Encapsulating the Java Fork-Join Framework's ManagedBlocker Interface

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Learning Objectives in this Part of the Lesson

- Understand how the common fork-join pool helps to maximize processor core utilization
- Recognize how the ManagedBlocker interface helps avoid starvation & improve performance
- Be able to apply the ManagedBlocker interface on blocking synchronizers & queues
- Know how to encapsulate ManageBlocker & apply it on blocking I/O operations

```
public class BlockingTask {
  ...
  public static<T> T
    callInManagedBlock
      (Supplier<T> supplier){
    ...
    ForkJoinPool.managedBlock
     (managedBlocker);
    ...
    return managedBlocker
      .getResult();
}
...
```

Encapsulating ManagedBlocker w/the BlockingTask Class

Encapsulating ManagedBlocker w/the BlockingTask Class

- BlockingTask integrates blocking suppliers with various Java fork/join pools

```
public class BlockingTask {
  ...
  public static<T> T callInManagedBlock(Supplier<T> supplier){



    SupplierManagedBlocker<T> managedBlocker =
      new SupplierManagedBlocker<T>(supplier);
    ...
    ForkJoinPool.managedBlock(managedBlocker);
    ...
    return managedBlocker.getResult();
  }
  ...
```

See github.com/douglascraigschmidt/LiveLessons/tree/master/Java8/ex20

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    SupplierManagedBlocker<T> managedBlocker =
      new SupplierManagedBlocker<T>(supplier);
    ...
    ForkJoinPool.managedBlock(managedBlocker);
    ...
    return managedBlocker.getResult();
  }
  ...
```

Enables the use of blocking suppliers with various types of Java fork/join pools

See stackoverflow.com/q/37512662 for pros & cons of this approach

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```
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  ...
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    SupplierManagedBlocker<T> managedBlocker =
      new SupplierManagedBlocker<T>(supplier);
    ...
    ForkJoinPool.managedBlock(managedBlocker);
    ...
    return managedBlocker.getResult();
  }
  ...
```

Create a helper object to encapsulate the supplier

Encapsulating ManagedBlocker w/the BlockingTask Class

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```
public class BlockingTask {
  ...
  public static<T> T callInManagedBlock(Supplier<T> supplier){



    SupplierManagedBlocker<T> managedBlocker =
      new SupplierManagedBlocker<T>(supplier);
    ...
    ForkJoinPool.managedBlock(managedBlocker);
    ...
    return managedBlocker.getResult();
  }
  ...
```

Submit managedBlocker to the calling thread's ForkJoin pool

See docs.oracle.com/javase/8/docs/api/java/util/concurrent/ForkJoinPool.html#managedBlock

Encapsulating ManagedBlocker w/the BlockingTask Class

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```
public class BlockingTask {
  ...
  public static<T> T callInManagedBlock(Supplier<T> supplier){



    SupplierManagedBlocker<T> managedBlocker =
      new SupplierManagedBlocker<T>(supplier);
    ...
    ForkJoinPool.managedBlock(managedBlocker);
    ...
    return managedBlocker.getResult();
  }
  ...
```

Return the result of the blocking call

Encapsulating ManagedBlocker w/the BlockingTask Class

- BlockingTask integrates blocking suppliers with various Java fork/join pools

```
public class BlockingTask {
  ...
  private static class SupplierManagedBlocker<T>
                       implements ForkJoinPool.ManagedBlocker {
    private final Supplier<T> mSupplier;

    private boolean mDone = false;

    private T mResult;


    private SupplierManagedBlocker(final Supplier supplier)
    { mSupplier = supplier; }
    ...
```

Blocking Supplier works w/various fork/join pools

Encapsulating ManagedBlocker w/the BlockingTask Class

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```
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  ...
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    private final Supplier<T> mSupplier;

    private boolean mDone = false;

    private T mResult;


    private SupplierManagedBlocker(final Supplier supplier)
    { mSupplier = supplier; }
    ...
```

Store supplier param for subsequent use

Encapsulating ManagedBlocker w/the BlockingTask Class

- BlockingTask integrates blocking suppliers with various Java fork/join pools

```
public class BlockingTask {
  ...
  private static class SupplierManagedBlocker<T>
                  implements ForkJoinPool.ManagedBlocker {
    private final Supplier<T> mSupplier;

    private boolean mDone = false;

    private T mResult;


    private SupplierManagedBlocker(final Supplier supplier)
    { mSupplier = supplier; }
    ...
```

Keeps track of whether blocking supplier is done

Encapsulating ManagedBlocker w/the BlockingTask Class

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```
public class BlockingTask {
  ...
  private static class SupplierManagedBlocker<T>
                  implements ForkJoinPool.ManagedBlocker {
    private final Supplier<T> mSupplier;

    private boolean mDone = false;

    private T mResult;


    private SupplierManagedBlocker(final Supplier supplier)
    { mSupplier = supplier; }
    ...
```

Stores result obtained from the supplier for later use

Encapsulating ManagedBlocker w/the BlockingTask Class

- BlockingTask integrates blocking suppliers with various Java fork/join pools

```
public class BlockingTask {
   ...
   private static class SupplierManagedBlocker<T>
                        implements ForkJoinPool.ManagedBlocker {
      ...
      public boolean block()
      { mResult = mSupplier.get(); mDone = true; return true; }

      public boolean isReleasable()
      { return mDone; }

      public T getResult()
      { return mResult; }
}
```

Sets result via the blocking supplier's get() method

Encapsulating ManagedBlocker w/the BlockingTask Class

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```
public class BlockingTask {
   ...
   private static class SupplierManagedBlocker<T>
                        implements ForkJoinPool.ManagedBlocker {
      ...
      public boolean block()
      { mResult = mSupplier.get(); mDone = true; return true; }

      public boolean isReleasable()
      { return mDone; }

      public T getResult()
      { return mResult; }
}
```

Indicate the result's been obtained

Encapsulating ManagedBlocker w/the BlockingTask Class

- BlockingTask integrates blocking suppliers with various Java fork/join pools

```
public class BlockingTask {
   ...
   private static class SupplierManagedBlocker<T>
                        implements ForkJoinPool.ManagedBlocker {
      ...
      public boolean block()
      { mResult = mSupplier.get(); mDone = true; return true; }

      public boolean isReleasable()
      { return mDone; }

      public T getResult()
      { return mResult; }
}
```

True if blocking supplier has finished, else false

There is no "non-blocking" behavior for BlockingTask

Encapsulating ManagedBlocker w/the BlockingTask Class

- BlockingTask integrates blocking suppliers with various Java fork/join pools

```
public class BlockingTask {
   ...
   private static class SupplierManagedBlocker<T>
                        implements ForkJoinPool.ManagedBlocker {
      ...
      public boolean block()
      { mResult = mSupplier.get(); mDone = true; return true; }

      public boolean isReleasable()
      { return mDone; }

      public T getResult()
      { return mResult; }
}
```

Returns supplier's result (called after pool.managedBlock() completes)

Encapsulating ManagedBlocker w/the BlockingTask Class

- This example uses BlockingTask to ensure there are enough threads in the common fork-join thread pool

```
Image blockingDownload(URL url) {
  return BlockingTask
    .callInManagedBlock
      (() -> downloadImage(url));
}
```

See github.com/douglascraigschmidt/LiveLessons/tree/master/Java8/ex20

Encapsulating ManagedBlocker w/the BlockingTask Class

- This example uses BlockingTask to ensure there are enough threads in the common fork-join thread pool

```
Image blockingDownload(URL url) {
  return BlockingTask
    .callInManagedBlock
      (() -> downloadImage(url));
}
```

Transform a URL to an Image by downloading each image via its URL

Encapsulating ManagedBlocker w/the BlockingTask Class

- This example uses BlockingTask to ensure there are enough threads in the common fork-join thread pool

```
Image blockingDownload(URL url) {
  return BlockingTask
    .callInManagedBlock
      (() -> downloadImage(url));
}
```

This method call ensures the common fork/join thread pool is expanded to handle the blocking image download

This solution works for non-common fork-join pools, as well

Encapsulating ManagedBlocker w/the BlockingTask Class

- This example uses BlockingTask to ensure there are enough threads in the common fork-join thread pool
  - Extra threads in the common fork-join pool are automatically terminated later

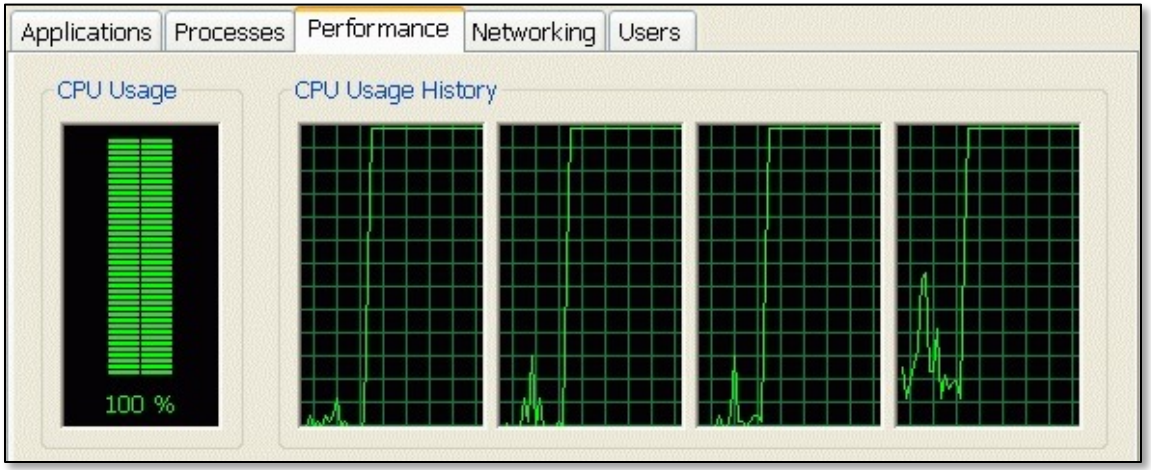
```
Image blockingDownload(URL url) {
  return BlockingTask
    .callInManagedBlock
      (() -> downloadImage(url));
}
```

The current limit is 256 threads (java.util.concurrent.ForkJoinPool.common.maximumSpares)

Encapsulating ManagedBlocker w/the BlockingTask Class

- This example uses BlockingTask to ensure there are enough threads in the common fork-join thread pool
  - Extra threads in the common fork-join pool are automatically terminated later
- However, it's possible to saturate the CPU cores during bursty workloads

```
Image blockingDownload(URL url) {
  return BlockingTask
    .callInManagedBlock
      (() -> downloadImage(url));
}
```



Not a problem in practice, however, since 256 (platform) threads is still pretty small

End of Encapsulating the Java Fork-Join Framework's ManagedBlocker Interface