support relaxed restrictions
- **Myth: Applets with digital signatures are no more or less safe than ActiveX**
 - Relaxed security in applets not "all or nothing" as in ActiveX

Java is Cross-Platform?

- **Truth: Java programs can compile to machine-independent bytecode**

Java Source Code	Java Bytecode
Compiler (javac)	JIT Compiler or Interpreter
Java Bytecode	Execution
Compile Time	**Run Time**

- **Truth: All major operating systems have Java runtime environments**
  - Most bundle it (Linux, Solaris, MacOS, Windows XP)

Mars Rover Controller and Simulator
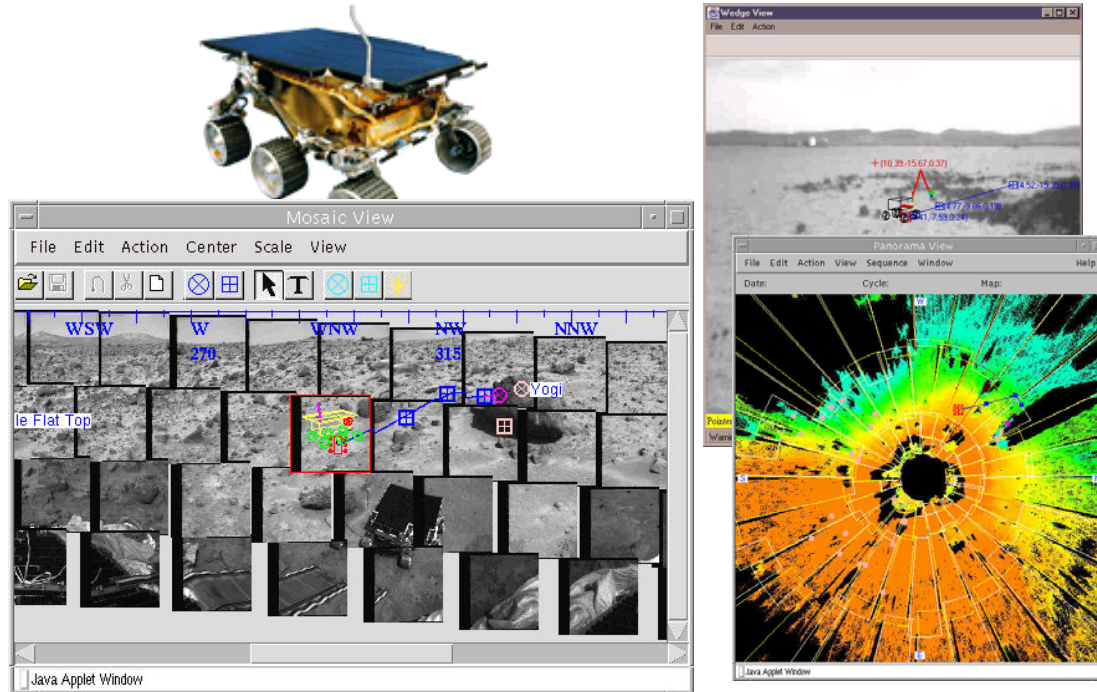
Java is Cross-Platform?

- **Myth: Safety and machine independence can be achieved with no performance penalty**
  - Current systems are about 20% slower than C++
  - Upcoming releases claim to lower or eliminate that gap
  - I expect the gap to stay at 10% or more
- **Myth: Java is interpreted**
  - Early releases were interpreted
  - Many major "Just in Time" (JIT) compilers

Java is Cross-Platform?

- **Myth:** **Write Once Run Anywhere**
  - Cross-platform code can be achieved, but you must test on all platforms you will deliver on.
    - Java apps can execute local code
    - The graphics library behaves slightly differently on different platforms
    - The behavior of the thread scheduler is only loosely defined

See Pat.
Pat wrote one program.
It can run on all platforms.

Pat used 100% Pure Java to write the program.

Run, program, run!

- **Myth:** **Java will kill Microsoft**
  - There is also no longer immediate danger of the reverse (Microsoft killing Java)
  - Microsoft wavered between trying to fight Java and joining it and making money by dominating the market. With .NET, they are back to fighting it again.
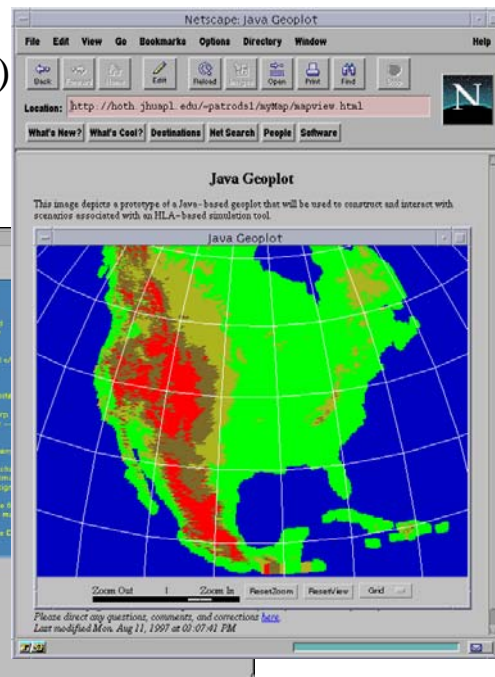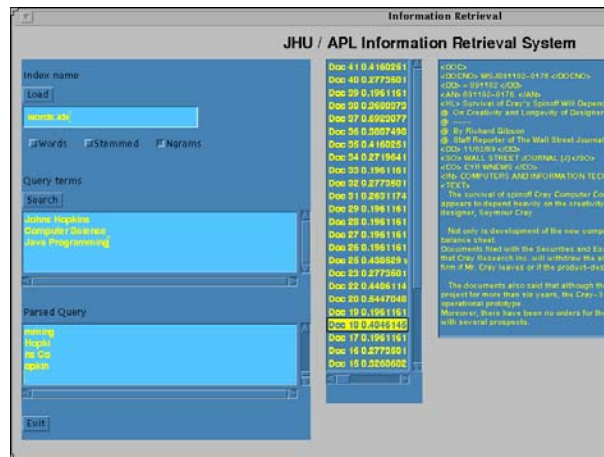
Java is Simple?

- **Truth:** **Java greatly simplifies several language features**
  - Java has automatic memory management
    - Does Windows and takes out the garbage
    - No dangling pointers. No memory leaks.
  - Java simplifies pointer handling
    - No explicit reference/dereference operations
  - No makefiles for simple applications
  - No header files
  - C++ syntax streamlined
  - C# is comparable to Java, at least as far as the core language goes.
    - For a comparison of Java and C# syntax/constructs, see
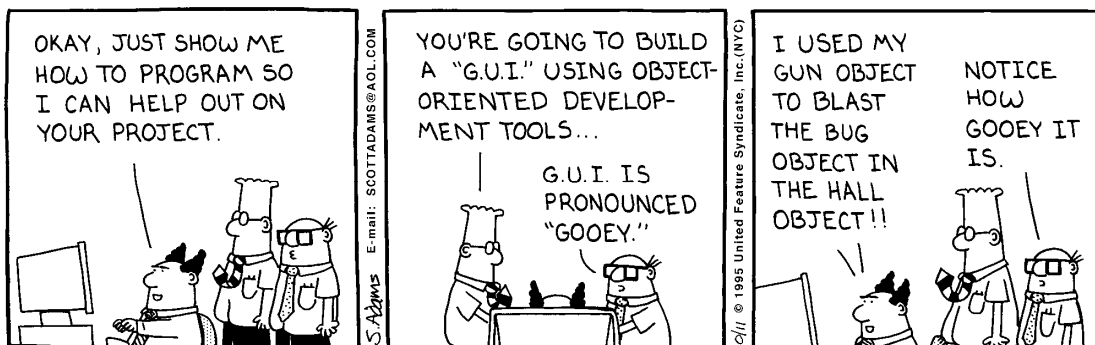   http://www.harding.edu/fmccown/java1_5_csharp_comparison.html

Rapid Application Development in Java

– Information Retrieval for multi-gigabyte text corpus (APL RTDC)
– Geoplot for distributed simulation (APL STD)

Java is Simple?

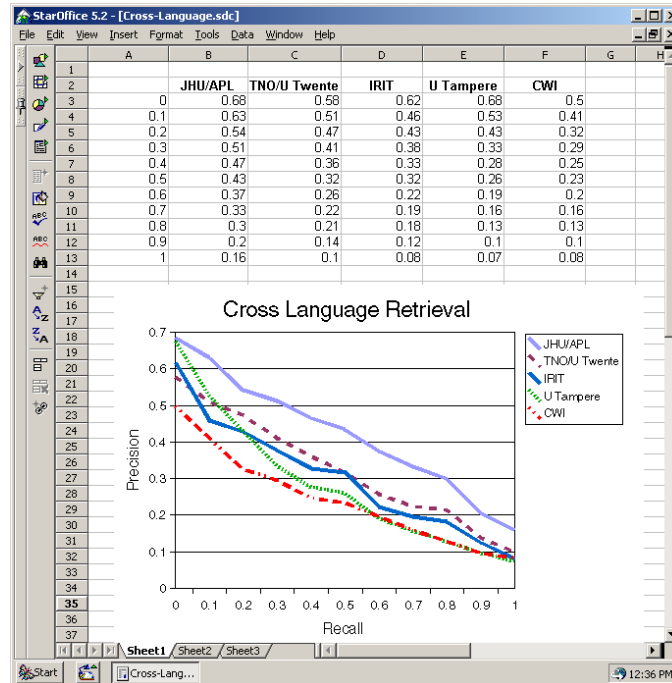• **Myth:** Java *programming* is simple

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– Programming is always hard
  • Java is nothing like HTML; only a little bit like JavaScript
– Programmers typically push complexity envelope
 • Multithreaded and network programming

Star Office
MS Office Competitor Written in Java

Java is Powerful?

- **Truth:** Java has a rich set of standard libraries
  - Networking
  - Threads (lightweight processes)
  - Distributed objects
  - Database access
  - Graphics: GUI controls and drawing
  - Data structure library
  - Arbitrary precision integral and fixed-point arithmetic
  - Digital signatures
  - Serialization (transmitting/reassembling data structures)
  - File and stream compression
 - XML parsing
  - Web services

MEL - Master Environmental Library (DMSO)
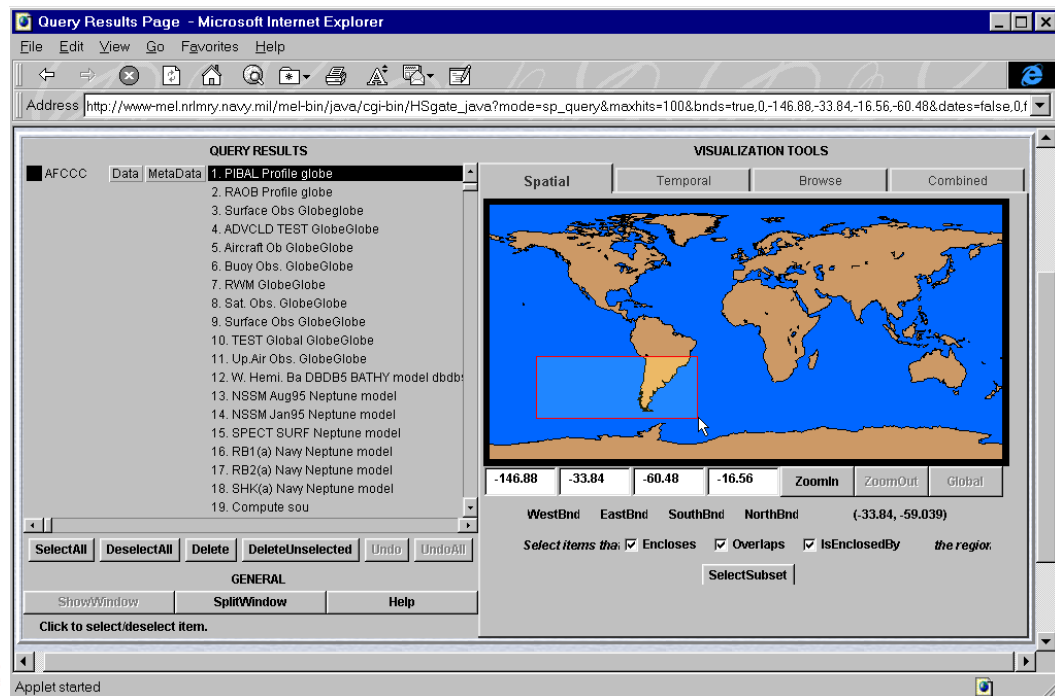
Java is Powerful?

- **Myth: Java will increase programmer productivity for all applications by XXX%.**
- **Myth: Java will kill C++**
- **Myth: All software should be written in Java**
  - Unix utilities: C
  - Desktop utilities: Python, Perl
  - Small/medium Windows-only programs: Visual Basic
  - String parsing: Perl
  - High-performance, single-platform OO systems: C++
  - Air traffic control, aircraft flight software: Ada
  - Knowledge-based systems: Lisp/CLOS
  - High-performance number crunching: FORTRAN
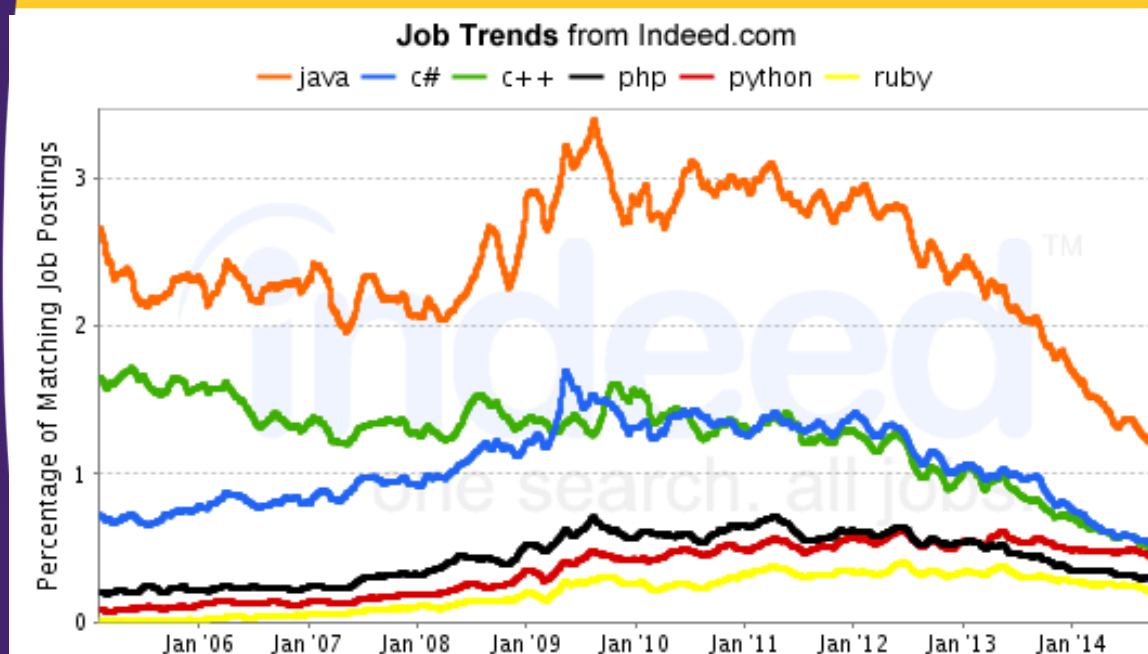 - Java also a good alternative for many of these

Java and C++
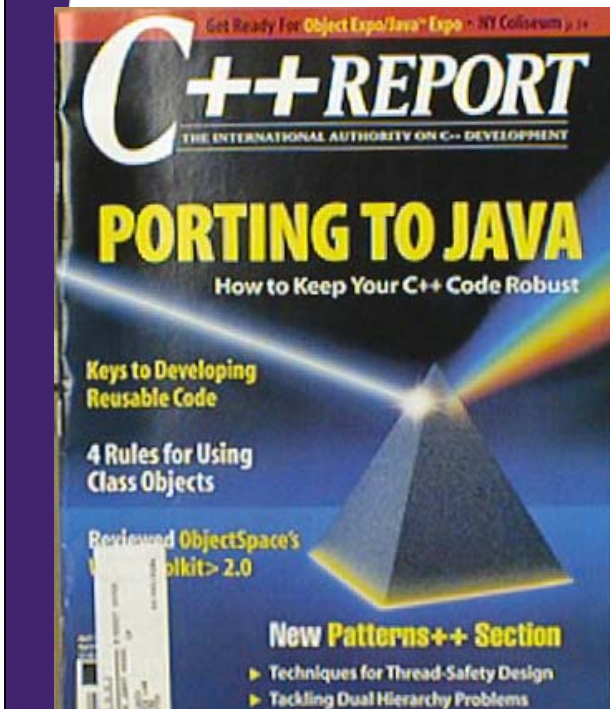
Although Java will certainly not kill off C++, Java and C++ do compete for some of the same territory.

Hmm, does *The C++ Report* think that the way to keep your C++ code robust is to port it to Java?
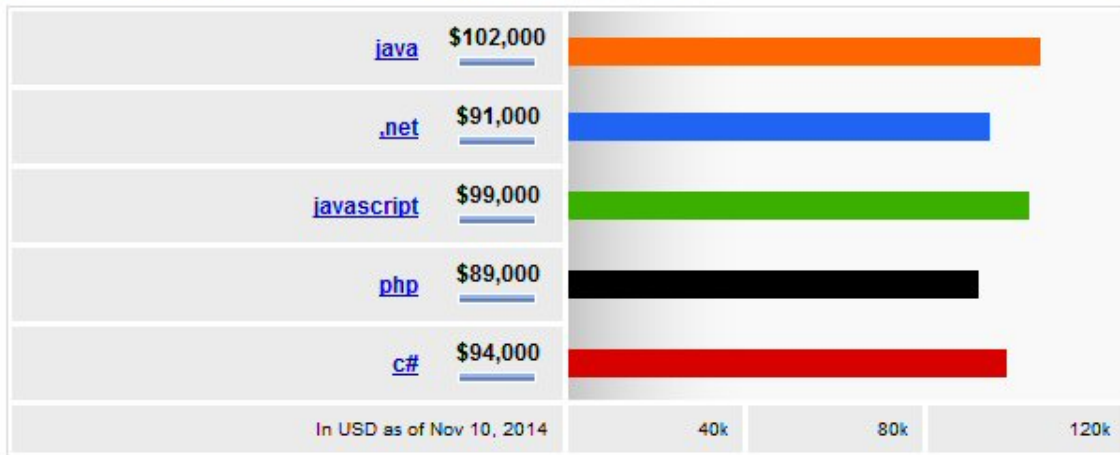
Java is Popular?

Java is Popular?

Average Salary of Jobs with Titles Matching Your Search

java	$102,000	
.net	$91,000	
javascript	$99,000	
php	$89,000	
c#	$94,000	
In USD as of Nov 10, 2014		40k 80k 120k

Data for US jobs from indeed.com as of November 2014, averaged over all states.

Java is Popular?

java	php	c#	c++	python
Search term	Search term	Search term	Search term	Search term

2005   2007   2009   2011   2013
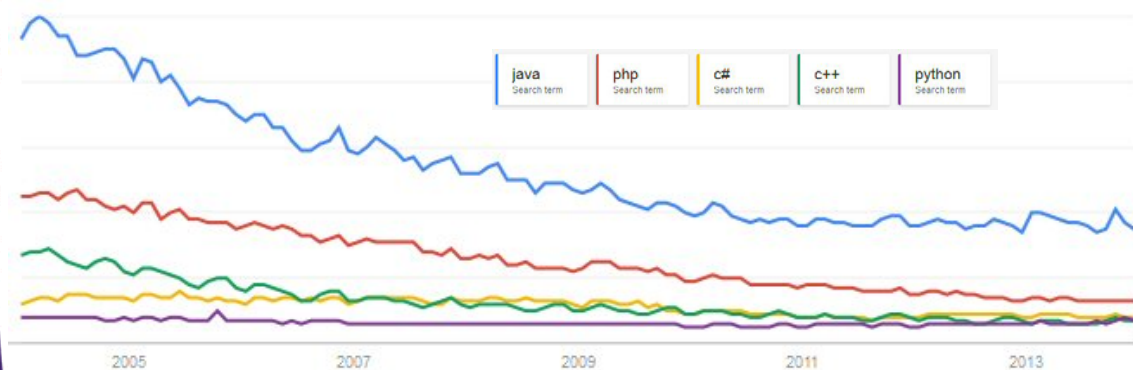
This reflects searches at Google

Java is Popular?
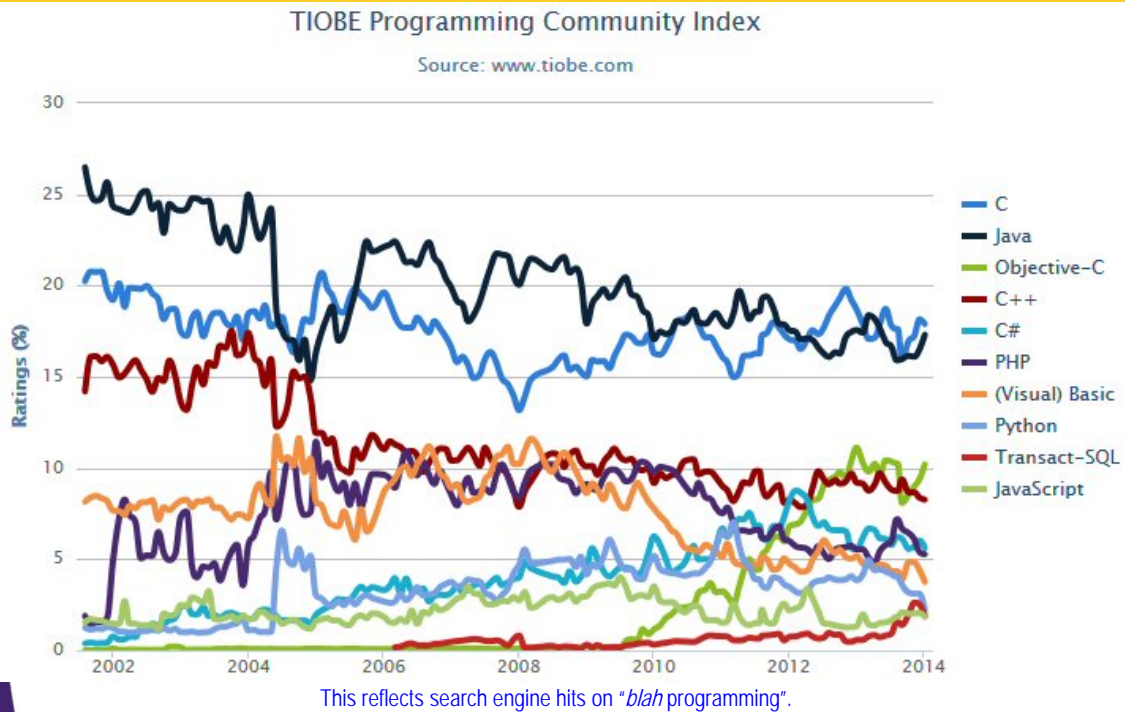
This reflects search engine hits on "*blah* programming".
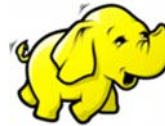

Major Java Editions

Standard Edition

- **Java SE**
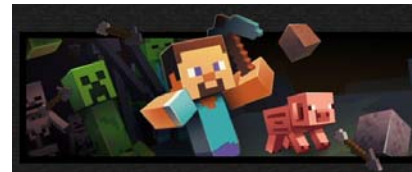 - This is often what people mean when they say "Java" or "the Java programming language"
- **Applications**
  - Desktop programming
  - Applets, Java FX
  - Java WebStart
  - Big data apps
  - Base on which to build Web apps that are not full Java EE
- **Famous examples**
  - Minecraft client
  - Eclipse, NetBeans, IntelliJ IDEA
  - Hadoop
  - Ant and ANTLR
  - GWT (Google Web Toolkit) and Laszlo

Enterprise Edition

- **Java EE (formerly "J2EE")**
  - This is Java running on app servers
- **Applications**
  - JSF, PrimeFaces, servlets, JSP, EJB, Spring, Hibernate
- **Famous examples**
  - Google home page, gmail, Google Maps, Google Docs
  - Ebay and PayPal
  - walmart.com, kmart.com, target.com, kohls.com, macys.com, homedepot.com, ikea.com, llbean.com
  - travelocity.com, orbitz.com, hotwire.com, hotels.com
  - Baltimore Orioles, Baltimore Ravens, Washington Nationals, Washington Redskins
  - Minecraft server

Micro Edition (or Java SE for Phones)

- **Java ME**
  - This is Java running on small devices
- **Applications**
  - Cell phone apps, embedded apps, printers, etc.
- **Famous examples**
  - Blackberry
  - Android
    - This is really optimized Java SE, not Java ME
  - Amazon Kindle
  - All Blu-Ray DVD players
  - Sony Ericson phones
  - EA Mobile

Java + Kindle: Amazon's new wireless reading device

Wrap-Up

Summary

- ## Java is a general purpose language
  - Supports standalone apps, browser-based applets, server-side programs, cell phones, and more
  - It is by far the most widely used language in the world
- ## Java has a number of good features
  - But not better in every way than all other languages
  - Few of the technical features were new to Java
- ## Reasons for using Java
  - Combination of technical features, widespread use, available developers, tools, and libraries
  - But in most application areas, other languages are also viable alternatives

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Questions?