Robo4J mit NetBeans und Java Flight Recorder

Java Mission Control und Java Flight Recorder

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Safe Harbor Statement

Faster and Easier Use and Redistribution of Java SE

- Oracle is proposing to increase the release cadence of Java SE to every six months
- Oracle will simplify how developers, customers, and consumers use Java SE
  - **Starting with JDK 9 GA Oracle plans to ship OpenJDK builds under the GPL**
  - Oracle has proposed a time-driven release model for Java SE instead of the historical feature-driven model
  - **Oracle JDK will contribute previously commercial features such as Java Flight Recorder to OpenJDK**
  - Oracle will work with other OpenJDK contributors to make the community infrastructure complete, modern and accessible
- The Oracle JDK will continue as a commercial long term support offering
  - The Oracle JDK will primarily be for commercial and support customers once OpenJDK binaries are interchangeable with the Oracle JDK (target late 2018)
  - Oracle will continue to enhance the packaging and distributing of complete ready-to-run applications

Java Mission Control

- A tools suite for ***production*** use (fine in development too)
  - Basic monitoring
  - Production time **profiling** and diagnostics

- Free for development and evaluation
  - Tool usage is free, data creation in production requires a commercial license

  tiny.cc/javalicense

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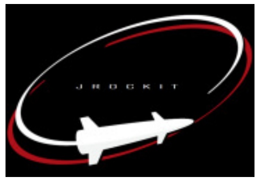
”Java Mission Control profiling tool”

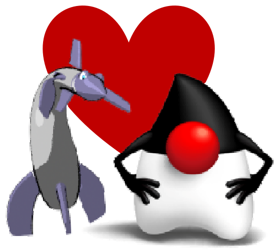
- Data from Java Flight Recorder
- Visualized in Java Mission Control

Java Mission Control - History

- JRockit Flight Recorder



- Appeal (JRockit) acquired by BEA Systems
  - Acquired by Oracle and acquired Sun Microsystems



- Best JRockit features converged with HotSpot JVM

- JFR and JMC released with JDK 7u40

Java Mission Control Main Tools

Two main tools:

- JMX Console
  - Online monitoring
- Flight Recorder
  - Offline low overhead profiler

- JRockit Mission Control also had the **Mem**ory **Leak** Analyzer

Experimental Plugins

Downloadable from within Mission Control

- DTrace
  - JFR style visualization of data produced by DTrace
- JOverflow
  - Memory anti-pattern analysis from hprof dumps
- JMX Console plug-ins
- Java Flight Recorder plug-ins
  - WLS
  - JavaFX

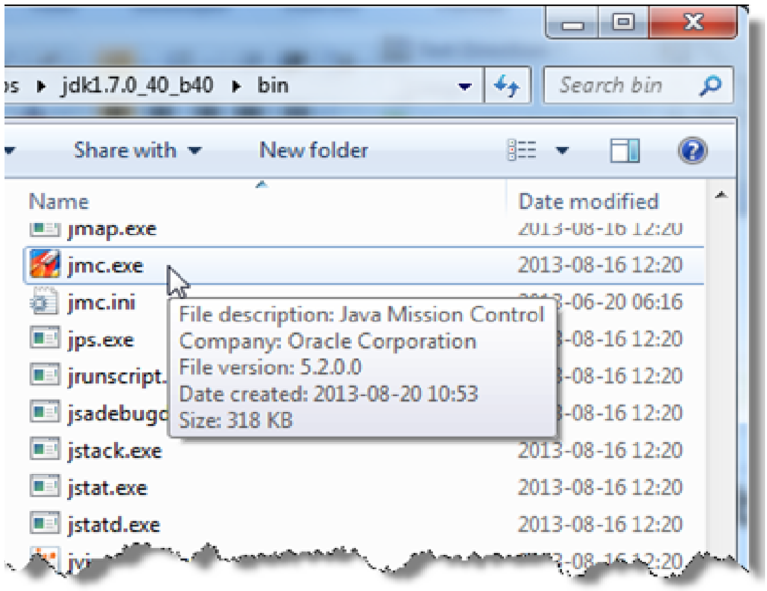
JMC installation/startup

`<JDK>/bin/jmc`

– Mac: `(/usr/bin/) jmc`

  Add if needed:

```
-consoleLog -debug     ( | more 2>&1 )
```



s ▸ jdk1.7.0_40_b40 ▸ bin

Search bin

Share with ▾ New folder

Name	Date modified
jmap.exe	2013-08-16 12:20
jmc.exe	2013-08-16 12:20
jmc.ini	3-06-20 06:16
jps.exe	-08-16 12:20
jrunscript.	-08-16 12:20
jsadebugd	-08-16 12:20
jstack.exe	2013-08-16 12:20
jstat.exe	2013-08-16 12:20
jstatd.exe	2013-08-16 12:20
jvi	3-08-16 12:20

File description: Java Mission Control
Company: Oracle Corporation
File version: 5.2.0.0
Date created: 2013-08-20 10:53
Size: 318 KB

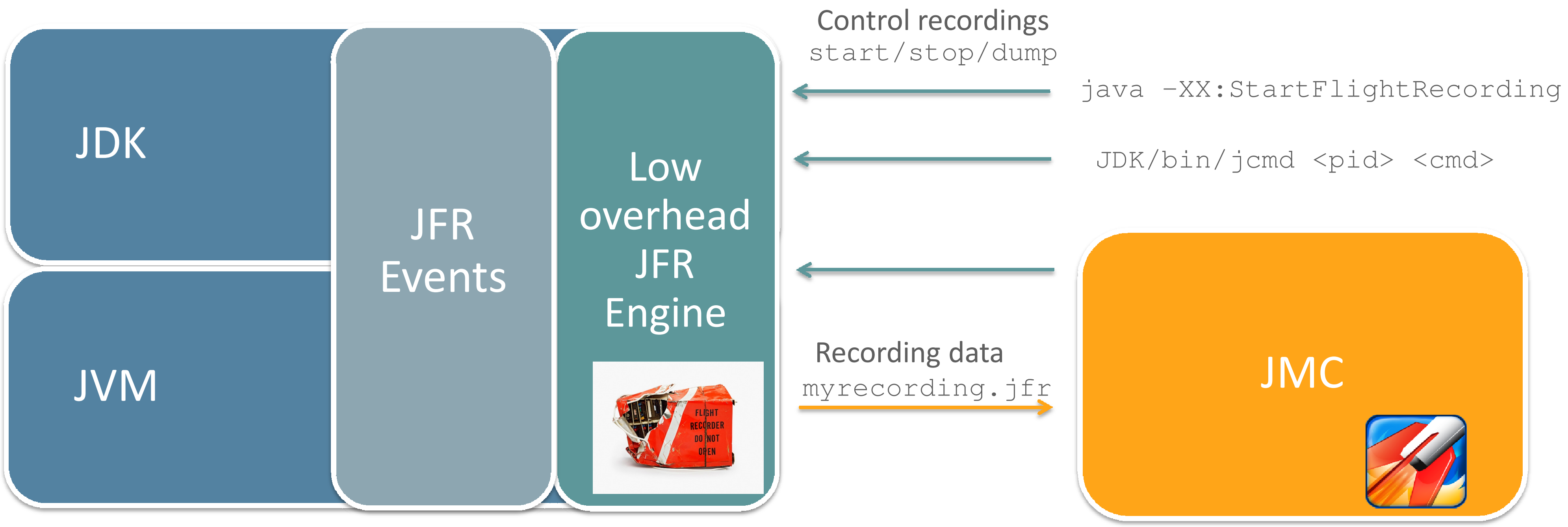
- Eclipse plug-ins
  – Install from update site on OTN: http://oracle.com/missioncontrol, Eclipse Update Site

- Experimental plug-ins: Install from within the JMC app, or from
  https://oracle.com/missioncontrol, Eclipse Experimental Update Site

Java Flight Recorder

- High Performance Event Recorder
- Built into the JVM
  - Already available runtime information
  - Measuring the real behavior, doesn’t disable JVM optimizations
- Binary recordings
  - Self contained self describing chunks
- Very detailed information
- Extremely low overhead (~ 2..3%)
  - Can keep it always on, dump when necessary

Java Flight Recorder (JFR) and Java Mission Control (JMC)



```
start/stop/dump
```

```
java -XX:StartFlightRecording
```

```
JDK/bin/jcmd <pid> <cmd>
```

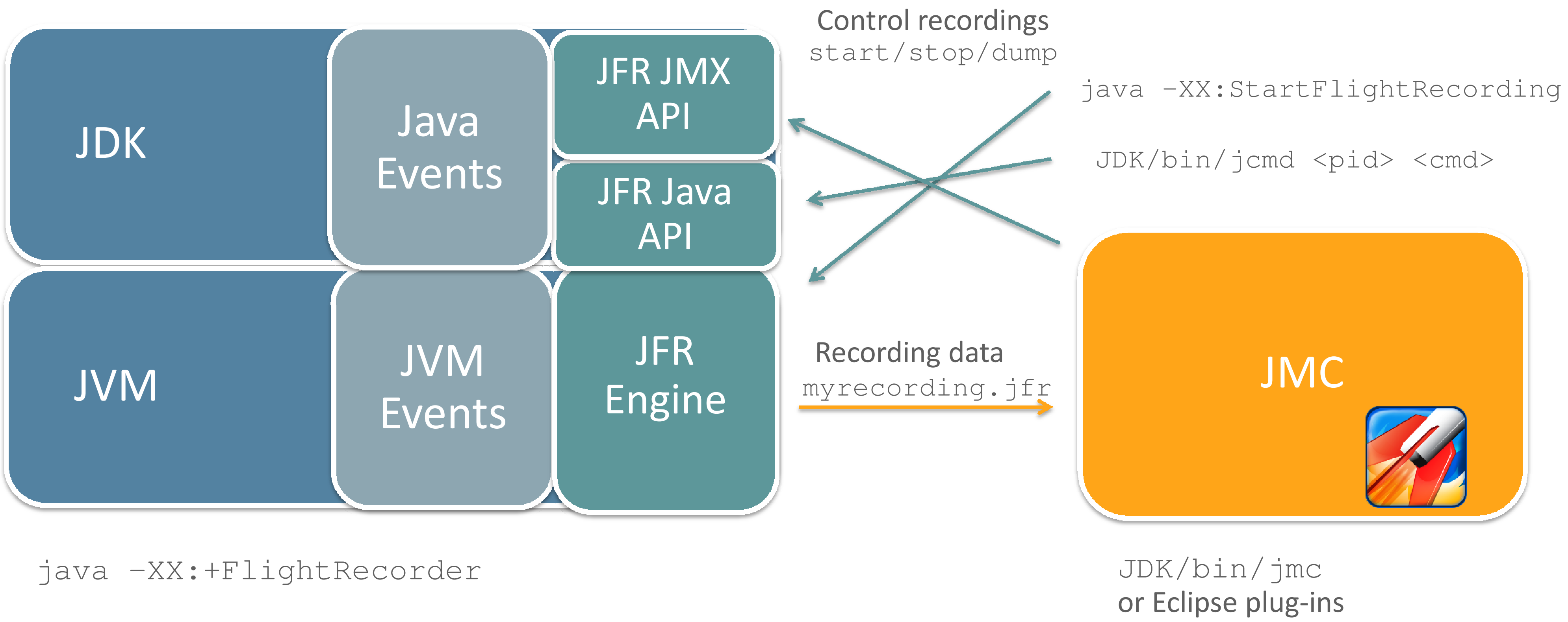
```
myrecording.jfr
```

```
java -XX:+FlightRecorder
```

```
JDK/bin/jmc
```

or Eclipse plug-ins

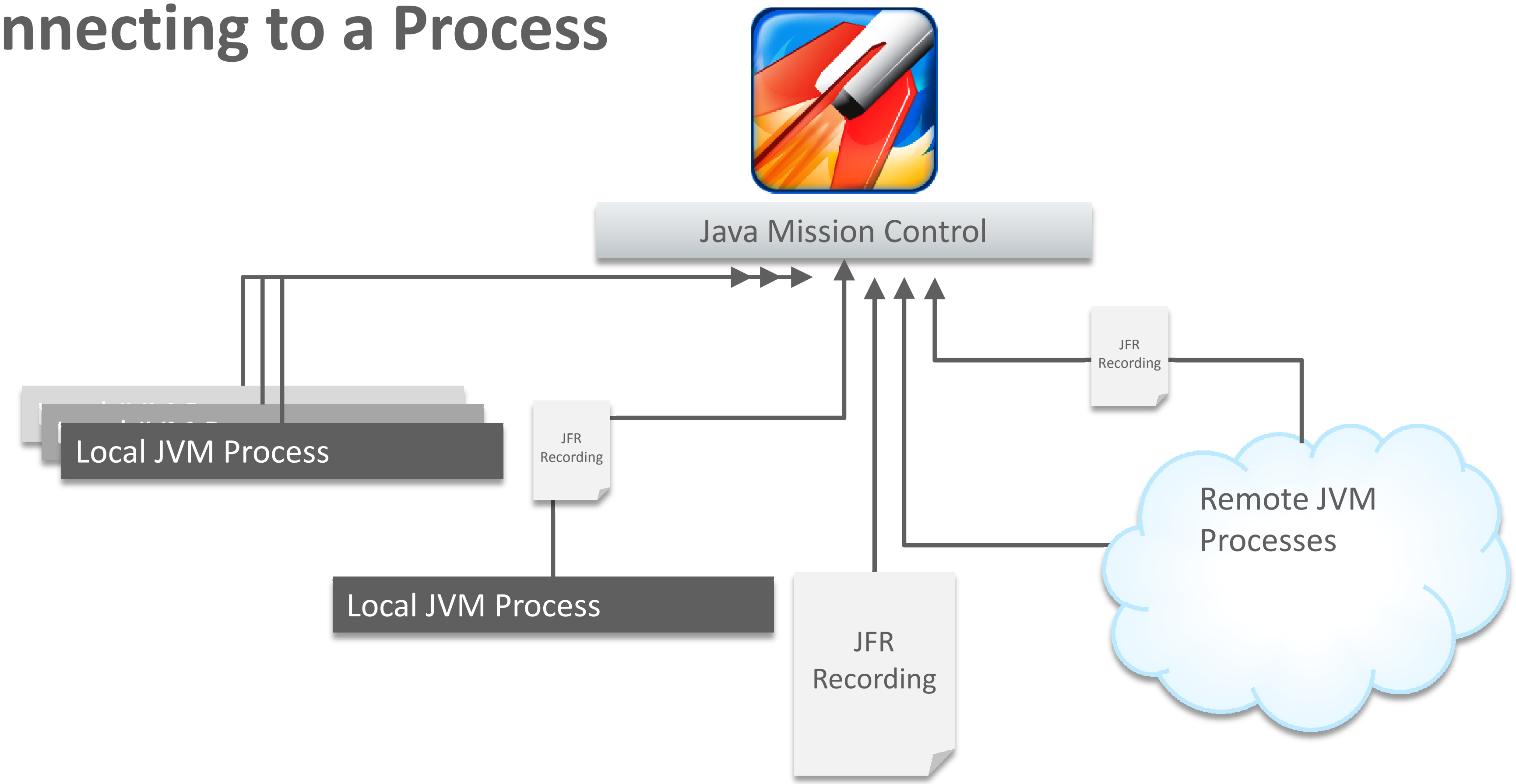
Java Flight Recorder (JFR) and Java Mission Control (JMC)



Connecting to a Process

- The entry point to running Java processes is the JVM Browser
- By default, it will list all discovered locally running processes
- The JVM Browser shows, by default, a flat list of all discovered and defined connectors. The list can be split into a tree to separate locally running processes, JDP (Java Discovery Protocol) discovered ones, and custom defined connectors

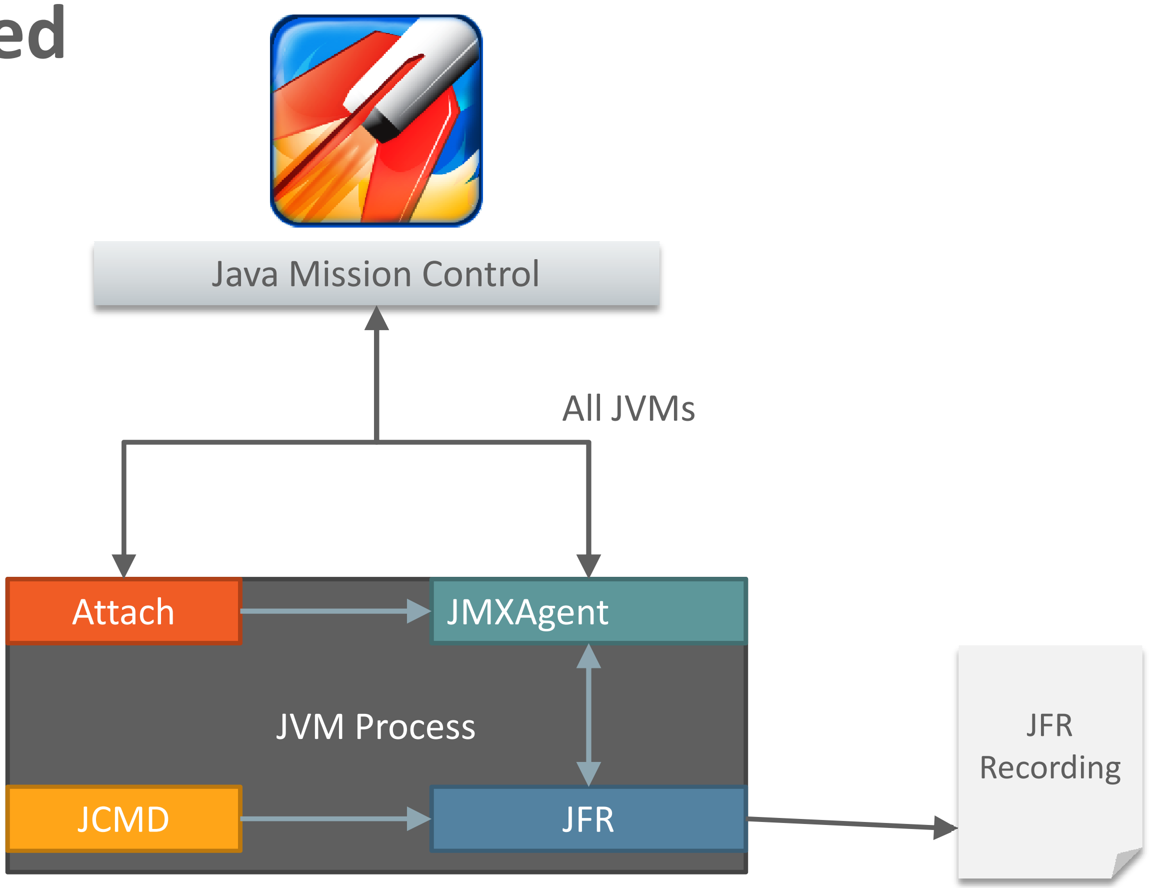
Connecting to a Process



Protocols involved

- Java Attach (only locally running Java processes)
  - Used for local discovery of JVMs
  - Used for starting the local JMX management agent, should a tool requiring JMX want to connect
  - Used directly by some tools, such as the tool for starting the external JMX agent
- JMX (normally JMXRMI, but can be configured)
  - Used by most tools for communication and transfer of data
  - Note that JFR can be used fully without ever using JMX through jcmd and/or command line options

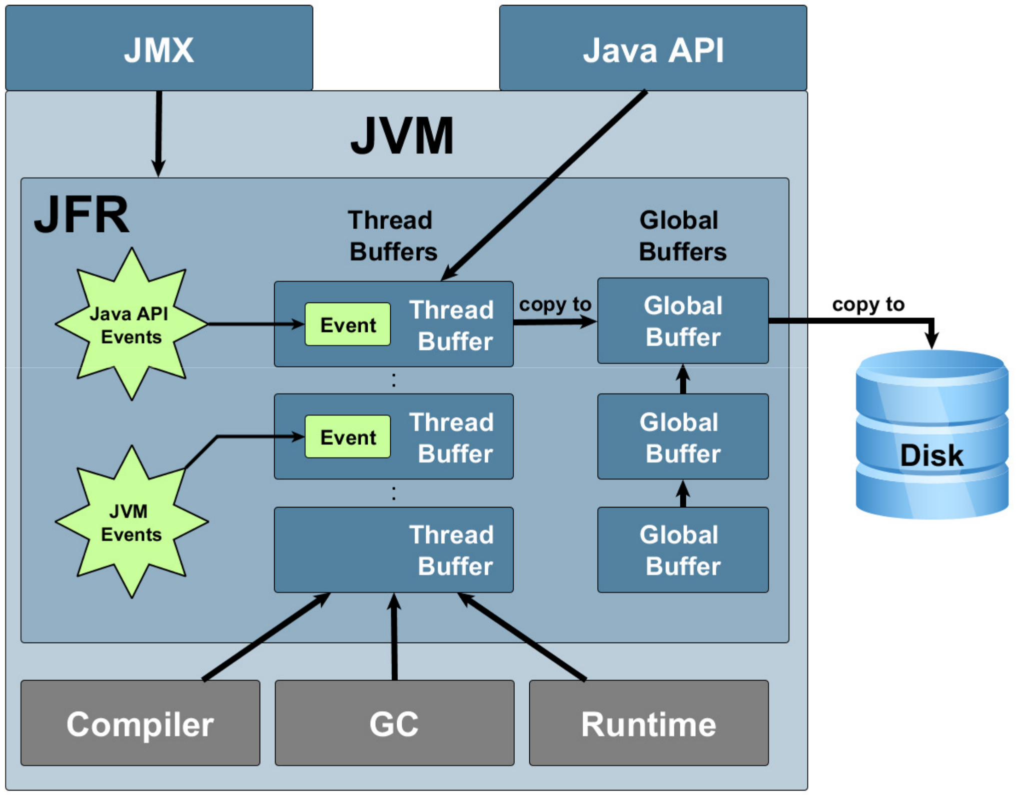
Protocols involved



Java Flight Recorder – Architecture

- Information gathering
  - Instrumentation calls all over the JVM
  - Application information via Java API
- Collected in Thread Local buffers

  ⇢ Global Buffers ⇢Disk
- Binary, proprietary file format
- Managed via JMX
- Java Flight Recorder
  - Start from JMC 5.5 or CLI
- Activate Flight Recorder
  - -XX: +UnlockCommercialFeatures
  - -XX: +FlightRecorder

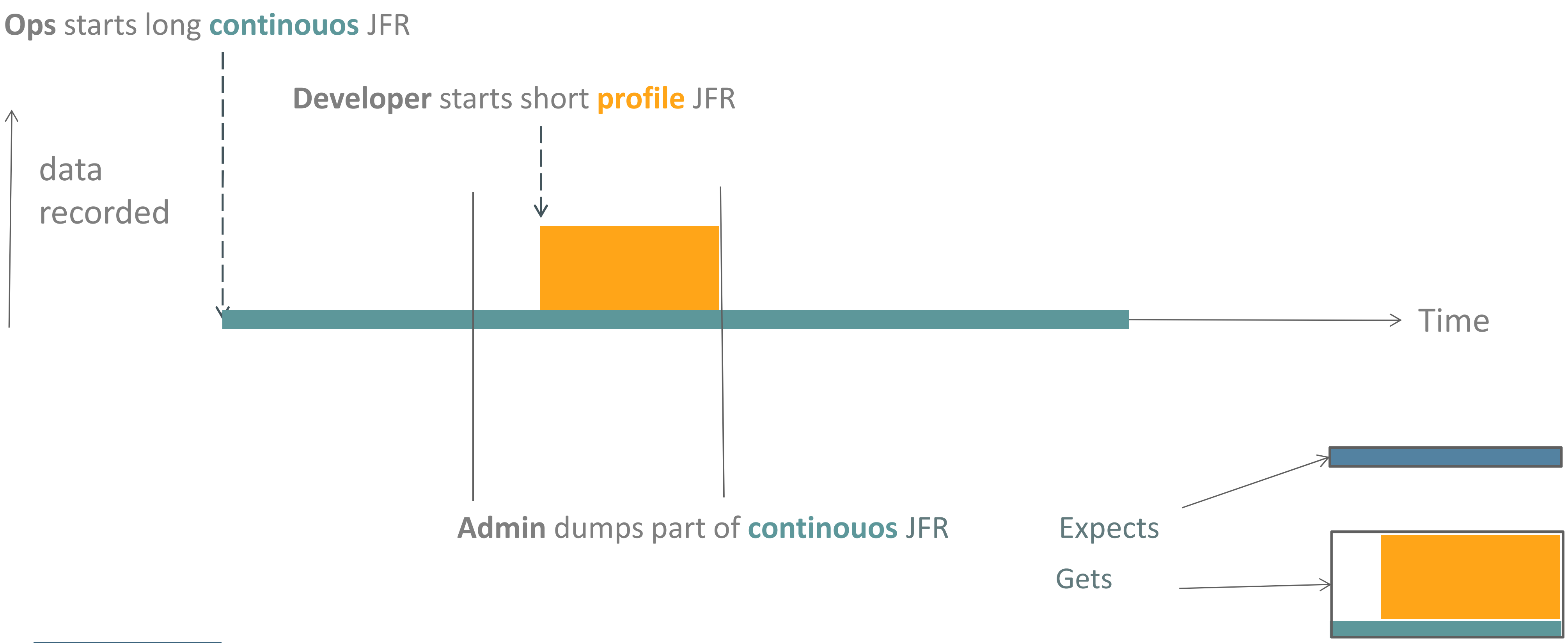


Different Kinds of Recordings

- Continuous Recordings
  - Have no end time
  - Must be explicitly dumped
  - Example use case: Enable at startup, dump the last X minutes when something goes wrong
- Time Fixed Recordings (‘profiling recordings’)
  - Have a fixed time
  - If started from Java Mission Control, opened automatically in the GUI
  - Example use case: Performance testing under load, do a 1 minute recording

How to Think About Recordings

What data does the **Admin** get when he dumps a recording?


Ops starts long **continouos** JFR
Developer starts short **profile** JFR
data recorded
Time
Admin dumps part of **continouos** JFR
Expects
Gets

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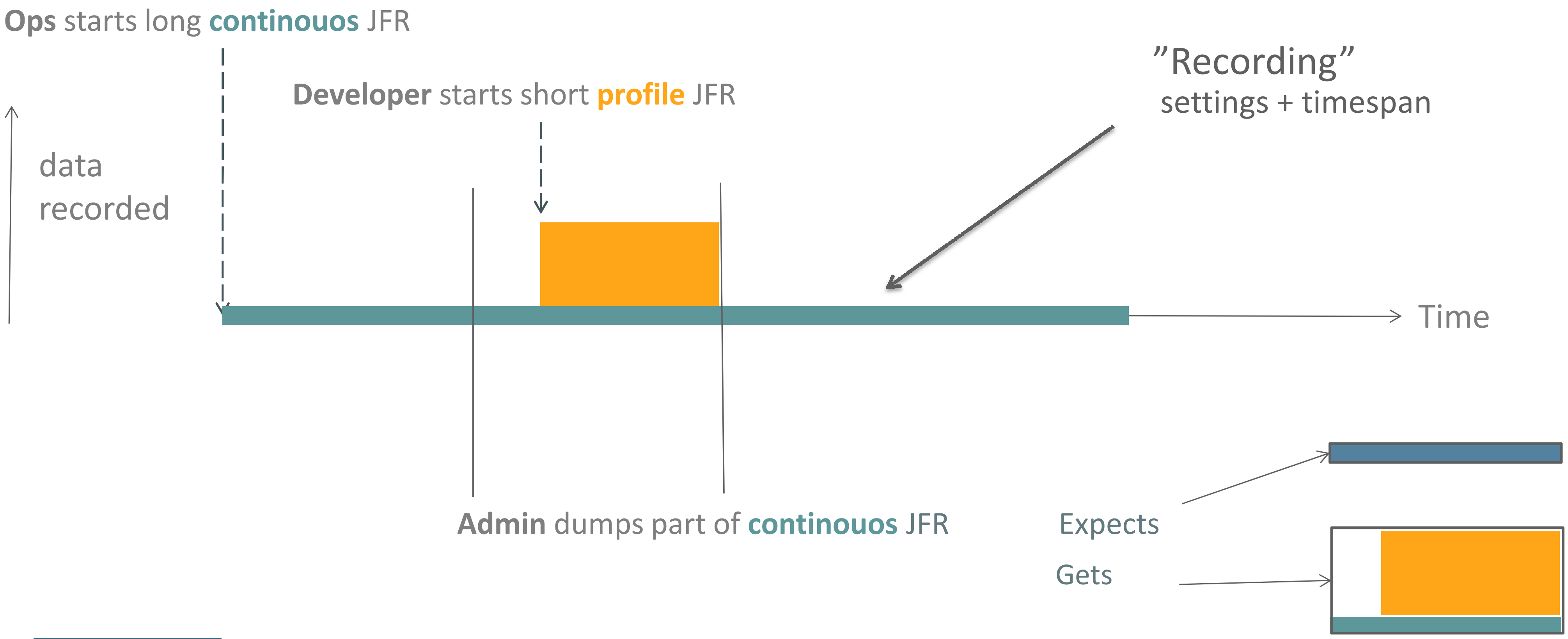
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”Recording”
settings + timespan
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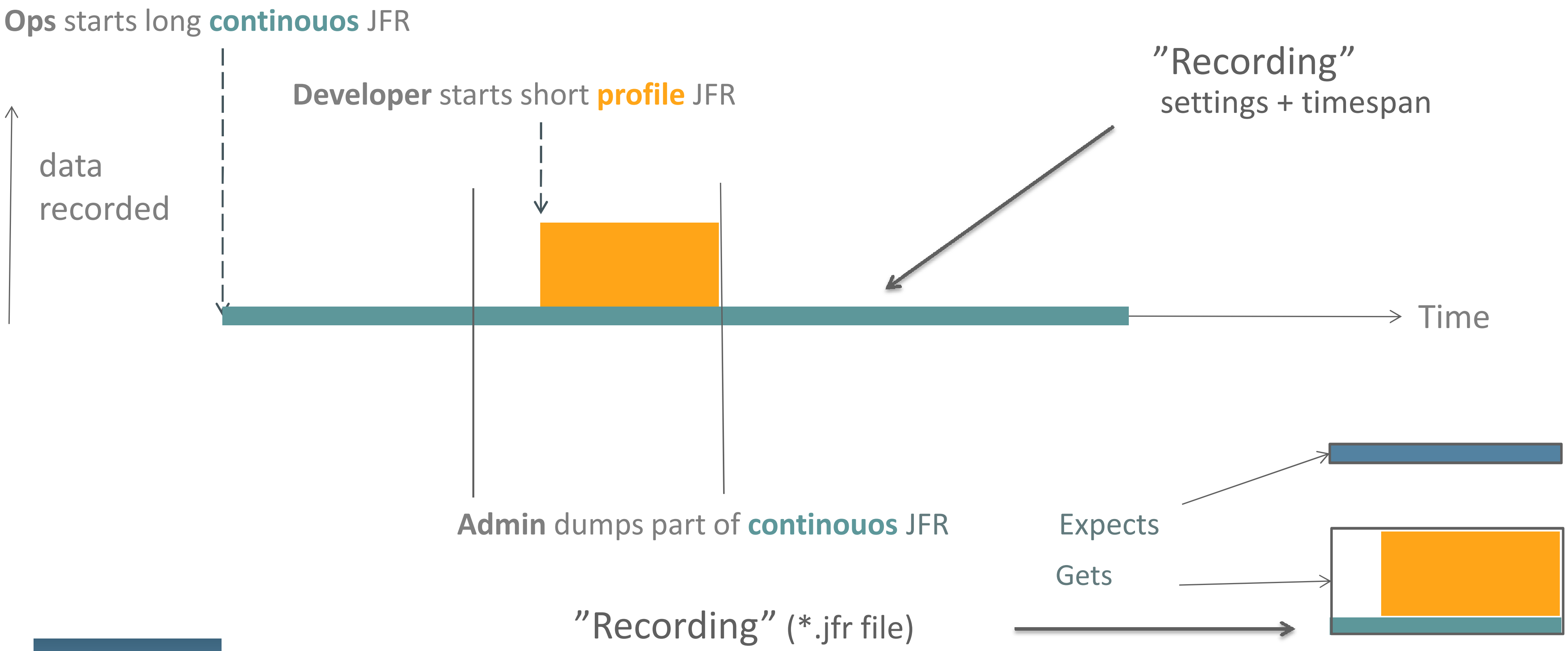
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data recorded
Time
”Recording” settings + timespan
Admin dumps part of **continouos** JFR
Expects
Gets
”Recording” (*.jfr file)

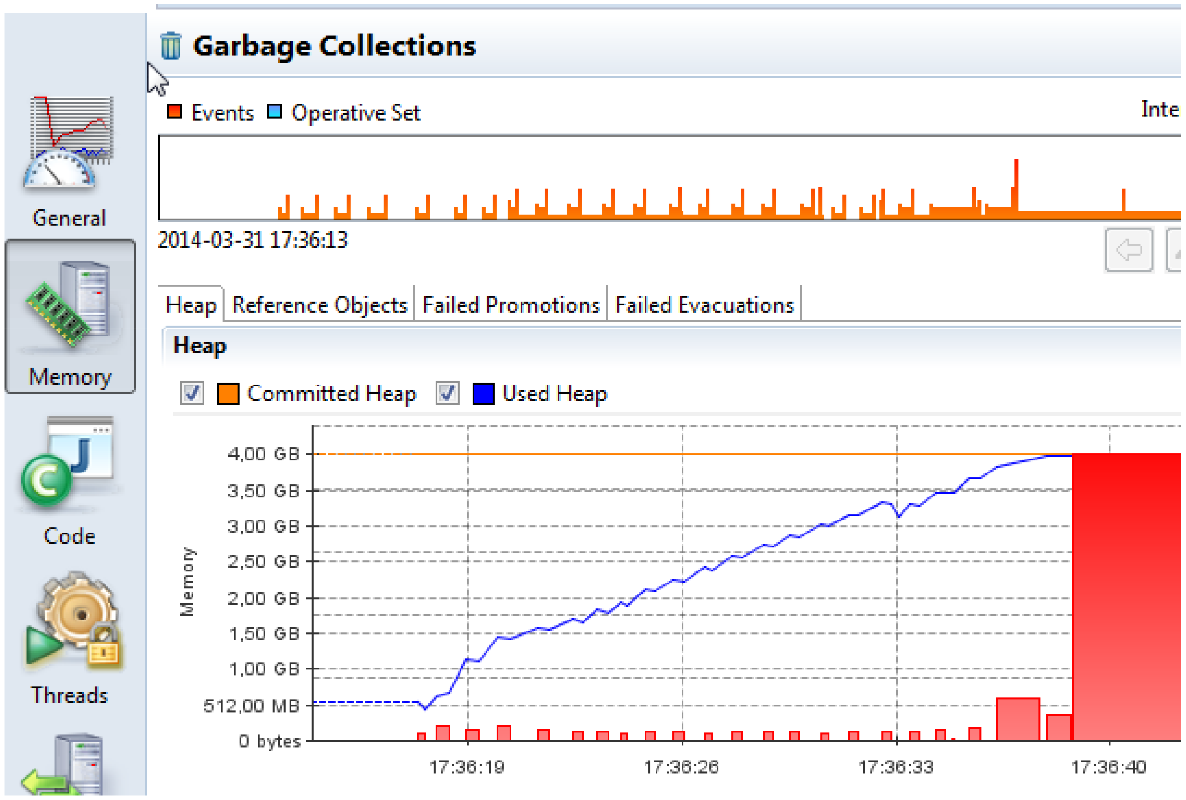
When analyzing Flight Recordings

- Only you know what your application is supposed to be doing
  - Batch job, or real time trading?
  - Do you want the CPU usage to be high or low?
  - If you have a theory about what is wrong, you can find out why

- Not trivial to see which recording has the best performance
  - Possibly to add custom data for tracking for example transaction times

Analyzing Flight Recordings in JMC

- Preconfigured tabs
  - Highlights various areas of common interest
    - Code
    - Memory
    - Threads
    - …



Roadmap

- JMC 6.0.0 with JDK 9
  - Automatic analysis of Flight Recordings
  - Greatly revised user interface (more modern, cleaner)
- Continually
  - New event types (improved I/O events, GC events, loaded libraries)

Improvements (1)

- New **Supported API's**
  - Easier to use
  - Moved namespace from oracle.jrockit.* to jdk.jfr.*
- Not compatible with old unsupported APIs
  - Modularized
- Performance enhancements
  - Compressed Integers
  - Smarter Event Classes
- Event reference does not escape into the generated code
- No event object reuse required

Improvements (2)

- Can emit data to disk even in bad situations
  - Useful in fatal situation, e.g. out-of-memory or crash
- New Events
  - More detailed safe point information
  - More detailed code cache information
  - New compiler events for detailed inlining information
  - New G1 specific information for better visualization of region states
  - Module events (loaded module, full transitive closure)
  - NativeLibrary (load, periodic event, by default each chunk)

Roadmap - JDK 9 JFR Features

- Easy to use supported APIs for all things Flight Recorder
  - Allows for custom events
  - Programmatic access for reading Flight Recordings
  - Programmatic access for controlling the Flight Recorder
  - Modularized, works on smaller profiles
- Improved command line ergonomics
- Can dump on crashes and out-of-memory

Summary

- Java Flight Recorder provides a common view to the JVM and the Java application
  - JVM Events and Java API Events
- Extremely low overhead (<= 2..3%)
  - Can keep it always on, dump when necessary
- Tooling for analysing recordings built into the Oracle JDK via Java Mission Control
- Java APIs available for recording custom information into the Flight Recorder in the Oracle JDK and with JDK 9 GA the OpenJDK get Java Flight Recorder
- Third party integration giving holistic view of the detailed information recorded by the Flight Recorder (WebLogic Server, JavaFX)

Thanks!

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