Files / IO in Java

Advanced Programming

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Introduction to Java I/O:

- I/O stands for Input/Output in Java.
- It involves:
  - Input: Reading data into the program.
  - Output: Writing data from the program to external sources.
- Java supports I/O operations through classes in the java.io package.
- Common sources/destinations for I/O include files, network connections, and the console.
- These operations are designed to be efficient and flexible for handling data.

Types of I/O in Java:

1. **Stream-Based I/O:**
   - InputStream: Reads bytes from a source.
   - OutputStream: Writes bytes to a destination.
   - Reader: Reads characters from a source.
   - Writer: Writes characters to a destination.

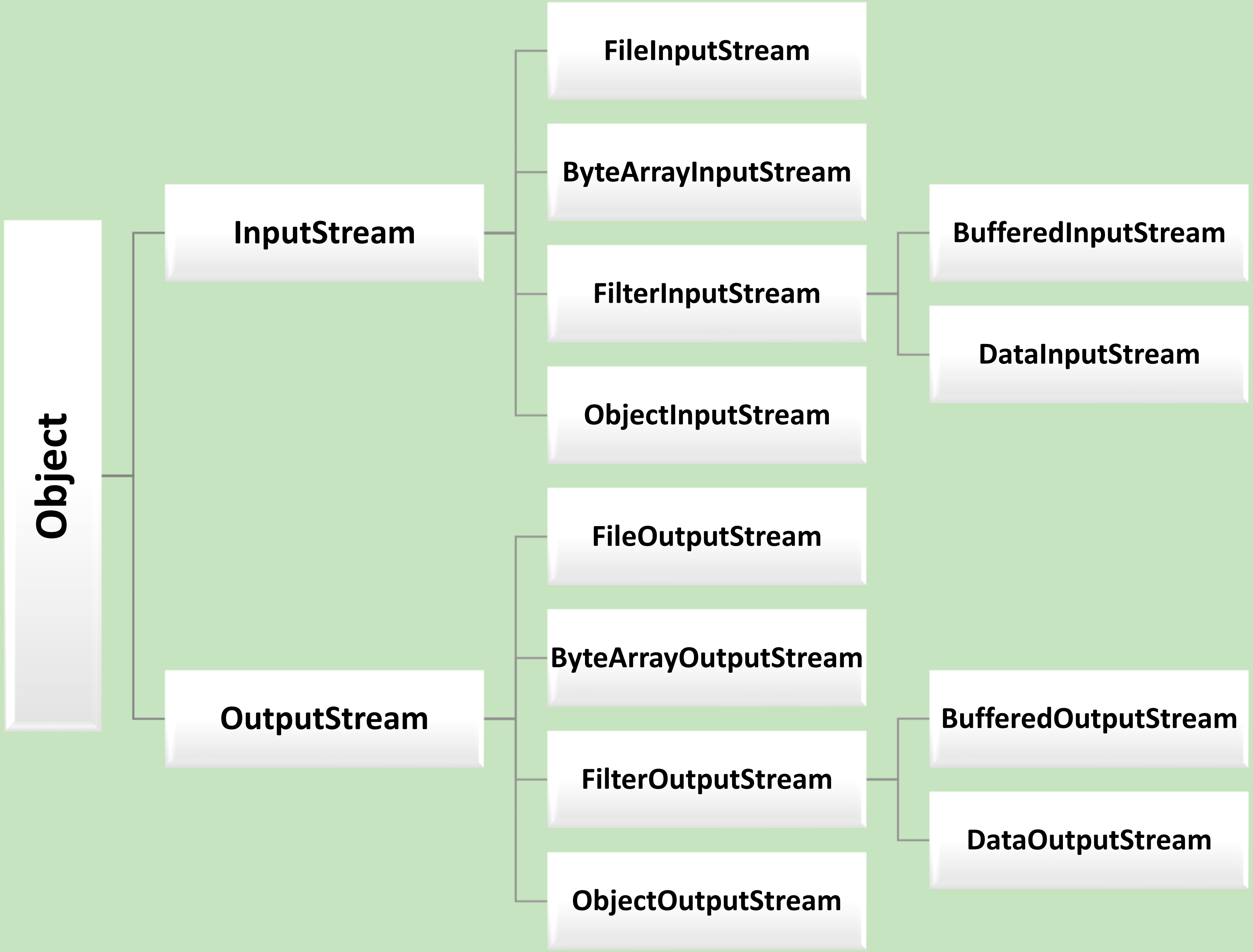
2. **Byte Streams vs Character Streams:**
   - Byte Streams: Handle raw binary data (e.g., images, files with binary data).
   - Character Streams: Handle text data (e.g., files with text content).

Common I/O Classes in Java:

1. **InputStream/OutputStream:** Base classes for byte streams.
2. **FileInputStream/FileOutputStream:** Read and write bytes to a file.
3. **Reader/Writer:** Base classes for character streams.
4. **FileReader/FileWriter:** Read and write characters to a file.
5. **BufferedReader/BufferedWriter:** More efficient way to read/write characters with a buffer.

Key Concepts in Java I/O:

- **Stream:** A sequence of data (either input or output) that flows through the program.
- **Input Streams:** Read data from a source (e.g., file, network).
- **Output Streams:** Write data to a destination (e.g., file, network).
- **Blocking I/O:** The program waits (blocks) until the data is available (input) or fully written (output).

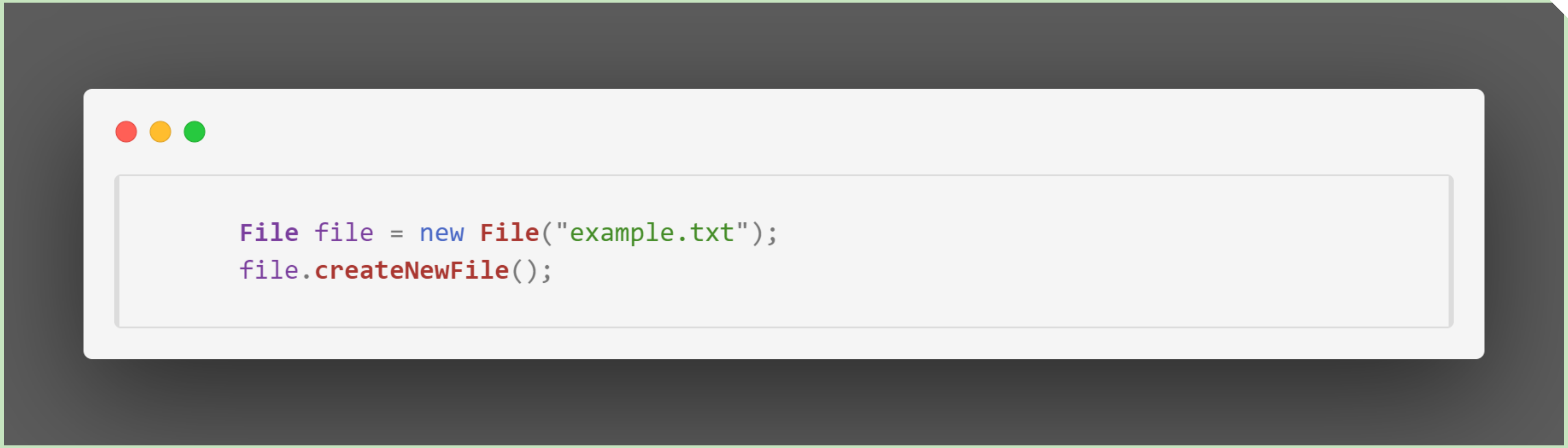

Object
InputStream
OutputStream
FileInputStream
ByteArrayInputStream
FilterInputStream
ObjectInputStream
BufferedInputStream
DataInputStream
FileOutputStream
ByteArrayOutputStream
FilterOutputStream
ObjectOutputStream
BufferedOutputStream
DataOutputStream

File Handling in Java

- Java provides the File class in the java.io package to work with files and directories.
- Important File Class Operations:

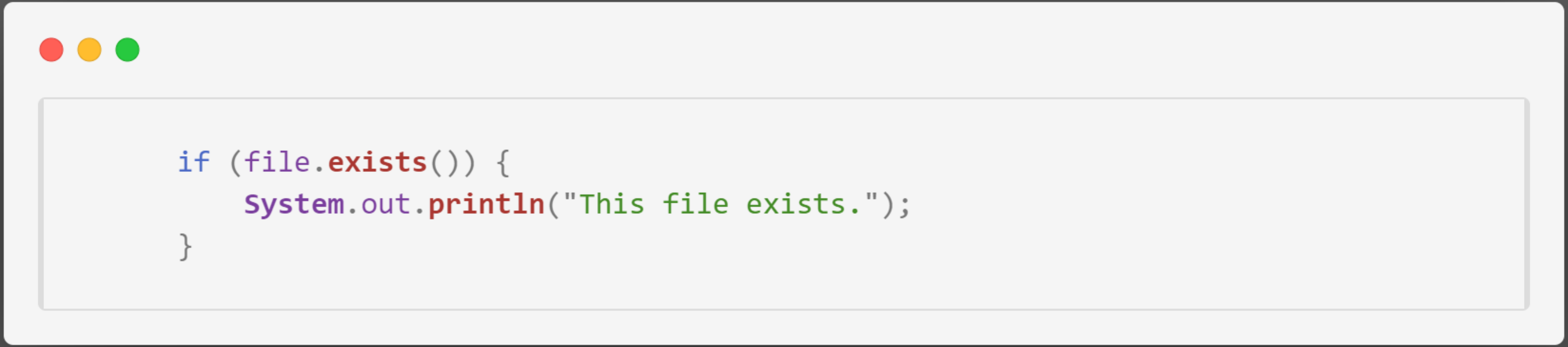
1. **Creating a File**
2. **Checking if a File Exists**
3. **Reading and Writing to a File**
4. **Renaming and Deleting Files**
5. **Working with Directories**

File Handling in Java



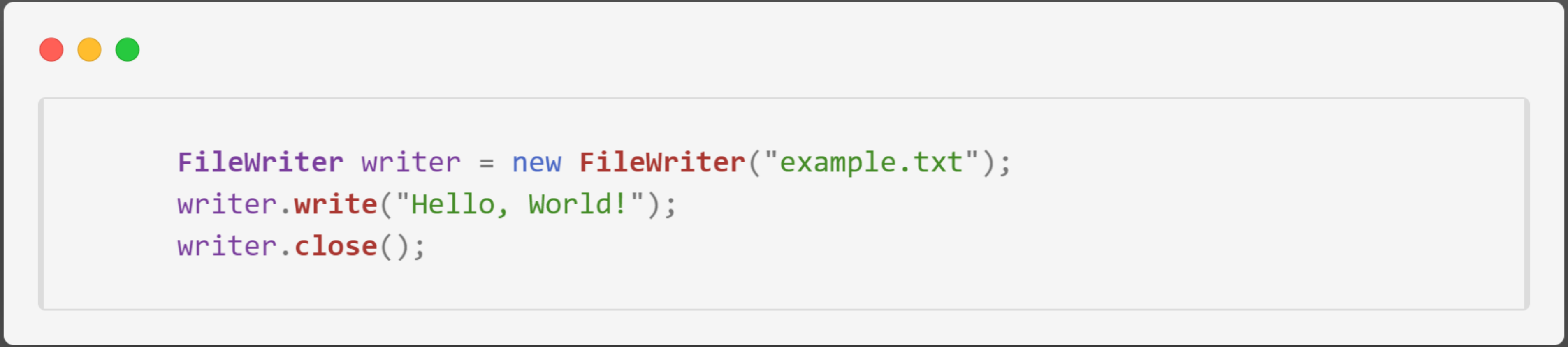
```
File file = new File("example.txt");
file.createNewFile();
```

File Handling in Java



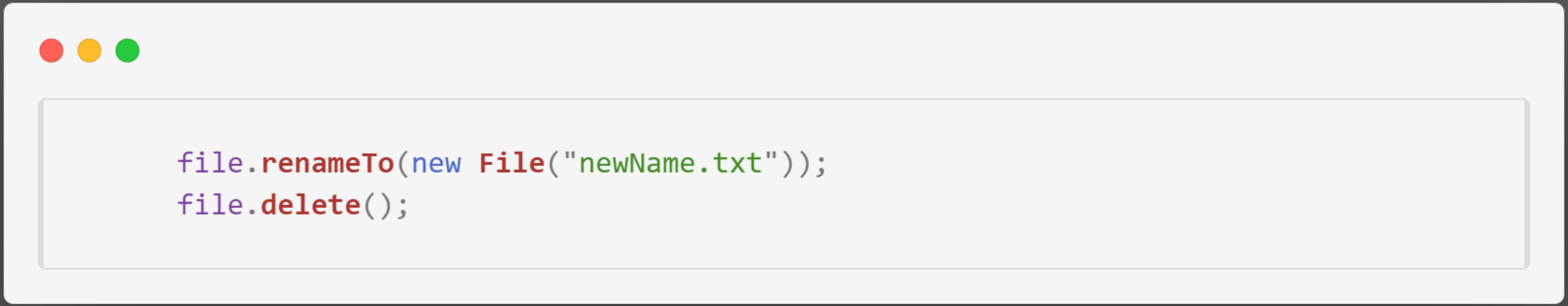
```
if (file.exists()) {
    System.out.println("This file exists.");
}
```

File Handling in Java



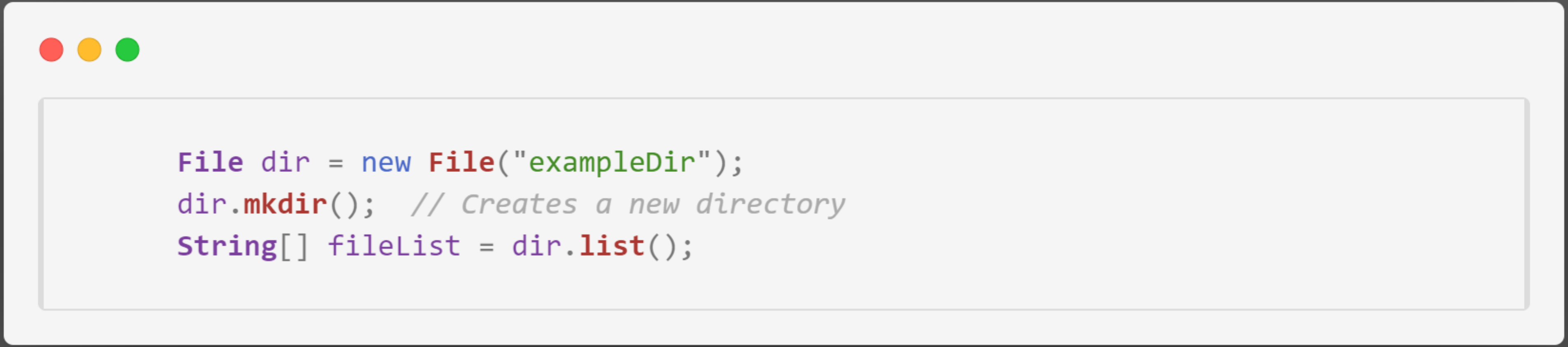
```
FileWriter writer = new FileWriter("example.txt");
writer.write("Hello, World!");
writer.close();
```

File Handling in Java



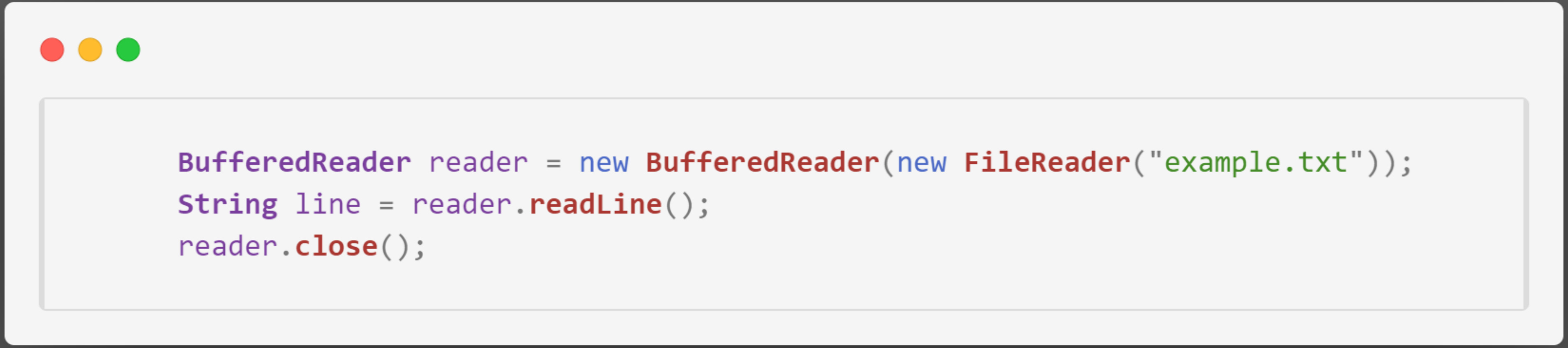
```java
file.renameTo(new File("newName.txt"));
file.delete();
```

File Handling in Java



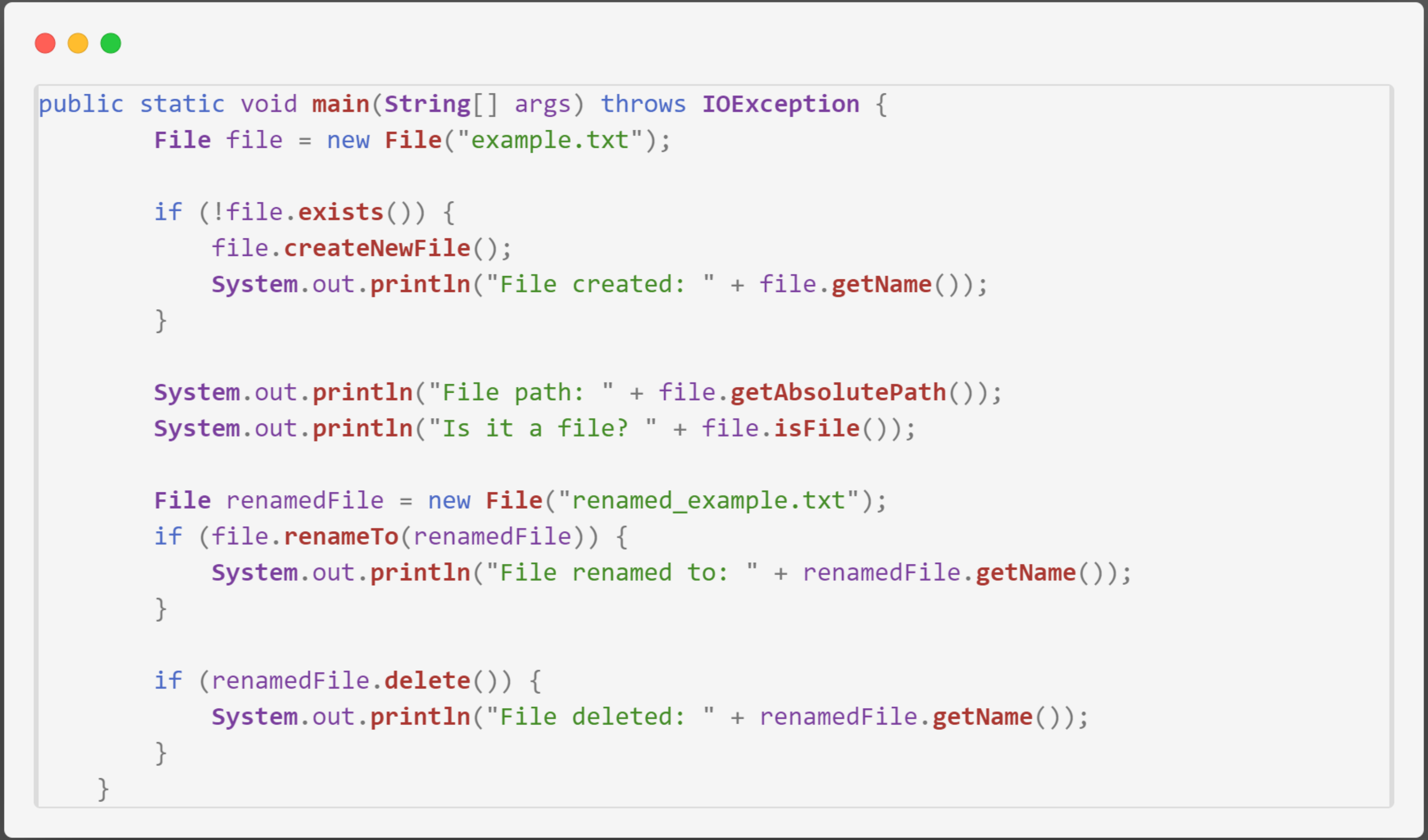
```
File dir = new File("exampleDir");
dir.mkdir();  // Creates a new directory
String[] fileList = dir.list();
```

Buffered I/O



```
BufferedReader reader = new BufferedReader(new FileReader("example.txt"));
String line = reader.readLine();
reader.close();
```

- Wrap around FileReader or FileWriter for efficient reading and writing.
- Reads/writes larger chunks of data at a time to improve performance.



```java
public static void main(String[] args) throws IOException {
        File file = new File("example.txt");

        if (!file.exists()) {
            file.createNewFile();
            System.out.println("File created: " + file.getName());
        }

        System.out.println("File path: " + file.getAbsolutePath());
        System.out.println("Is it a file? " + file.isFile());

        File renamedFile = new File("renamed_example.txt");
        if (file.renameTo(renamedFile)) {
            System.out.println("File renamed to: " + renamedFile.getName());
        }

        if (renamedFile.delete()) {
            System.out.println("File deleted: " + renamedFile.getName());
        }
    }
```

File I/O Exceptions:

Common Exceptions:

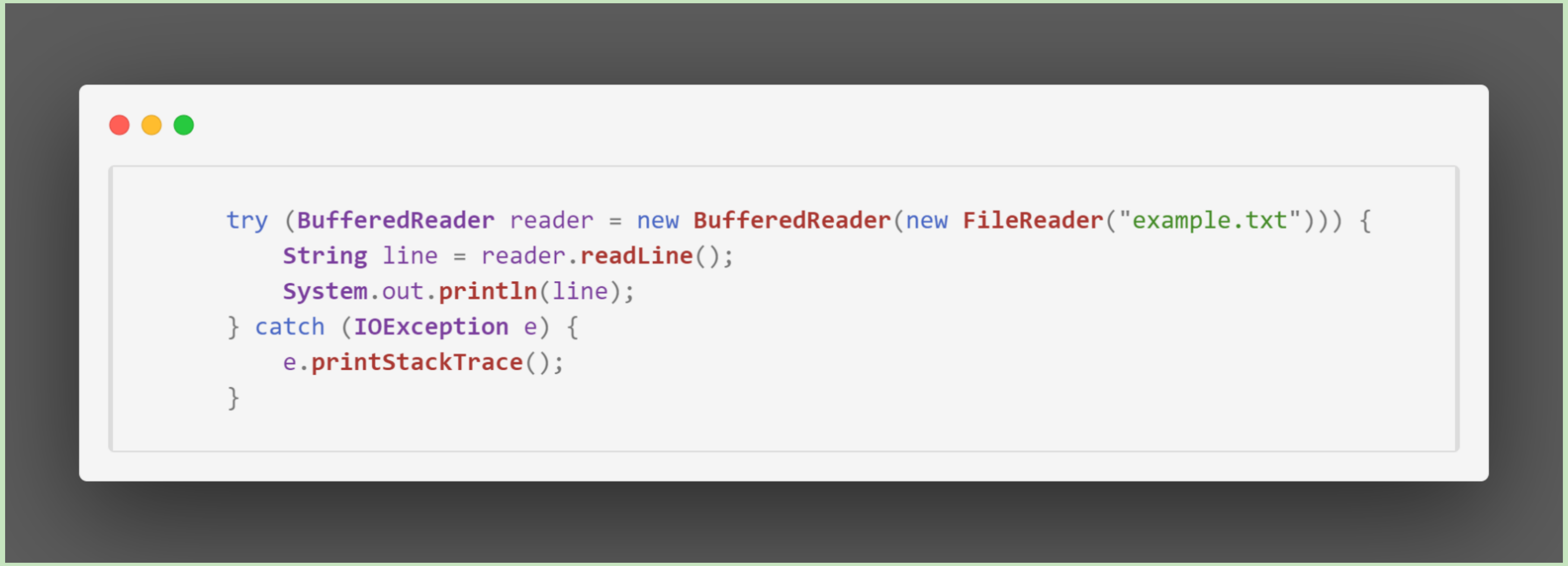
- **IOException:** General I/O failure (e.g., file not found, read/write failure).
- **FileNotFoundException:** File not found or cannot be opened.

- Always handle these exceptions **using try-catch** or **try-with-resources**.

File I/O Exceptions:

1. Try-With-Resources (Java 7+):

- Automatically closes the resource (file) when you're done to prevent resource leaks.



```java
try (BufferedReader reader = new BufferedReader(new FileReader("example.txt"))) {
    String line = reader.readLine();
    System.out.println(line);
} catch (IOException e) {
    e.printStackTrace();
}
```

File I/O Exceptions:

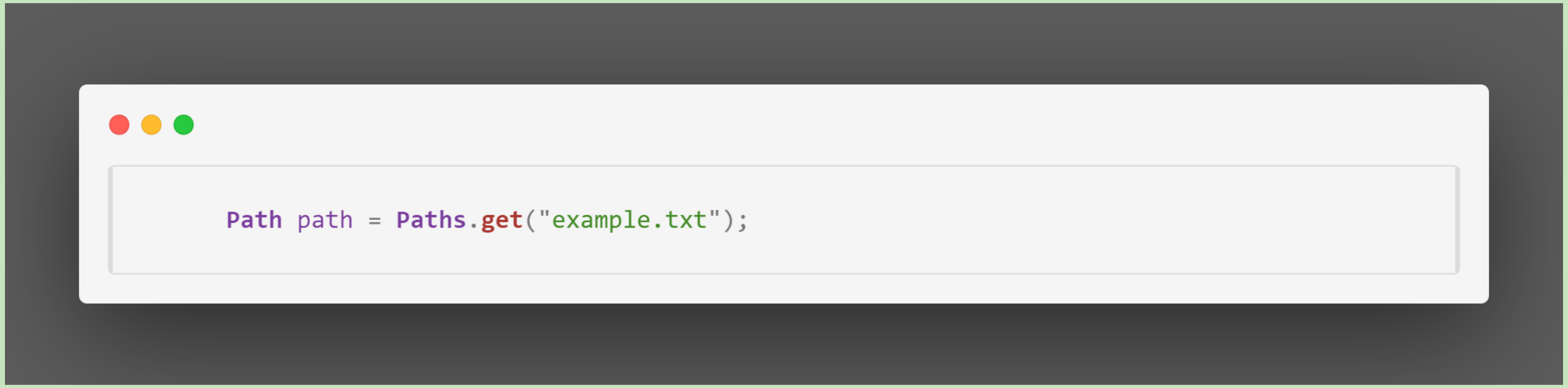
2. Using java.nio.file (Java 7+):

I. **Path Class:**
   - Represents file and directory paths.
   - More modern and flexible than File class.

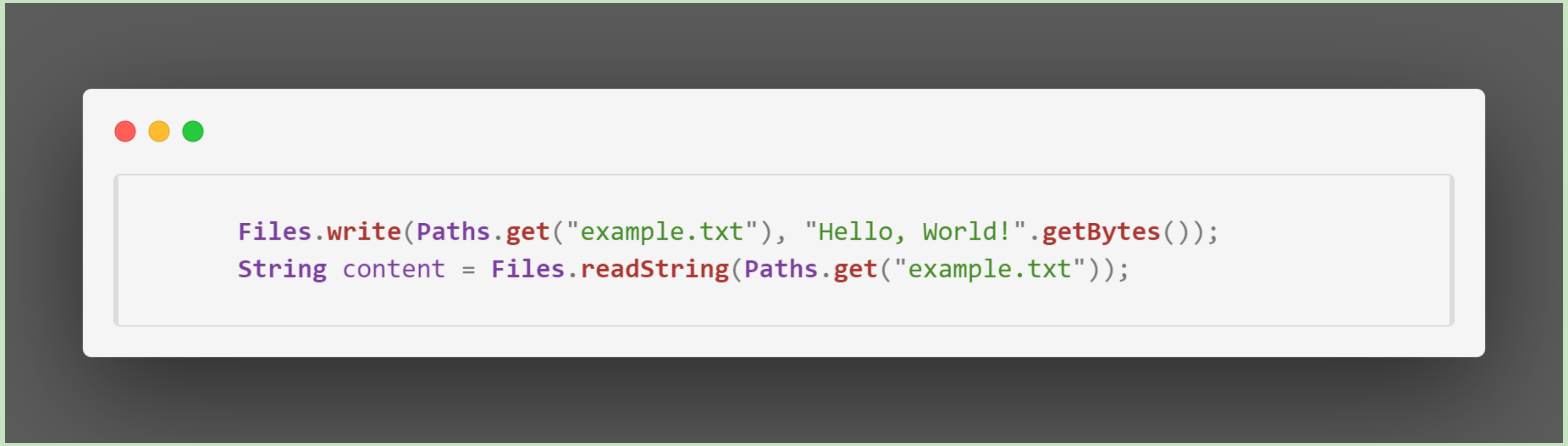
II. **Files Class:**
   - Utility class to perform common file operations easily.

III. **Walking Through Directories:**
   - Files.walk() allows recursively traversing directories.

Usage of the Path and File Classes:



```java
Path path = Paths.get("example.txt");
```



```java
Files.write(Paths.get("example.txt"), "Hello, World!".getBytes());
String content = Files.readString(Paths.get("example.txt"));
```

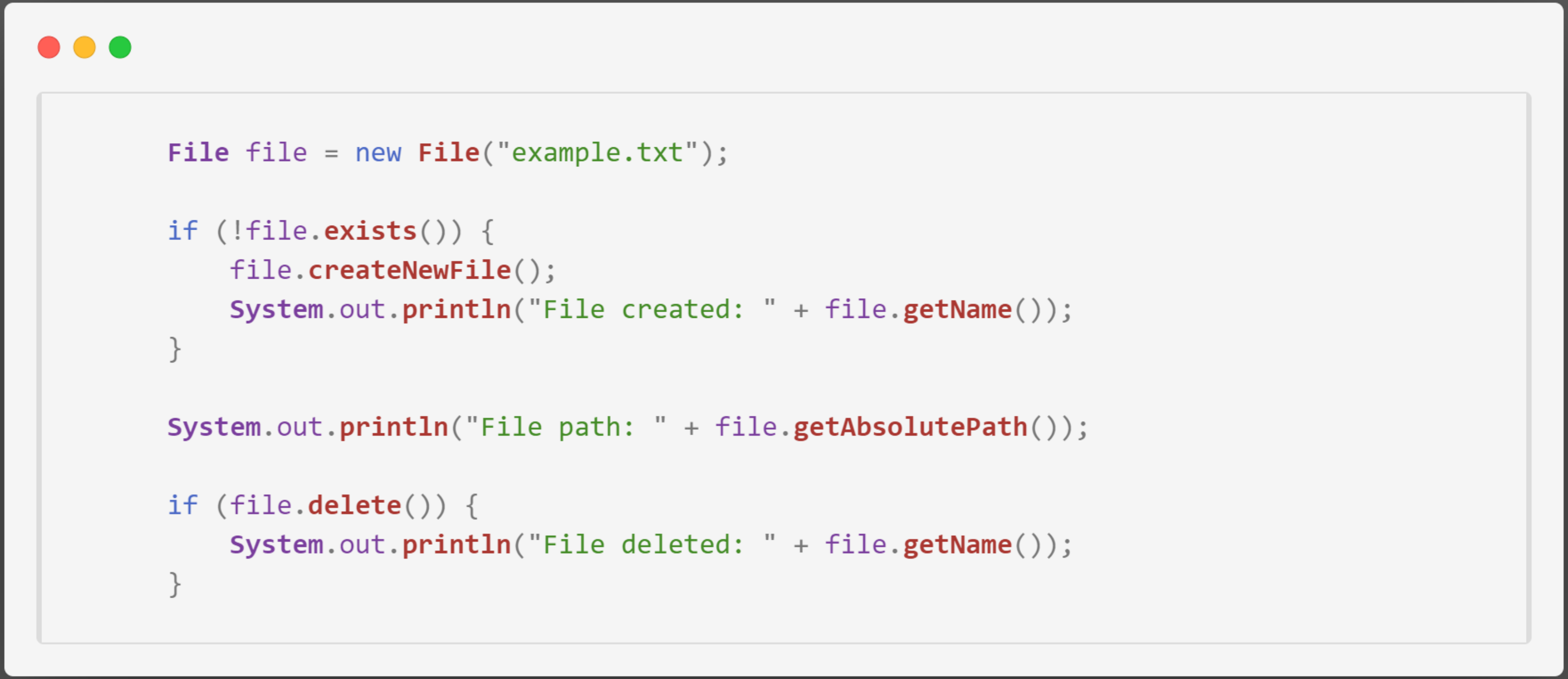
Essential File Handling Tips in Java:

1. **Always Close Resources:**
   - Either manually or using try-with-resources to avoid resource leaks.

2. **Use Buffered I/O:**
   - For efficient reading and writing, especially for large files.

3. **Handle Exceptions:**
   - Properly handle IOException and related exceptions to avoid crashes.

4. **Use java.nio.file for New Code:**
   - Prefer the Path and Files classes in new code for more features and better flexibility.



```java
File file = new File("example.txt");

if (!file.exists()) {
    file.createNewFile();
    System.out.println("File created: " + file.getName());
}

System.out.println("File path: " + file.getAbsolutePath());

if (file.delete()) {
    System.out.println("File deleted: " + file.getName());
}
```

Resources:

- https://www.javatpoint.com/java-io
- https://www.w3schools.com/java/java_files.asp
- https://www.geeksforgeeks.org/file-class-in-java/
- https://www.tutorialspoint.com/java/java_files_io.htm

Any questions?

Thanks for your Attention.