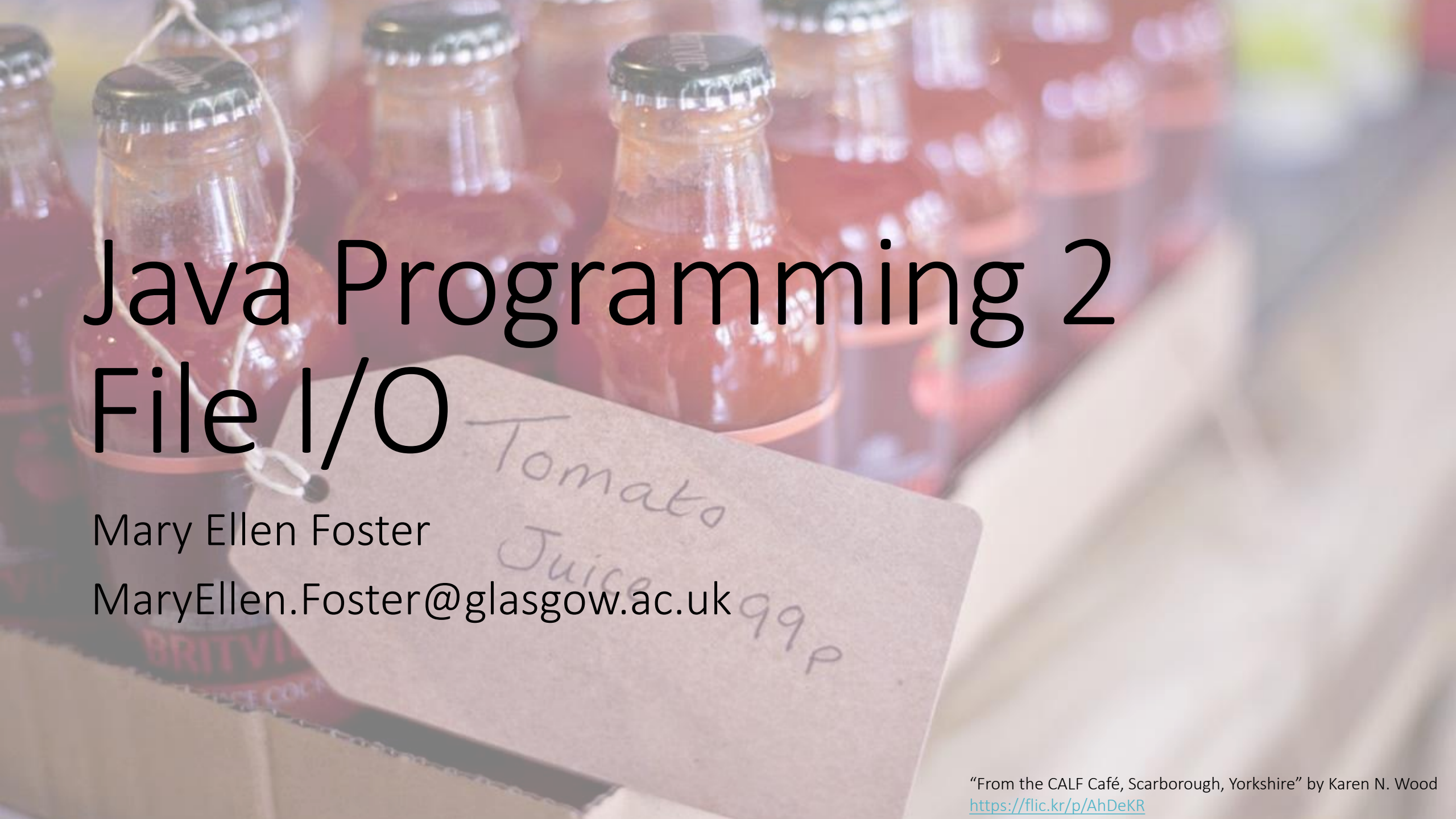

Java Programming 2
File I/O

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Packages for input and output

Basic input/output handling classes are in the `java.io` package

Advanced features in the `java.nio` package

"New" since Java 1.4 (revised in Java 1.7)

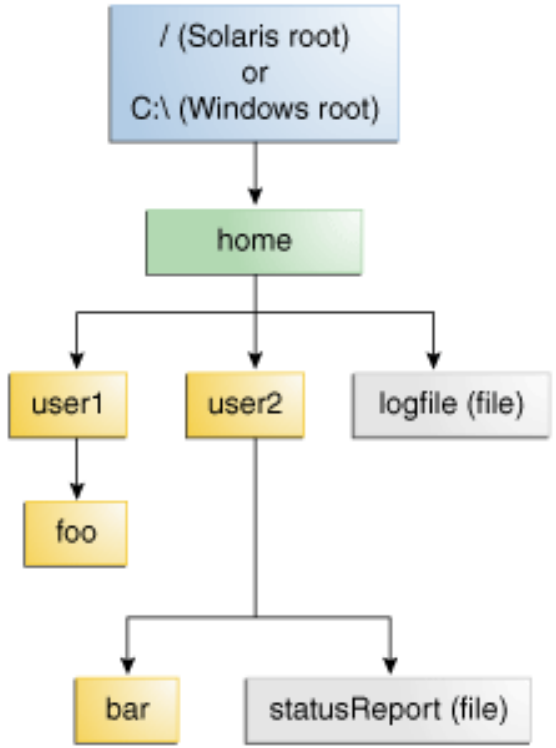
File I/O with `java.nio` (version 2)

Basic concept: Path

A ***path*** identifies a file through its location in the file system, beginning from the root node

A ***delimiter*** separates directory names

- Windows: "\"
- Everything else: "/"



Java tutorial "File I/O"

`java.nio.file.Path`

Represents a path in the file system:
- File name
- List of directories to reach it

Used to examine, locate, and manipulate files

Corresponds to the underlying file system – not system independent
- *C:\Users\mefos\Documents*
- */usr/local/bin/perl*

Corresponding file does not need to exist; you can manipulate a `Path` all you want
- Use methods in `Files` class to deal with actual files

Relative and absolute paths

Absolute path always contains the root element and the complete directory

C:\Users\mefos\Documents

Relative path needs to be combined with another path to access the file

Lab6\Submission6_1\MyClass.java

`Path` objects can be absolute or relative, depending if they begin at the root or not

Operations on `Path`

Syntactic operations: operate on path itself, don't touch file system

Creating a Path:

```
Paths.get ("c:\\users\\joe\\foo");// Paths helper class
```

Retrieving information about a Path:

- Path stores name elements as a sequence
- You can access elements in various ways …

Access methods

Method	Return	Notes
`p.toString()`	`c:\users\joe\foo`	String representation of path
`p.getFileName()`	`foo`	Last element in sequence of names
`p.getName(0)`	`users`	Path element closest to root
`p.getNameCount()`	`3`	Number of elements in path
`p.subpath(0,2)`	`users\joe`	Subsequence of path between beginning and ending index
`p.getParent()`	`\users\joe`	Path of parent directory
`p.getRoot()`	`c:\`	Root of the path

```
Path p = Paths.get ("c:\\users\\joe\\foo");
```

Processing Paths

Remove redundancies: use `normalize()`

c:\users\sally\..\joe\foo -> *c:\users\joe\foo*

Does not check the file system – just cleans up the path internally

Converting a Path

`toAbsolutePath()` : prepends current working directory

`toRealPath()` : returns the real path of an existing file

- Converts relative path to absolute path
- Resolves symbolic links (if `true` is passed)
- Removes redundant elements
- Throws an exception if file does not exist (FileNotFoundException) or cannot be accessed (IOException)

Other notes on Path

It implements `Comparable<Path>`

Collections of Paths can be sorted

It can be used in iteration:

```
Path myPath = …;
for (Path name: myPath) {
    System.out.println (name);
}
```

Also: `equals()`, `beginsWith()`, `endsWith()`

java.nio.file.Files

Set of static methods for reading, writing, and manipulating files and directories

Methods work on `Path` instances

Most methods throw an `IOException` on I/O failure

Checking a file or directory

Verify existence:

```
Files.exists (Path), Files.notExists (Path)
```

Check accessibility:

```
Files.isReadable (Path), Files.isWritable (Path),
Files.isExecutable (Path)
```

Do two Paths locate the same file?

```
Files.isSameFile (Path, Path)
```

Deleting, copying, moving

```
Files.delete (Path)
Files.deleteIfExists (Path)
 // Doesn't throw Exception even if file doesn't exist
Files.copy (Path, Path)
Files.move (Path, Path)
```

Creating files and directories

`Files.createFile (Path)`

Throws Exception if file already exists, or of parent directory does not exist

`Files.createDirectory (Path)`

Throws Exception if file already exists, or of parent directory does not exist

`Files.createDirectories (Path)`

Creates all necessary directories from the top down

Listing files in a directory

```
Path dir = …;

DirectoryStream<Path> stream =
        Files.newDirectoryStream (dir);

for (Path file : stream) {

    System.out.println (file.getFileName());

}
```

Reading from a file

```
// Assuming file contains text content …
Path path = // …
String content = Files.readString (path);
// Or if you want it a line at a time
List<String> content = Files.readAllLines (path);
// For more control
BufferedReader br = Files.newBufferedReader (path);
```

Writing to a file

```
// Easiest method assuming text content

Path path = // whatever

PrintWriter pw = new PrintWriter (Files.newBufferedWriter
(path));

// Then you can call pw.println()
```

Example code

```
Path p1 = Paths.get ("c:\\Users\\mefos\\Documents\\in.txt");
Path p2 = Paths.get ("c:\\Users\\mefos\\Documents\\out.txt");
try {
    List<String> lines = Files.readAllLines (p1);
    Files.createFile (p2);
    PrintWriter pw = new PrintWriter (Files.newBufferedWriter (p2));
    for (String line : lines) {
        pw.println (line);
    }
    pw.close();
} catch (IOException ex) {
    ex.printStackTrace();
}
```