Difference between String, StringBuilder, and StringBuffer

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Overview

This document is intended to provide difference between String, StringBuilder and StringBuffer in java.

Difference between String , StringBuilder and StringBuffer

Feature	String	StringBuilder	StringBuffer
Mutability	**Immutable** (cannot change once created)	**Mutable** (can be modified)	**Mutable**
Thread Safety	Not thread-safe	Not thread-safe	Thread-safe (synchronized)
Performance	Slower for modifications (creates new objects)	Faster (no synchronization overhead)	Slower than StringBuilder (due to sync)
Use Case	Use when string won't change	Use in single-threaded environment with frequent string changes	Use in multi-threaded environment needing safe modifications

Mutability Explanation

- `String`:

```
String s = "Hello";
s = s + " World";  // Creates a new object
```

- `StringBuilder` / `StringBuffer`:

```
StringBuilder sb = new StringBuilder("Hello");
sb.append(" World");  // Modifies the existing object
```

Thread Safety

- `String`: Safe to use as it's immutable, but changes always create new objects.
- `StringBuilder`: Not thread-safe — not synchronized, so faster but not safe for multiple threads.
- `StringBuffer`: Synchronized methods make it thread-safe, but slower due to locking.

Performance

For repeated string operations (like in a loop):

- `String` is **slowest**.
- `StringBuilder` is **fastest** in **single-threaded** apps.
- `StringBuffer` is **safer but slower** in **multi-threaded** apps.

When to use

Situation	Best Choice
Constant string values	`String`
Frequent string changes in 1 thread	`StringBuilder`
Frequent changes + multi-threaded program	`StringBuffer`

Summary

- Use `String` for simple, constant text.
- Use `StringBuilder` for high-performance string operations in single-threaded scenarios.
- Use `StringBuffer` when thread safety is important and multiple threads might modify the string.