Where has all my Memory gone?
Determining Memory Characteristics of Product Variants using VM-Level Monitoring

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Motivation – Performance Prediction + Interaction

2GB + 1GB = 4GB?

Memory Consumption

Product 1 (Feature A)  2GB
Product 2 (Feature B)  1GB
Product 3 (Feature A + B)  4GB
Motivation – Feature-based Online Monitoring + Real-time Anomaly Detection

![Graph showing Memory Consumption over Time with two features, Feature A and Feature B. Feature A has a generally increasing trend with occasional dips, while Feature B has a more erratic pattern with peaks and troughs.]
Provide feature-to-code mapping:

```c
register_get_feature_callback(featureID (*get_feature)(jclass clazz))
```

Access per-feature memory statistics:

```c
get_feature_memory_usage(featureID feature, jlong* allocations, jlong* deallocations)
```

*based on OpenJDK 8*
Allocations and Deallocations

```java
class A {
    ...
    b = new B(0,1);
    ...
}
class B {
    int x, y;
    B(int x, int y) {
        ...
    }
}
```

**Feature Model:**
A → Feature 1
B → Feature 2

```java
header
"Feature 1"
0 (x : int)
1 (y : int)
```

```java
class A {
    ...
    b = null;
    System.gc();
    ...
}
```

```java
deallocations[b->feature] += b->size();
```

```java
b->feature = "Feature 1"
allocations[b->feature] += b->size();
```
Unassigned Code

```java
class A {
    void x() {
        B.y();
    }
}

class B {
    void y() {
        C.z();
    }
}

class C {
    void z() {
        new A();
    }
}
```

Feature Model:
A → Feature 1
B → Feature 2
C → ?

Stack:

assign “Feature 2”
DesktopSearcher

TXT Input: King James Bible, Works of William Shakespeare
HTML Input: www.ssw.jku.at
Validation (½) – Single Files

Allocations of TXT product for different file sizes
Validation (2/2) - Directories

Allocations of TXT product for different directory contents

- Others
- Base
- TXT
Performance Prediction

**TXT**

**HTML**

**HTML + TXT**

(Thread dispatch of HTML)

 allocations [MB] vs input size [%]
Monitoring Tool
Questions