



***The Use of Java™ and Web-based
Architecture in Mission Management
Applications***

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Agenda

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Command, Control, Communication
and Information Systems

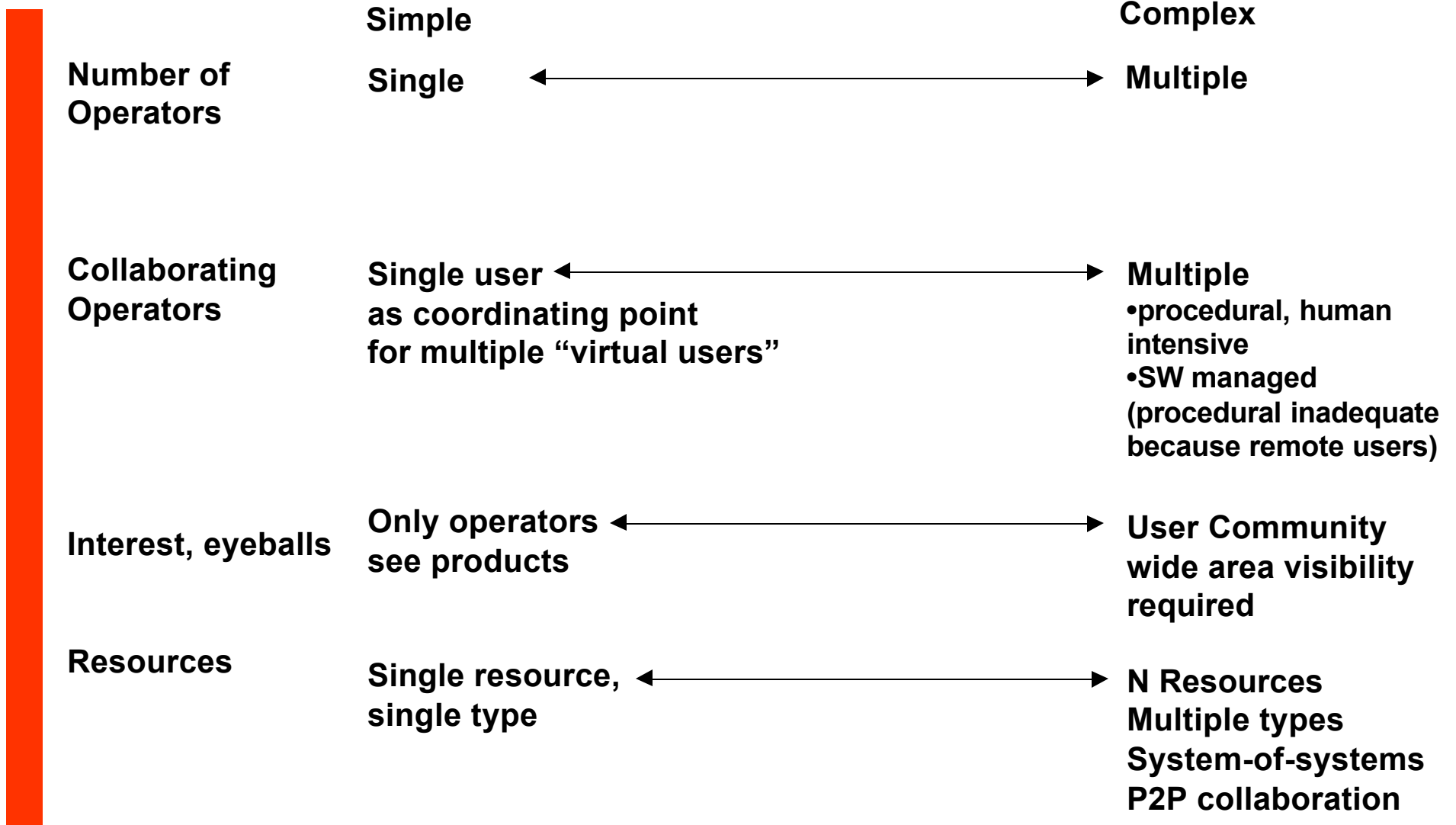
- **Evolving Needs of Mission Management**
- **Web Impact of Development**
- **Enabling Technologies**
- **Side-benefits of Java™**

Evolving Needs of Mission Management

Growth of Complexity



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Web Impact on User Expectations

- **Portability**
- **Access from anywhere**
- **Access to “any” necessary data**
 - **Search engines**
 - **Links to related “stuff”**
 - **Data fusion**
- **Easy version releases (download new versions)**
- **Light weight client boxes**
- **User defines their view of system (www.mymissionplanning.gov)**
- **Interfaces to legacy**

Enabling Technologies

Architecture Principles

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- **Component-Based Architecture**
 - **Clearly defined interfaces exist between each layer**
 - **Provides flexibility in deployment and implementation**
 - **Components in one tier can be modified and replaced independent of the other tiers**
 - **Accommodates rapid evolution**

- **N-Tier Architecture**
 - **Enables portability through easy deployment on a different environment (platforms, databases, user interface)**
 - **Scalability through ability to upgrade servers and load-balancing across multiple servers without impact to rest of architecture**

Commercial Standards/Products

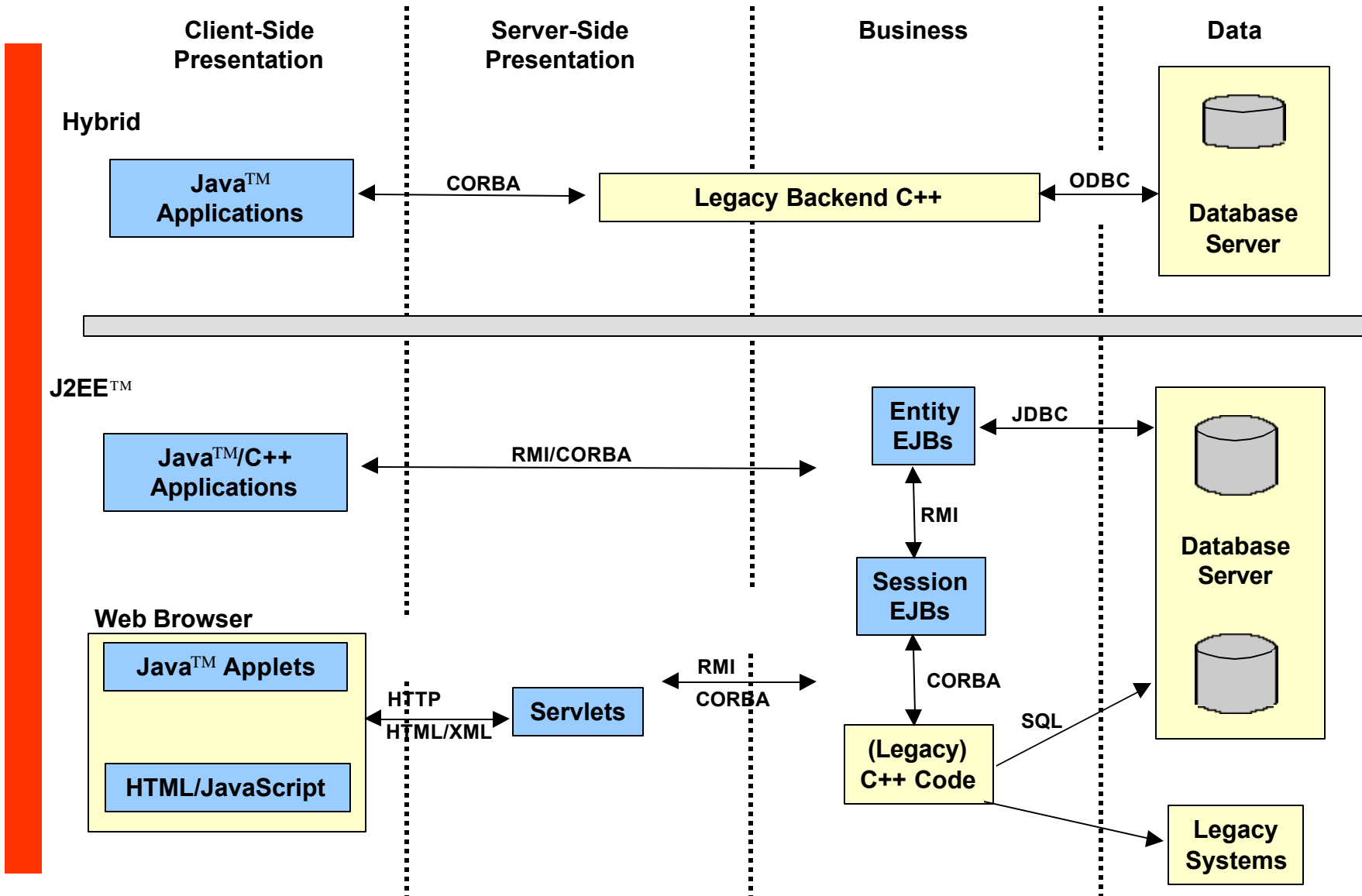
- **J2EE™**
- **Corba/RMI**
- **Web Browsers**
- **Application Servers**
- **DBMS evolving into application/web servers**
 - **Products to provide web data content**
 - **Gui builders**
 - **Interfaces to Corba, etc.**
- **HTTP**
- **XML**
- **EJBs, SJBs**
- **Java™**
- **New development methodologies**
 - **Extreme programming**
 - **RUP**

Enabling Technologies

J2EE™



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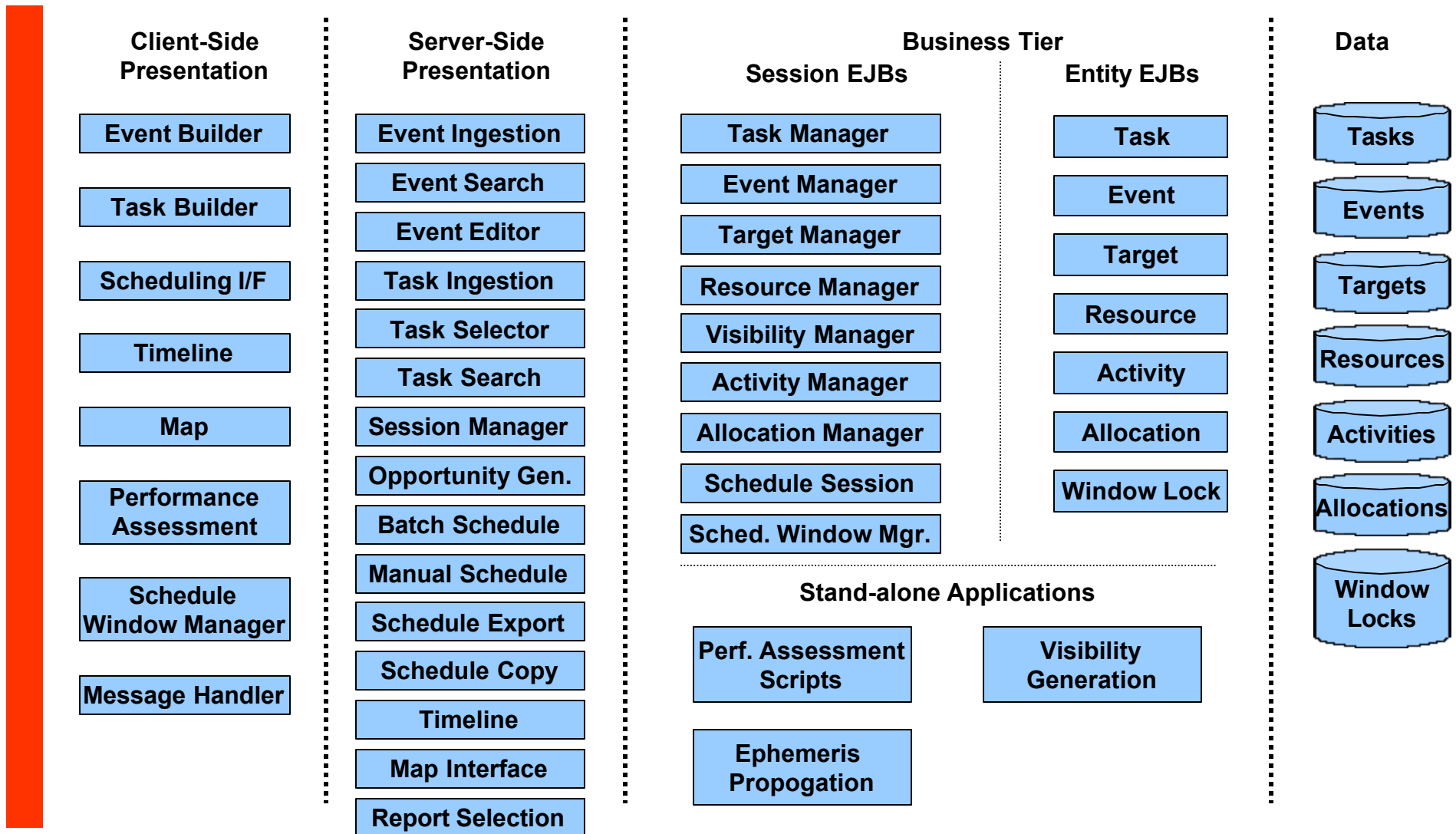


Enabling Technologies - J2EE™

MM N-Tier Implementation (example)



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Side-benefits of Java™

Software Cost Equation



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$$\text{Cost of S/W} = \left[\frac{\text{Total}}{\text{Functionality}} \right] \left[\frac{\$}{\text{Staff-Months}} \right] \left[\frac{\text{New LOC}}{\text{New Functionality}} \right] \left[\frac{\text{Effort in Staff-Months}}{\text{New LOC}} \right] + \left[\frac{\text{Reuse LOC}}{\text{Reuse Functionality}} \right] \left[\frac{\text{Effort in Staff-Months}}{\text{Reuse LOC}} \right] + \left[\frac{\text{Integration effort in Staff-Months}}{\text{COTS Functionality}} \right] + \text{Cost of COTS}$$

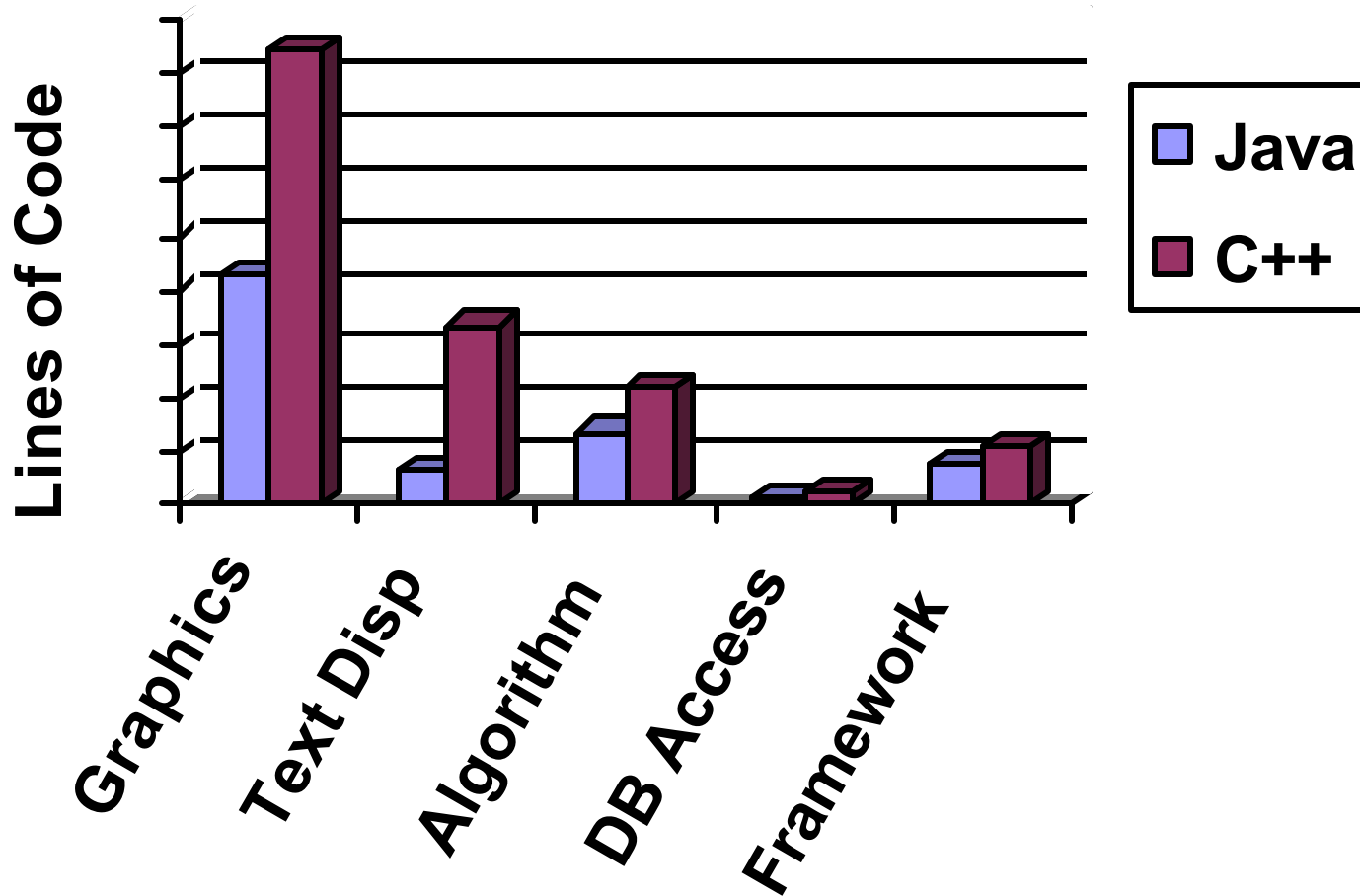
↑
Less LOC
Easier to Build

 ↑
Less COTs
Easier Integration

- We have identified potential for up to 12% project savings in development when using Java™

Side-benefits of Java™ - Inherent Savings

Line of Code Counts



Side-benefits of Java™ - Inherent Savings

Increased Productivity

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- **Even if Java™ was equal to C++ in LOC counts, it is quicker to build**
 - ***More built-in functions*** – This includes both built-in libraries as well as automatic memory management and support for multi-threading.
 - ***Simpler language syntax*** – Features which make Java™ both easier to learn and use, such as lack of pointers, array checking, single inheritance model, and no operator overloading.
 - ***Faster code iteration*** – No waiting for compiles and links.
 - ***Better documentation*** – Due to automated document generation using Javadoc as well as quantity of online tutorials and examples.

Side-benefits of Java™ - Inherent Savings

Reduced Cost for COTS Usage

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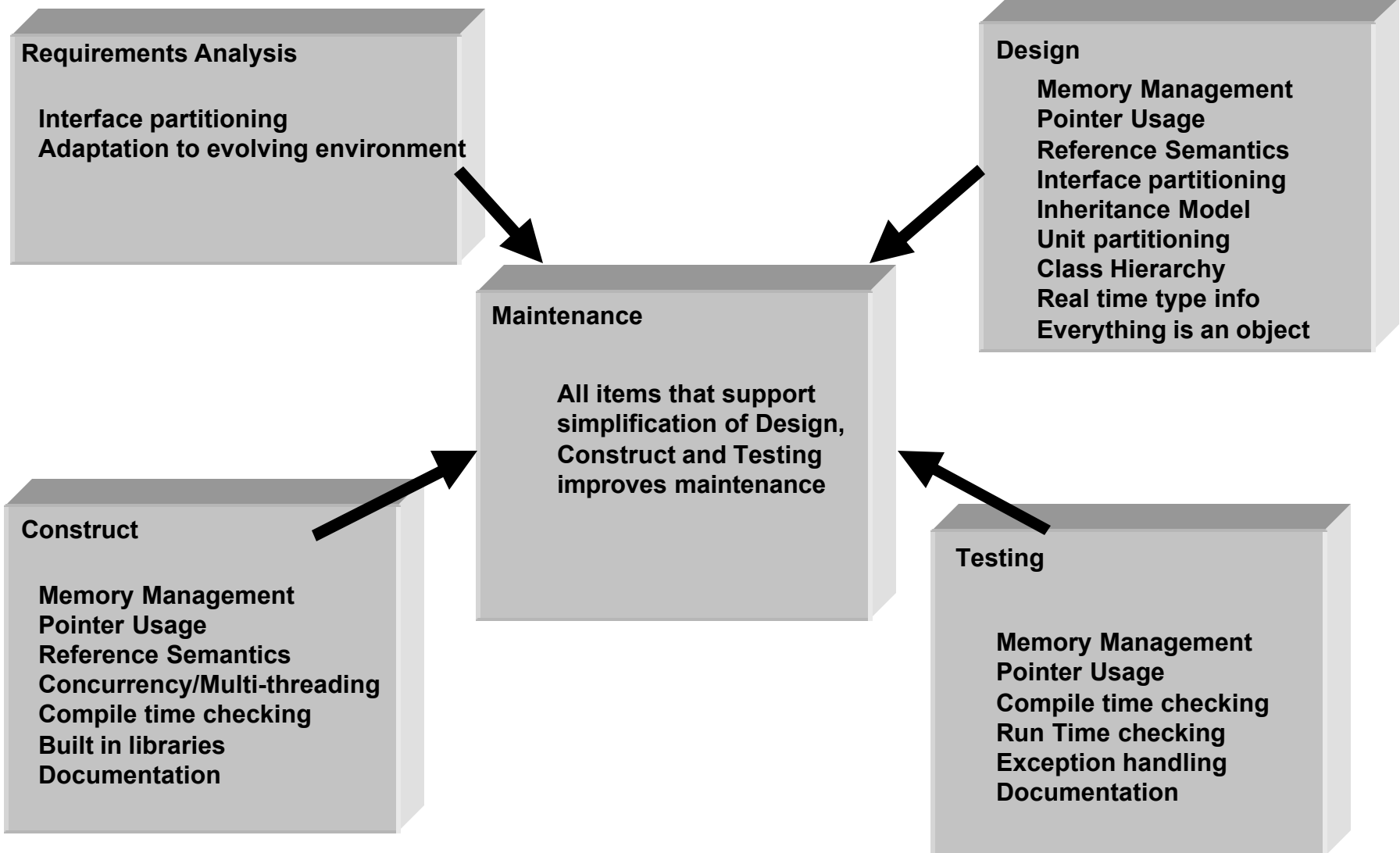
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- **Java™ development may required as much as \$300K less COTS purchases**
 - **Some products used for Java™ are less than C++**
 - **ex:C++ must be purchased, Java™ is free**
 - **Profilers, visual development tools**
 - **Some products not needed for Java™ because of built-in capabilities**
- **C++ purchases not required for Java™**
 - **Object Request Broker**
 - **Distribution Middleware**
 - **Utility libraries (Objectspace, Dbtools, XRT/Table)**
- **Java™ needs not used with C++**
 - **Browser**
 - **Application Server**

Side-benefits of Java™ - Process-Dependent Savings Life Cycle Quality Improvements

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Side-benefits of Java™

Staffing

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- **Java™ may help improve our ability to staff future projects:**
 - **Hiring - More new hires are going to know Java™ than C++ since it is becoming the language of choice for computer science education.**
 - **Training – For the people that have to learn on the job, Java™ is simpler to learn.**
 - **Retention - Developers find Java™ more “fun” and on the leading edge of technology, which will help staff retention.**

Java™ is Not a Silver Bullet

- **Performance – Will Java™ provide the operational performance required by our customers?**
 - Preliminary benchmarks show Java™ improvements have made this a minor issue
 - Want to double check for specific problem areas
- **Large-scale Development Configuration Management- Developments with greater than 10 people may not be able to fully use the Java™ Interactive Development Environments (IDEs) because of their immature interaction with CM tools.**
- **Size - How big can a system get before it will substantially impact the Virtual Machine?**

Conclusions

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- **The Market is Driving Architecture Changes**
 - Users more sophisticated because of the Internet
 - Focus on standard interfaces (HTTP, XML for physical implementation)
- **Evolution is Do-able**
 - Separation of client and server applications
 - Legacy components become plug-ins