

Spf4j overview

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1. Performance monitoring

1.1. How to record measurements?

a) Via API

Lowest impact:

```
private static final MeasurementRecorder recorder = RecorderFactory.createScalableQuantizedRecorder(forWhat,
    unitOfMeasurement, sampleTime, factor, lowerMagnitude, higherMagnitude, quantasPerMagnitude);
...
recorder.record(measurement);
```

More flexible in case you want to decide on what to measure at runtime:

```
private static final MeasurementRecorderSource recorderSource =
    RecorderFactory.createScalableQuantizedRecorderSource( forWhat,
        unitOfMeasurement, sampleTime, factor, lowerMagnitude, higherMagnitude, quantasPerMagnitude);
...
recorderSource.getRecorder(forWhat).record(measurement)
```

b) Via Aspect

Annotate a method you want to measure and monitor performance with the annotation:

```
@PerformanceMonitor(warnThresholdMillis=1, errorThresholdMillis=100, recorderSource = RecorderSourceInstance.Rs5m.class)
```

Start your jvm with aspectj load time weaver:

```
-javaagent:${project.build.directory}/lib/aspectjweaver-${aspectj.version}.jar
```

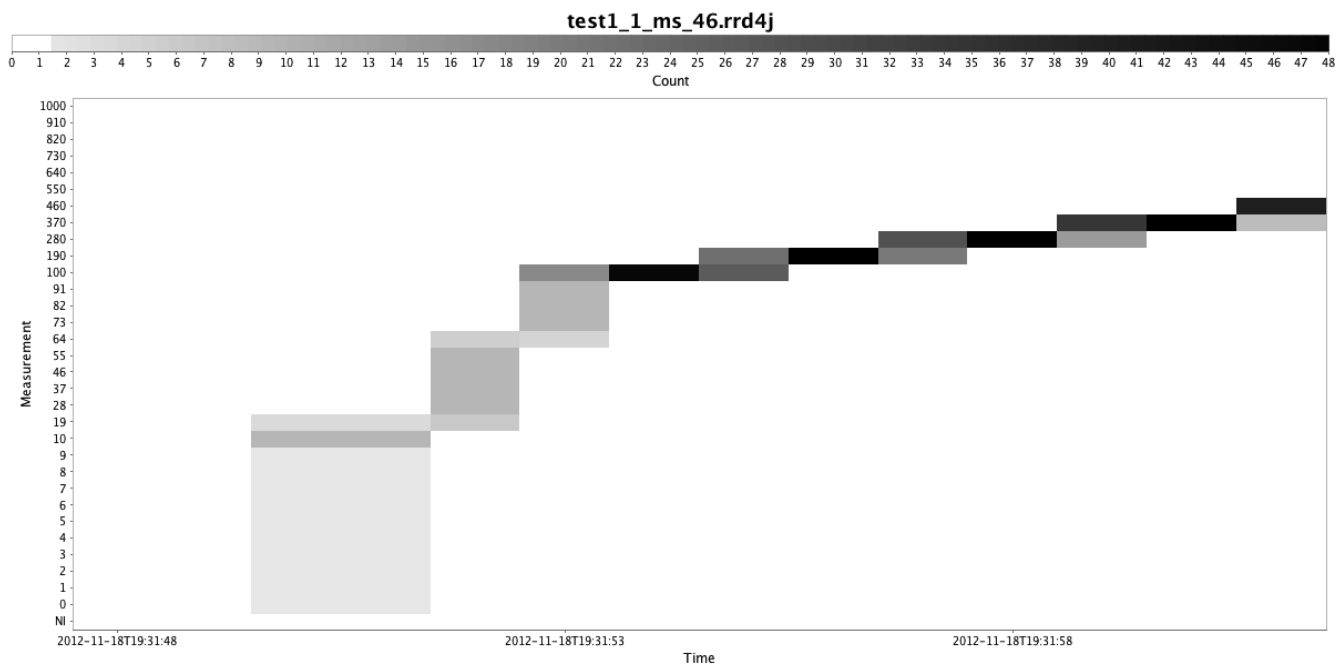
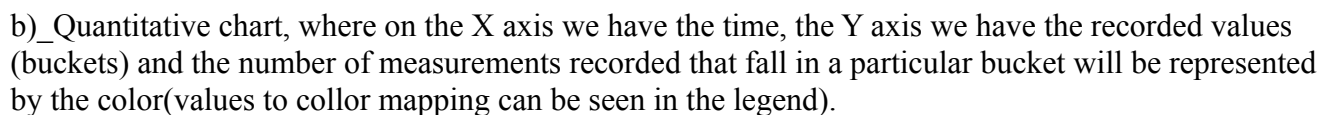
Make sure your aspectj config file (META-INF/aop.xml) contains:

```
<aspectj>
  <aspects>
    <aspect name="com.zoltran.perf.aspect.PerformanceMonitorAspect"/>
  </aspects>
  <weaver options="-verbose">
    <include within="com.*..*" />
  </weaver>
</aspectj>
```

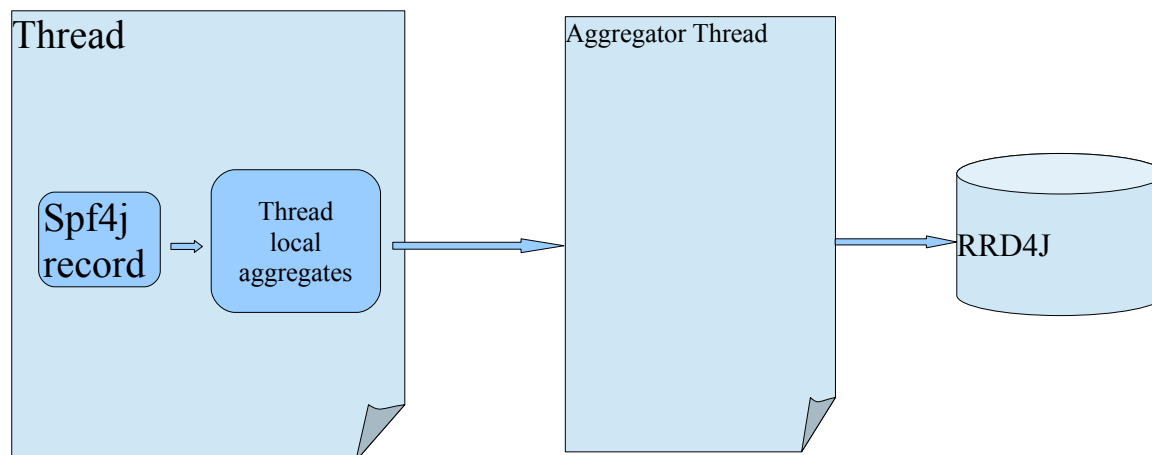
This will record the execution times of the annotated method and will also log (via spf4j) a message containing the call detail and execution time if the warn or error thresholds are exceeded.

1.2. How to see the recorded measurements?

a) min, max, avg , measurement count values/ time axis



1.3. How does it work ?



Charts are generated using jfreechart library.

2. Performance Profiling

2.1. When to profile your code?

1. I recommend to deploy your code with profiling turned on as much as you can. In my case I have profiling data collection turned on in test/qa environments all the time. (with 100ms sampling interval). If you can afford to do it in PROD do it.

2.2. How to profile your code?

Add spf4j to your classpath and the following to your command line:

```
${JAVA_HOME}/bin/java [your jvm args] com.zoltran.stackmonitor.Monitor -f reportFile.html -ss -si 100 -w 600 -main [your app main class] - - [your app arguments]
```

This will start your application with profiling enabled, with a 100 ms sampling interval. After the process ends reportFile.html will be generated with a graphic width of 600 pixels. Profiling can also be enabled/disabled via JMX.

Supported arguments:

- f VAL : output to this file the perf report, format is HTML
- main VAL : the main class name
- md N : maximum stack trace depth
- nosvg : stack visualization will be in svg format
- si N : the stack sampling interval in milliseconds
- ss : start the stack sampling thread. (can also be done manually via jmx)

-w N : flame chart width in pixels

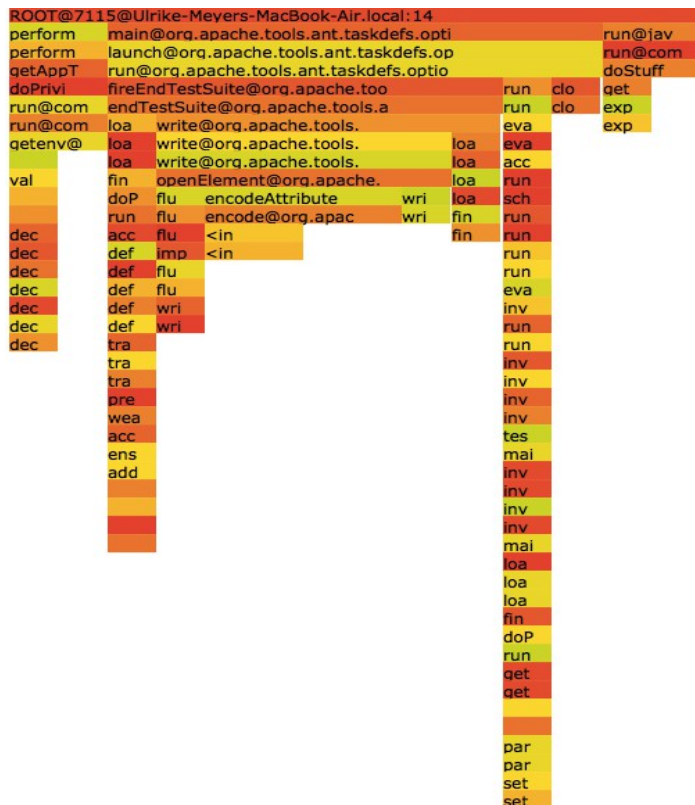
2.3. How to see the profile data?

After the program finishes it will write the data to the reportFile.html

The total view shows the total picture of what your application is doing.



Now as you can see this profile of my simple test code is sleeping most of the time. If you are interested into what the process is doing while it is on CPU, the next report will provide that detail:



Processes are staying quite a bit waiting for things to happen/sleeping and there is not much you can do about that, eliminating those states from the report allows you to see and concentrate on the “useful” parts of your application. As you can see above (if you look at the actual reports hovering with the mouse above a entry will display the details) DemoTest is also doing stuff (doStuff) not only sleeping...

2.4. How does it work?

A sampling thread is started and running in the background. This thread uses `Thread.getAllStackTraces()` or the JVM MX beans (configurable) to get all stack traces for all threads. Each sample is added to a tree that aggregates the stack trace data.

3. High Performance Object Pool

3.1. Why another object pool implementation?

In my(I am not alone) view current available object pool implementations are less than perfect. Beside the scalability issues and bugs, I don't like the following implementation choices found in other implementations:

1. Test on borrow is pointless, there is no guarantee that you will get a valid object even if you test on borrow. This encourages the developer to disregard handling of this case when it receives an invalid object. This practice also often is a performance killer.
2. Indiscriminate test on return is not optimal. Test on return should be done only in the case where there is a suspicion that the object is invalid, otherwise the performance impact will be too high to be acceptable in most cases. Pool client should be able to provide feedback on return for that case.
3. NO exception swallowing. If a exception happens with the pooled objects the pool user will know about it and will have to handle it.

You will not find code like this (apache commons):

```
131      /**
132       * Unconditionally close an <code>Reader</code>.
133       * <p>
134       * Equivalent to {@link Reader#close()}, except any exceptions will be
ignored.
135       * This is typically used in finally blocks.
136       *
137       * @param input the Reader to close, may be null or already closed
138       */
139       public static void closeQuietly(Reader input) {
140           try {
141               if (input != null) {
142                   input.close();
143               }
144           } catch (IOException ioe) {
145               // ignore
146           }
147       }
```

In Guava (my favorite open source library) the authors did the same mistake as the apache folk above. But I am happy they realized the problem recently:

`closeQuietly`([Closeable](#) closeable)

Deprecated.

This method has few valid use cases and encourages misuse by making it easy to do the wrong thing. Among other things, it may swallow exceptions that really should be thrown, such as exceptions thrown when closing an output stream: this often involves flushing buffered data to the final output destination and as such it is just as important to throw the exception thrown when closing as it is to throw an exception thrown by a call to a write method. This method is scheduled to be removed in Guava 16.0.

In guava they recommend the following pattern for not losing the original exception:

```
public void useStreamNicely() throws IOException {
    SomeStream stream = new SomeStream("foo");
    boolean threw = true;
    try {
        // ... code which does something with the stream ...
        threw = false;
    } finally {
        // If an exception occurs, rethrow it only if threw==false:
        Closeables.close(stream, threw);
    }
}
```

I prefer using the exception chaining technique in which case both exceptions info will be thrown:

```
T object = pool.borrowObject();
try {
    handler.handle(object);
} catch (Exception e) {
    try {
        pool.returnObject(object, e);
    } catch (ObjectReturnException ex) {
        throw Exceptions.chain(ex, e);
    } catch (ObjectDisposeException ex) {
        throw Exceptions.chain(ex, e);
    }
    if (e instanceof RuntimeException) {
        throw (RuntimeException) e;
    } else {
        throw new RuntimeException(e);
    }
}
pool.returnObject(object, null);
```

3.2. Use case

The classical use case for an object pool is to pool your jdbc connections. One of the most popular object pool implementations is apache commons-pool with dbcp-pool specialized in JDBC object based on it. A lot of people are unhappy with this implementation (including myself), so much that the apache tomcat developers wrote their own implementation. Here is a comparison of their implementation

against dbcp pool:

<http://tomcat.apache.org/tomcat-7.0-doc/jdbc-pool.html>

A performance comparison between dbcp, c3p0, and tomcat jdbc pool :

<http://www.tomcatexpert.com/blog/2010/03/22/understanding-jdbc-pool-performance-improvements>

The goal of this implementation is to be more reliable and faster than any of the implementations out there. (Unit test will fail otherwise)

3.3. How to use the object pool

Creating a pool is simple:

```
ObjectPool<ExpensiveTestObject> pool = new ObjectPoolBuilder(10, new ExpensiveTestObjectFactory()).build();
```

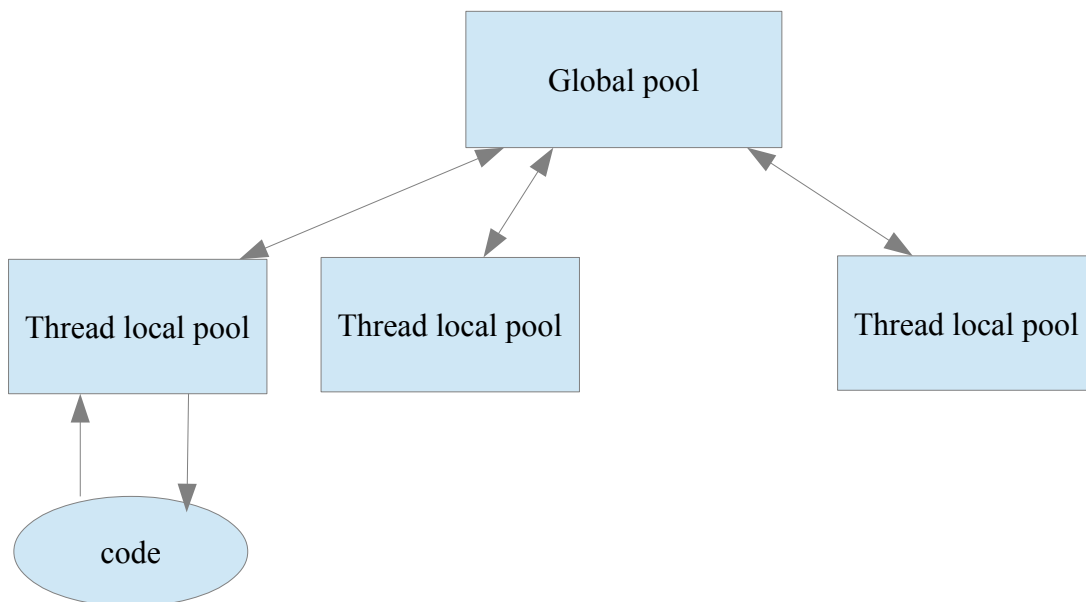
at minimum you will need to provide the maximum size and the object factory.

To do something with a object from a pool you will need to:

```
Template.doOnPooledObject(new ObjectPool.Hook<PooledObject, SomeException>() {  
    @Override  
    public void handle( PooledObject object) throws SomeException {  
        object.doStuff();  
    }  
}, pool, IOException.class);
```

You can also use the borrow and return methods on the object pool to get and return an object to the pool.

3.4. How does the pool work?



The architecture above biases object to threads, so a thread will most likely get the same object minimizing object contention (if pool size \geq thread nr which is the recommended sizing).