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@Contended (a.k.a. JEP 142)

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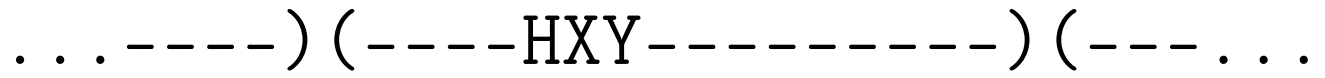
Basics

Basics: False Sharing

Java view:

```
public class Point {
    int x;
    int y;
}
```

Memory view:



Basics: False Sharing

Java view:

```
public class Point {
    int x;
    int y;
}
```

Memory view:

Approaches

Approaches: Padding

Java view:

```
public class Point {
    int x;
    int p01, p02, ..., p16;
    int y;
    int p17, p18, ..., p32;
}
```

Memory view (expected):

```
...----)(----HXpppppppppppp)(ppYpp...
...--HX)(ppppppppppppppppp)(Yppp...
```

Approaches: Padding

Java view:

```
public class Point {
    int x;
    int p01, p02, ..., p16;
    int y;
    int p17, p18, ..., p32;
}
```

Memory view (legal):

```
...-----)(----HXYpppppppppppp)(ppppp...
```


Approaches: Arrayifying

Java view:

```
public class Point {
    int x;
    int[] storage = new int[2*64+1];

    int getX() { return x; }
    int getY() { return storage[64]; }
}
```

Memory view (hopefully):

```
...----)(----HX**********)(****Y****...
```


Approaches: Subclass trick

Relies on «superclass fields laid out first» mojo.

Java view:

```
class L1                    { int x; }
class L2 extends L1         { int p01, ..., p16; }
class L3 extends L2         { int y; }
class L4 extends L3         { int p17, ..., p32; }
class Point extends L4 { // x, y visible }
```

Memory view:

```
...-----)(----HXpppppppppp)(ppppYpp...
```


Approaches: @Contended

Java view:

```
public class Point {
    int x;

    @Contended
    int y;
}
```

Memory view:

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@Contended: Semantics

@Contended declares the **intent**.

- «This field/object should not experience false sharing»
- Only advertises the memory contention effects, makes no promises about the actual implementation
- sun.misc.Contended :(

@Contended: Actual implementation

- HS already packs the fields to minimize the footprint
- Field-level @Contended «bails out» the specific fields from that packing, laying them out at sparse offsets
- Class-level @Contended «shifts» the entire instance field block away from the header; and also beefs up instance size to provide the pad in the back
- Done during the initial field layout (class load)

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@Contended: Caveats

- Object header is not protected
  - ...only concerns itself with the fields (blocks)
- Pads for twice the cache line size
  - Without the GC support, the object is not guaranteed to be aligned to cache line
  - Pessimistically handling the case of enabled adjacent cache line prefetchers
- Static fields are not supported
  - Requires significant rework of static field mechanics
- Restricted on user classpath
  - Unlock: -XX:-RestrictContended

@Contended: Usages

```
$ ack-grep -Q \@sun.misc.Contended
src/share/classes/java/util/concurrent/ConcurrentHashMap.java
2458:     @sun.misc.Contended static final class CounterCell {

src/share/classes/java/util/concurrent/Exchanger.java
310:      * bookkeeping. Padded via @sun.misc.Contended to reduce m
313:     @sun.misc.Contended static final class Node {

src/share/classes/java/util/concurrent/ForkJoinPool.java
161:@sun.misc.Contended
643:     @sun.misc.Contended

src/share/classes/java/util/concurrent/atomic/Striped64.java
55:      * (via @sun.misc.Contended) to reduce cache contention. Pa
119:     @sun.misc.Contended static final class Cell {

src/share/classes/java/lang/Thread.java
2004:     @sun.misc.Contended("tlr")
2008:     @sun.misc.Contended("tlr")
2012:     @sun.misc.Contended("tlr")
```

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@Contended:
Try it. Use it. Break it.

Thanks!