Javolution C++
They call him Ginger!
« It looks like Java, it tastes likes Java… but it is C++ »
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What is the problem?

- More and more hybrid C++/Java projects
  - Developer expertise required in both Java and C++

- C++ total cost is significantly higher
  - But cost of migrating existing C++ components to Java is prohibitive.

- Standardized and well established software practices exist in the Java world
  - C++ developers are on their own (multiple solutions to address the same problems lead to additional complexity)

- Many Open-Source implementations of Software Standards exist only in Java
  - OSGi, GeoAPI, UnitsOfMeasure, etc.
Many causes of variability.

- Developers expertise varies considerably.
- Testing performed at the end (integration) due to component inter-dependencies.
- Insufficient documentation.
- “Not Invented Here” Syndrome.
- Proprietary solutions not maintained which later become legacy burden.
- It is very beneficial to follow well-established standard specification.

“Doing the right thing is difficult, but doing it right is easier.”
Javo(So)lution.

- Uniformization of C++/Java development through the use of a common framework (Javolution) based on Java standard library specification.

- Facilitating the migration of Java OSS code to C++

- Promote the “Service Oriented Approach” by providing an OSGi framework for both Java and C++

- Reduce documentation by having the same specification/design for our Java and C++ components.

- Unification of code building for Java and C++ (maven used for both).
Maven Build

- **Apache Maven** (maven native plugin) is used to produce artifacts (dynamic libraries, static libraries, executable) and to perform unit tests.

- Profiles and packaging classifiers are used to address platform variability (windows, linux, etc.)
What is Javolution C++?

• A mirrored C++ library sharing the same specifications, documentation and unit testing as its Java pendant.

• A “behind-the-scenes” C++ infrastructure based on smart pointers (real-time garbage collection through reference counting).

• Integrated memory cache making small, short lived objects (e.g. value types) very efficient.

• C++ packages/classes derived from standard Java (e.g. javolution::lang, javolution::util)

• A C++ dynamic execution and testing framework (OSGi & JUnit) identical to Java.
C++ Class Definition

The general pattern for class/interface is as follow:

```
#include "javolution/lang/Object.hpp"

namespace com { namespace bar {
    class Foo_API; // Value type (used to define the API)
    typedef Type::Handle<Foo_API> Foo; // Reference (same as Java)
}
}

class com::bar::Foo_API : public virtual javolution::lang::Object_API {
    private:
        Param param;

    protected:
        Foo_API(Param const& param) { // const& for handles parameters.
            this->param = param;
        }

    public:
        static Foo newInstance(Param const& param) { // Generalized use of
            return new Foo_API(param); // factory methods.
        }
        virtual void fooMethod () { ... };  
    }
```
C++ Parameterization – Better than Java!

- Unlike Java, C++ class parameterization is not syntactic sugar but efficient use of C++ templates!

- All javolution::util collections are parameterized.

```cpp
class String {
  //...
}

List<String> list = FastTable_API<String>::newInstance();
list->add(L"First");
list->add(Type::Null);
list->add(L"Second");
```

- Also used for Java-Like Enums
Synchronization

- Supported through a macro: `synchronized(Object)` mimicking the Java synchronized keyword.

- Can be performed on instances of Javolution collections and Class (for static synchronization).

```java
synchronized (trackedServices) {
    // trackedServices instance of FastMap
    for (int i = 0; i < serviceReferences.length; i++) {
        Object service = actualCustomizer->addingService(serviceReferences[i]);
        trackedServices->put(serviceReferences[i], service);
    }
    trackingCount = 0;
}
```
Miscellaneous

• Limited reflection support through RTT

• Auto-boxing of primitive types (boolean, integer, float, wide strings).

```java
Integer32 i = 23;
Float64 f = 3.56;
Boolean b = true;
String s = L"xx";
```

• All variables are initialized to Type::Null (NullPointerException if not set before use).

• Wide-String (literal) concatenation supported.

```java
throw RuntimeException_API::newInstance(
    L"Bundle " + symbolicName + L" not in a resolved state" );
```

• Dynamic length array Type::Array</t>ype

```java
Type::Array<ServiceReference> serviceReferences
    = context->getServiceReferences(serviceName, Type::Null);
if (serviceReferences.length == 0) return;
```
Minor differences with Java

- No ‘finally’ keyword in C++ (but try…catch same as Java).

- Static methods are called using the name of the class with the suffix ‘_API’

- Generalized use of static factory methods, e.g. MyClass_API::newInstance(…)

- Synchronization not supported on every object but only on those whose class implements the Object_API::getMutex() virtual method.
What next?

- Automatic translator (JavaCC based) of Java source code to Javolution C++
- More Java library conversion (e.g. OpenSDK, JScience, ...)
- Help wanted in writing the translator tool 😊