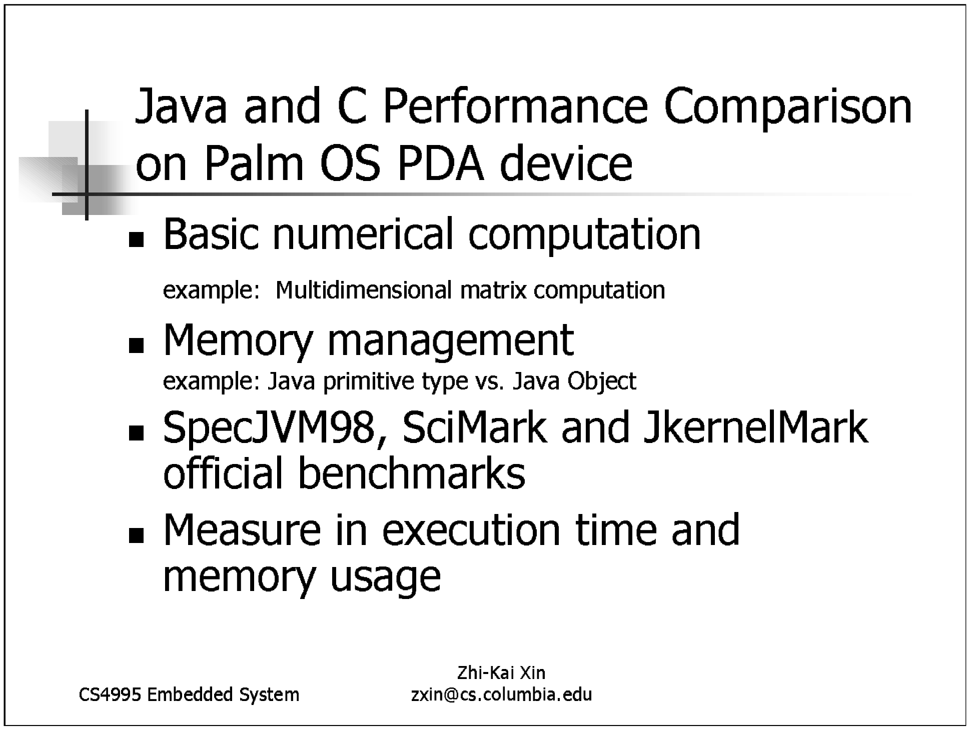

Java and C Performance Comparison on Palm OS PDA device

- Basic numerical computation

  example: Multidimensional matrix computation
- Memory management

  example: Java primitive type vs. Java Object
- SpecJVM98, SciMark and JkernelMark official benchmarks
- Measure in execution time and memory usage

CS4995 Embedded System

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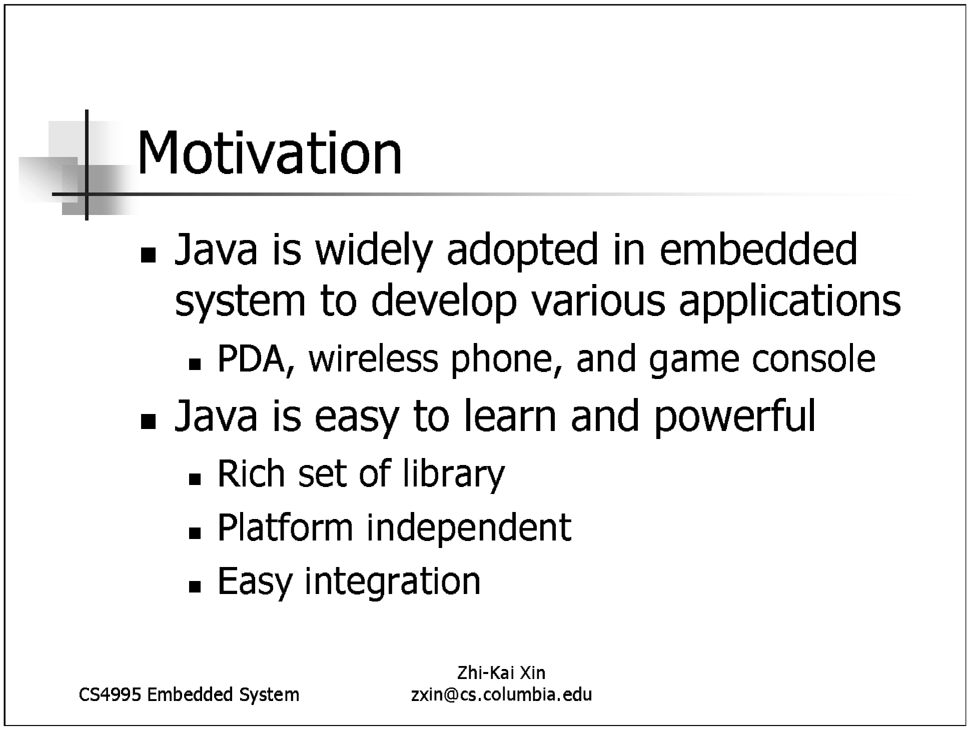
The project will compare the runtime performance of Java and C on Palm OS device. I like to perform series of numerical computation and memory management benchmark test with Java and C in resource limited embedded system. If time allows I also like to run some of official Java benchmark test from http://www.spec.org such as SpecJVM09 and SciMark. I will concentrate on the execution speed and memory usage of Java and C programs.



Motivation

- Java is widely adopted in embedded system to develop various applications
  - PDA, wireless phone, and game console
- Java is easy to learn and powerful
  - Rich set of library
  - Platform independent
  - Easy integration

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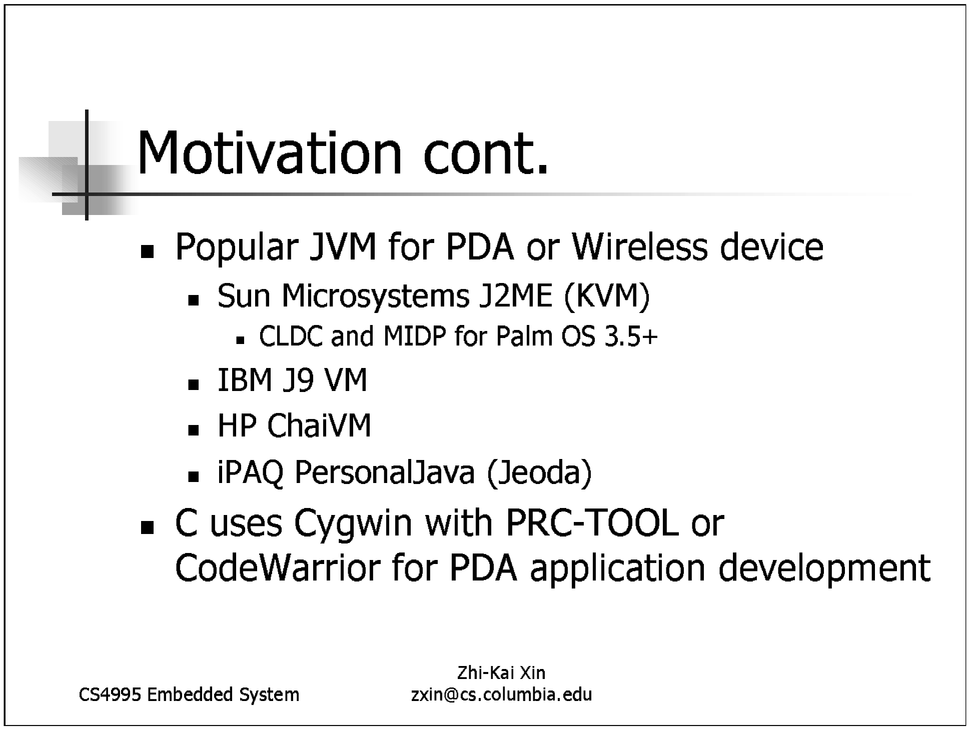
Java is already used widely for many real-world applications because its fast development cycle and easy integration. And PDA and Wireless devices are becoming popular, so Java should be considered for development on those devices. But I like to find if Java’s performances are acceptable or not on those resource limited PDA devices.



Motivation cont.

- Popular JVM for PDA or Wireless device
  - Sun Microsystems J2ME (KVM)
    - CLDC and MIDP for Palm OS 3.5+
  - IBM J9 VM
  - HP ChaiVM
  - iPAQ PersonalJava (Jeoda)
- C uses Cygwin with PRC-TOOL or CodeWarrior for PDA application development

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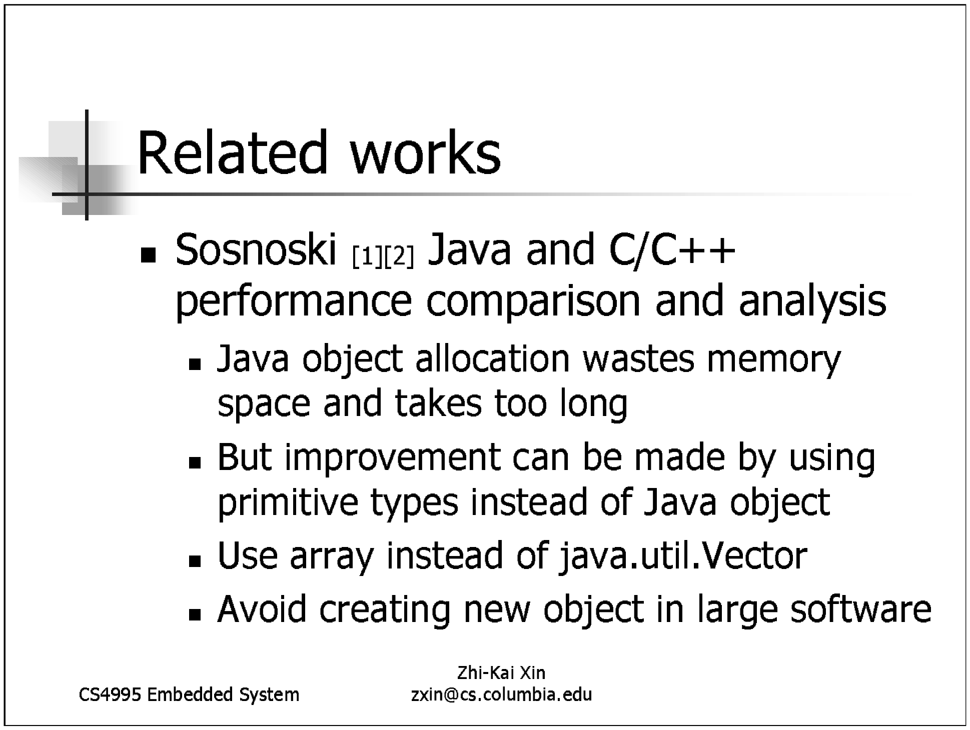
Here are some of the popular Java Virtual Machine available for some of popular PDA and Wireless devices.

Different embedded JVM has its own specification and gives different performance output on the PDA devices.



Related works

- Sosnoski [1][2] Java and C/C++ performance comparison and analysis
  - Java object allocation wastes memory space and takes too long
  - But improvement can be made by using primitive types instead of Java object
  - Use array instead of java.util.Vector
  - Avoid creating new object in large software

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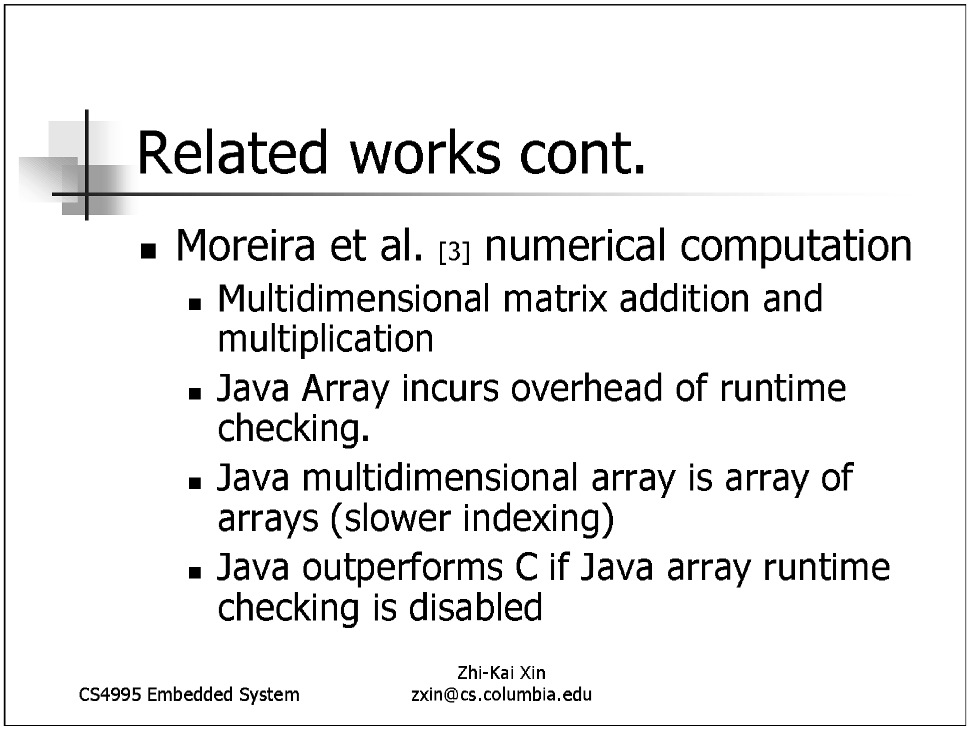
Dennis Sosonoski carried out series of experiment on comparing Java and C performance.

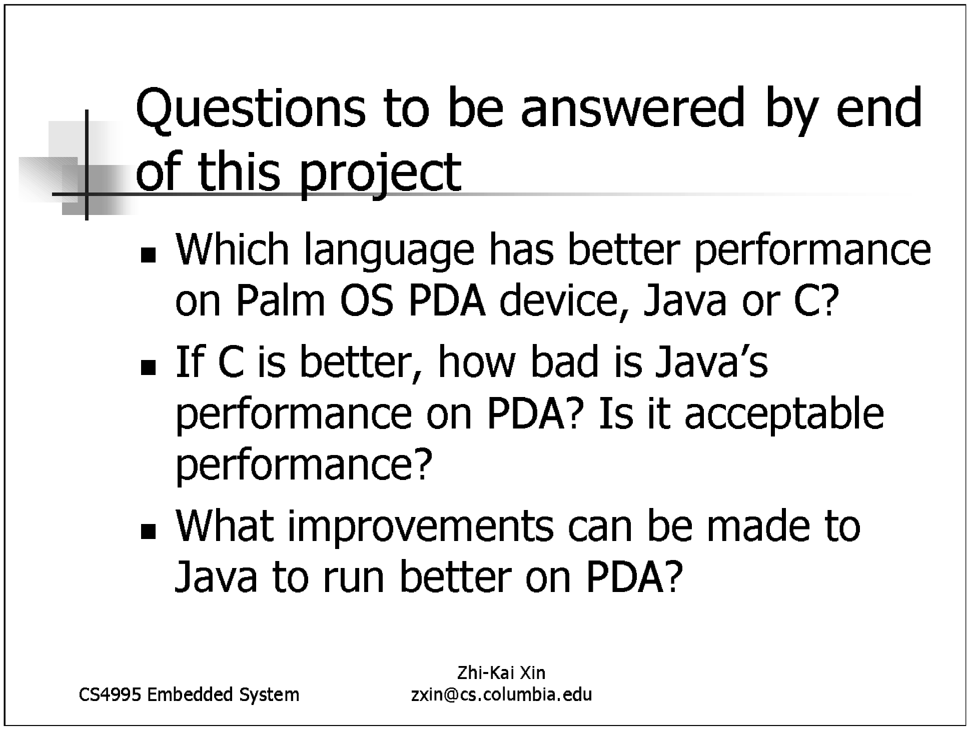
His results showed that Java performance can be improved if Java program is carefully written such that use Java primitive types as much as you can, avoid using java.util.Vector, avoid creating new object whenever you can.



Related works cont.

- Moreira et al. [3] numerical computation
  - Multidimensional matrix addition and multiplication
  - Java Array incurs overhead of runtime checking.
  - Java multidimensional array is array of arrays (slower indexing)
  - Java outperforms C if Java array runtime checking is disabled

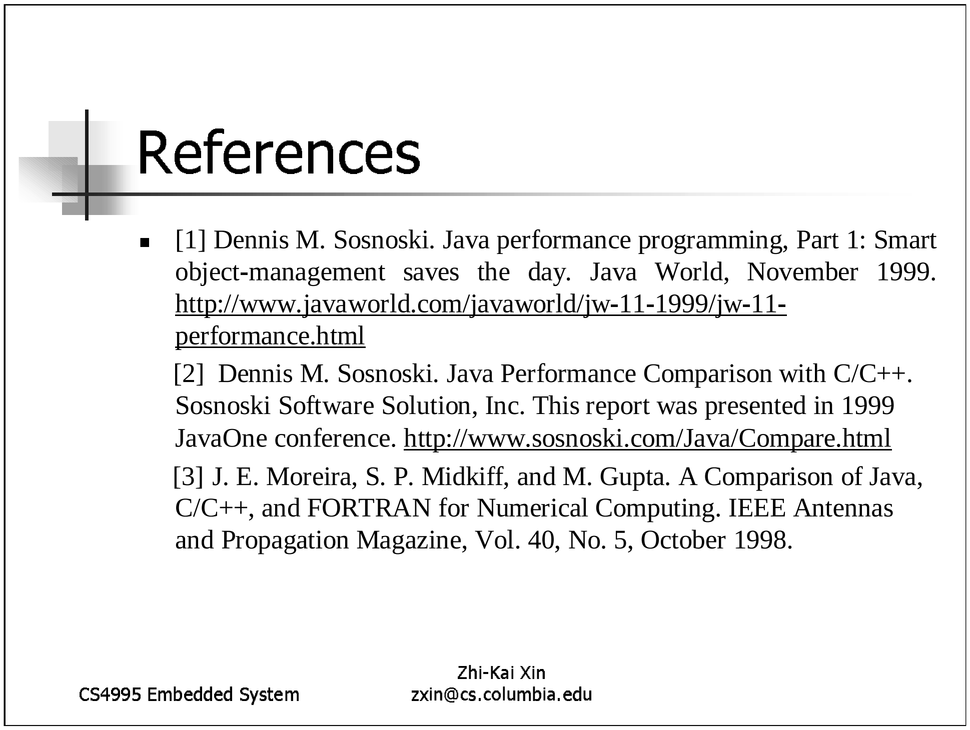
Moreira et al. carried out series of matrix computation experiment for Java, C and FORTRAN. FORTAN and C clearly outperforms Java in the experiment. But Java performance can be improve if Java array runtime checking is disabled.



Questions to be answered by end of this project

- Which language has better performance on Palm OS PDA device, Java or C?
- If C is better, how bad is Java's performance on PDA? Is it acceptable performance?
- What improvements can be made to Java to run better on PDA?

Most of the existing works compared Java and C/C++ performance on Unix or Window machines. My experiment will expand on those existing works by carrying out the similar benchmark test in embedded system such as Palm OS device. Hopefully I can answer these questions by end of the project.



References

- [1] Dennis M. Sosnoski. Java performance programming, Part 1: Smart object-management saves the day. Java World, November 1999. http://www.javaworld.com/javaworld/jw-11-1999/jw-11-performance.html

  [2] Dennis M. Sosnoski. Java Performance Comparison with C/C++. Sosnoski Software Solution, Inc. This report was presented in 1999 JavaOne conference. http://www.sosnoski.com/Java/Compare.html

  [3] J. E. Moreira, S. P. Midkiff, and M. Gupta. A Comparison of Java, C/C++, and FORTRAN for Numerical Computing. IEEE Antennas and Propagation Magazine, Vol. 40, No. 5, October 1998.