

The Java™ Tutorials

Trail: Essential Classes

Lesson: Basic I/O

Section: I/O Streams

The Java Tutorials have been written with backward compatibility in mind. Examples and code fragments shown on this page don't take advantage of improvements introduced in later releases.

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Byte Streams

Programs use *byte streams* to perform input and output of 8-bit bytes. All byte stream classes are descended from [InputStream](#) and [OutputStream](#).

There are many byte stream classes. To demonstrate how byte streams work, we'll focus on the file I/O byte streams, [FileInputStream](#) and [FileOutputStream](#). Other kinds of byte streams are used in much the same way; they differ mainly in the way they are constructed.

Using Byte Streams

We'll explore [FileInputStream](#) and [FileOutputStream](#) by examining an example program named [CopyBytes](#), which uses byte streams to copy `xanadu.txt`, one byte at a time.

```
import java.io.FileInputStream;
import java.io.FileOutputStream;
import java.io.IOException;

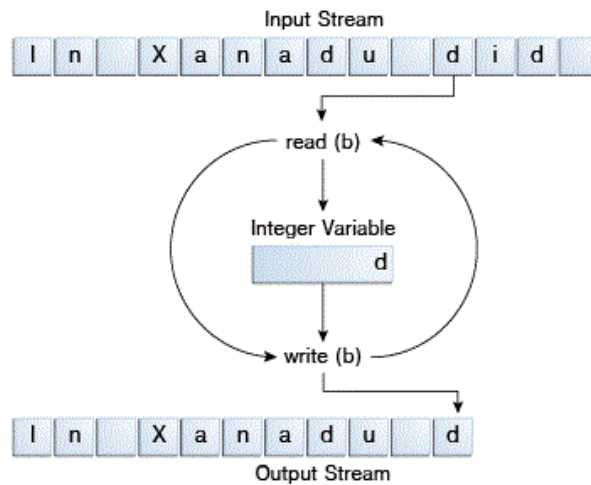
public class CopyBytes {
    public static void main(String[] args) throws IOException {

        FileInputStream in = null;
        FileOutputStream out = null;

        try {
            in = new FileInputStream("xanadu.txt");
            out = new FileOutputStream("outagain.txt");
            int c;

            while ((c = in.read()) != -1) {
                out.write(c);
            }
        } finally {
            if (in != null) {
                in.close();
            }
            if (out != null) {
                out.close();
            }
        }
    }
}
```

`CopyBytes` spends most of its time in a simple loop that reads the input stream and writes the output stream, one byte at a time, as shown in the following figure.



Simple byte stream input and output.

Always Close Streams

Closing a stream when it's no longer needed is very important — so important that `CopyBytes` uses a `finally` block to guarantee that both streams will be closed even if an error occurs. This practice helps avoid serious resource leaks.

One possible error is that `CopyBytes` was unable to open one or both files. When that happens, the stream variable corresponding to the file never changes from its initial `null` value. That's why `CopyBytes` makes sure that each stream variable contains an object reference before invoking `close`.

When Not to Use Byte Streams

`CopyBytes` seems like a normal program, but it actually represents a kind of low-level I/O that you should avoid. Since `xanadu.txt` contains character data, the best approach is to use [character streams](#), as discussed in the next section. There are also streams for more complicated data types. Byte streams should only be used for the most primitive I/O.

So why talk about byte streams? Because all other stream types are built on byte streams.

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