# Dealing with Hybrid Streams of Text and Bytes



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#### Agenda



How to write text on binary streams

How to write both text and bytes on binary streams

Using the Java I/O API to use sockets



### Introducing Hybrid Streams





#### Two new classes:

- InputStreamReader that extends Reader
- OutputStreamWriter that extends Writer





InputStreamReader is a Reader

So it can read chars and Strings

But it is created on an InputStream

And can take a CharSet as a 2<sup>nd</sup> parameter





OutputStreamWriter is a Writer

So it can write chars and Strings

But it is created on an OutputStream

And can take a CharSet as a 2<sup>nd</sup> parameter



```
InputStream is = ...;
InputStreamReader isr = new InputStreamReader(is, StandardCharsets.UTF_8);
LineNumberReader lnr = new LineNumberReader(isr);
String line = lnr.readLine();
int lineNumber = lnr.getLineNumber();
```

Since an input stream reader is a reader...

It can be used to create other readers, using the decorator pattern

And these readers can be used as usual



```
OutputStream os = ...;
OutputStreamWriter osw = new OutputStreamWriter(os, StandardCharsets.UTF_8);
PrintWriter pw = new PrintWriter(osw);
pw.printf("Hello %s\n", person.getFirstName());
```

And the same goes for writers

It can be used to create other writers, using the decorator pattern

And these readers can be used as usual



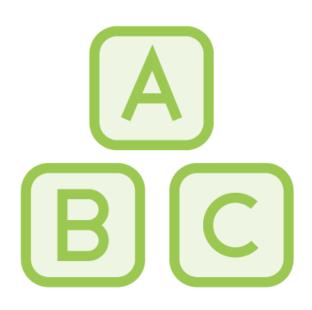


Those two classes InputStreamReader and OutputStreamWriter

**Enable the writing / reading of chars** 

On streams of bytes





And since several streams can be opened on the same file, in-memory array, etc...

It allows for the creation of hybrid structures

Mixing strings / chars and raw bytes on the same stream



#### Hybrid Streams Case Study





We have a list of all the Aesop's fables:

- each fable has a title
- and a text, which can be a little long
- there is a lot of fables



```
Aesop's Fables
291
1235
123 The Wolf and the Lamb
3271
245 The Bat and the Weasels
```

#### The format is the following

- a magic ID
- the total number of fables in plain text
- then for each fable: its position (aligned), length (aligned) and title



```
Aesop's Fables
291
1235 123 The Wolf and the Lamb
3271 245 The Bat and the Weasels
<br/>
<br/>
<br/>
<br/>
<br/>
123 The Wolf and the Weasels
```

Then, in binary compressed format, the text of each fable, one by one



#### Demo



Let us see some code!

Let us create a writer method that takes a list of fables, and produces this file



#### Creating Streams Over the Network





Passing data from one machine to another across a network can be done with sockets

A socket listens for incoming requests on a machine

When a request arrives, it can create two streams:

- an input stream, to read data from it
- an output stream, to send data to the other machine



```
ServerSocket serverSocket = new ServerSocket(12345);
Socket socket = serverSocket.accept();

InputStream inputStream = socket.getInputStream();
OutputStream outputStream = socket.getOutputStream();
```

First we create a server socket, that listens to a given port

Then we put this socket on a listen state, the accept call is blocking

The rest is pure Java I/O



```
Socket socket = new Socket();
InetSocketAddress address = new InetSocketAddress("127.0.0.1", 12345);
socket.connect(address);
InputStream inputStream = socket.getInputStream();
OutputStream outputStream = socket.getOutputStream();
```

Then we create a client socket, that connects to the same port

Then we can send requests and get responses from the server socket using pure Java I/O

... and maybe a little Java Thread



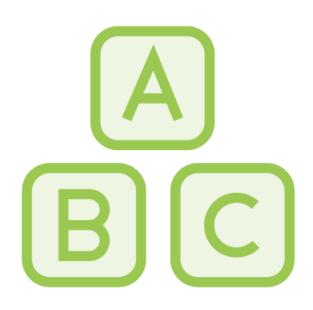
#### Demo



Let us see some code!

Let us create a server and a client socket and show how they can communicate together





There are many parts of the JDK that relies on Java IO to communicate:

- network (socket)
- HTTP support with servlets (Java EE)
- database (JDBC)



# Module Wrap Up



What did you learn?

**Hybrid Streams!** 

How to communicate through the network using Socket and Java I/O

How to create complex file formats mixing text and binary information

This kind of format is used in JPEG, MPEG and many other standard file formats



# Course Wrap Up



The Java I/O API is at the basis of many other API

It is very useful to write low level code

There are hurdles when using it, the use of charsets is one of them

It can be use to transfer objects from one application to another

It is also used to generate XML or JSON

There are extensions to it, NIO and NIO2



## Course Wrap Up



# Thank you!

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