Istanbul
Java User Group
https://kommunity.com/istanbul-jug

Java 16 Features

Rahman Usta
rahmanusta@kodedu.com

/ustarahman

/rahmanusta

Java 16 Features

- JEP 357 - Migrate from Mercurial to Git
- JEP 369 - Migrate to GitHub
- JEP 375 - Pattern Matching for instanceof (Standard)
- JEP 384 - Records Component (Standard)
- JEP 360 - Sealed Classes (Second Preview)
- JEP 389 - Foreign Linker API (Incubator)
- JEP 380 - Unix-Domain Socket Channels (Standard)

See the other features:
https://openjdk.java.net/projects/jdk/16/

New release every 6 months

Java 10, Java 11 (**LTS**) => 2018 (March & September)

Java 12, Java 13 => 2019 (March & September)

Java 14, Java 15 => 2020 (March & September)

Java 16 => 2021 (March)

- **LTS** -> Long Term Support
- New LTS every 3 years

Preview Features

- Not a standard yet
- Ready to try, review and feedback
- May be changed, even removed
- Can be staged, first preview, second preview etc.

Enable preview features, disabled by default

--enable-preview

JEP 357: Migrate from Mercurial to Git

JEP 369: Migrate to GitHub

https://github.com/openjdk/

Reasons to Migrate GIT

GIT is kinda standard among version control systems

- Size on Disk
  - Git: 300 MB. vs Mercurial 1.2 GB for jdk/jdk repository
- Plenty of tools
  - Most IDEs have GIT integration
    - IntelliJ IDEA, Visual Studio Code, Vim. etc
- Available hosting
  - Github, Bitbucket, Gitlab etc.

Github is the most popular hosting service for GIT

- Well known in community
- Integration with external systems

Migration principles

- Keep the same history as in hg
- Migrate only single-repo projects
- Migrate JDK tools to work with Git
- Translate commit messages

JEP 394: Pattern Matching for instanceof (Standard[16])

Pre Pattern Matching

```
Object obj = "Hello world!";

if (obj instanceof String) {
   String s = (String) obj;
   System.out.println("String: " + s);
}
```

Pattern Matching

```
if (obj instanceof String s) {
    System.out.println("String: " + s);
}
```

```
// cannot resolve symbol 's'
if (obj instanceof String s || !s.isBlank()) {
    System.out.println("String: " + s);
}
```

```
// legal usage
if (obj instanceof String s && !s.isBlank()) {
    System.out.println("String: " + s);
}
```

JEP 395: Records (Standard[16])

Pre Records

```
public class Point {
    private int x;
    private int y;

    // constructor
    // setters & getters
    // equals & hashcode
    // toString

}
```

```
public Point(int x, int y) {
    this.x = x;
    this.y = y;
}
```

```
public int getX() {
    return x;
}

public void setX(int x) {
    this.x = x;
}

public int getY() {
    return y;
}

public void setY(int y) {
    this.y = y;
}
```

```
@Override
public boolean equals(Object o) {
    if (this == o) return true;
    if (o == null || getClass() != o.getClass()) return false;
    Point point = (Point) o;
    return x == point.x &&
            y == point.y;
}

@Override
public int hashCode() {
    return Objects.hash(x, y);
}
```

```
@Override
public String toString() {
    return "Point{" +
            "x=" + x +
            ", y=" + y +
            '}';
}
```

Records

```
record Point(int x, int y){ }
```

- 1 canonical constructor
- Fields are final
- No setter but getters -> point.x() , point.y()
  - Records are shallowly immutable!
- Default implementation of hashCode and equals
- A standard toString implementation “Point[x=1, y=2]”
- Default characteristic can be overridden
- Record classes can’t extend/be extended
- Can implement interfaces
- Can be declared locally

JEP 360: Sealed Classes (Second Preview[16])

Sealed Classes

too **restrictive**

A **final** class

cannot have any subclass(es)

restrictive as API developer's desire

A **sealed** class

defines what are the sum of subtypes.

too **permissive**

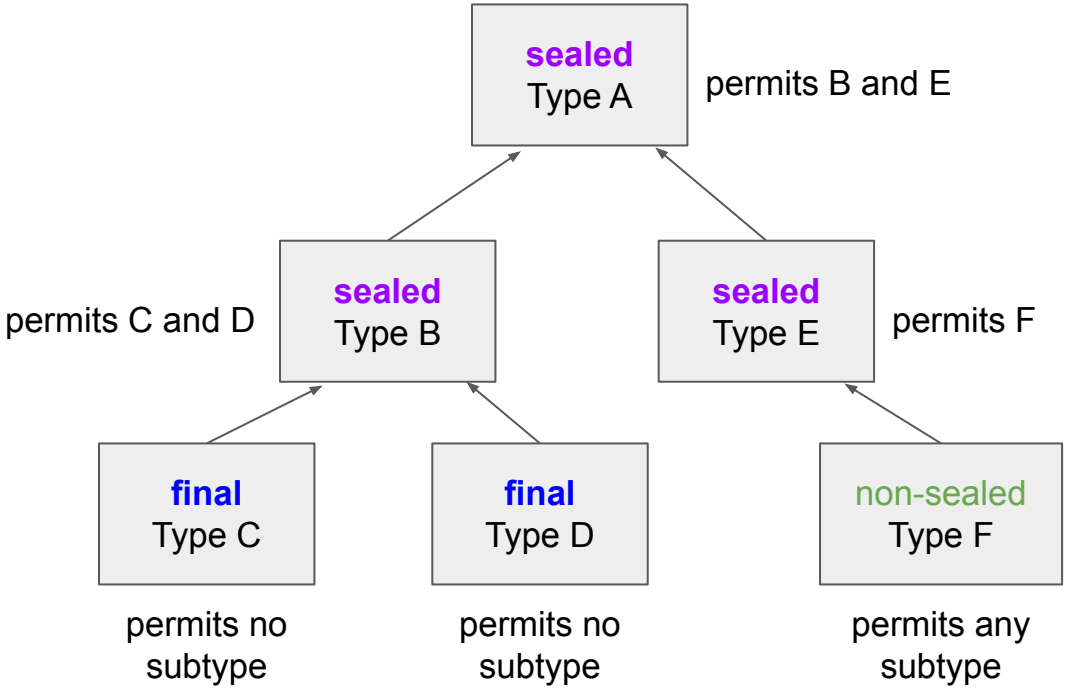
A **non-final** class

may have subclass(es)

Sealed Classes

```
public sealed class Shape permits Square, Circle {

}

public final class Square extends Shape {

}

public final class Circle extends Shape {

}
```

Sealed Classes : Exhaustive



Algebraic types: Records + Sealed Classes

```
sealed interface Expr permits  ConstantExpr, NegExpr, PlusExpr, TimesExpr   { }

record ConstantExpr(int i) implements Expr { }
record PlusExpr(Expr a, Expr b) implements Expr { }
record TimesExpr(Expr a, Expr b) implements Expr { }
record NegExpr(Expr e) implements Expr { }
```

- Records
  - Defines product types
- Sealed classes
  - Defines sum of types

```
int calculate(Expr e) {
        return switch (e) {
                case ConstantExpr(var i) -> i;
                case PlusExpr(var a, var b) -> calculate(a) + calculate(b);
                case TimesExpr(var a, var b) -> calculate(a) * calculate(b);
                case NegExpr(var e) -> -calculate(e);
                // no default needed, Expr is sealed
  }
}
```

JEP 389: Foreign Linker API (Incubator)

Foreign Linker API

An API to access native code in statically-typed, easy, and performant way. Can be considered as alternative to JNI (Java Native Interface), JNA (Java Native Access) etc.

```
--add-modules jdk.incubator.foreign
```

OR

```
module modulename {
    requires jdk.incubator.foreign;
}
```

```
-Dforeign.restricted={deny,permit,debug,warn}
```

Foreign Linker API

An API to access native code in statically-typed, easy, and performant way. Can be considered to replace JNI (Java Native Interface)

```
MethodHandle strlen = CLinker.getInstance().downcallHandle(
        LibraryLookup.ofDefault().lookup("strlen").get(),
        MethodType.methodType(long.class, MemoryAddress.class),
        FunctionDescriptor.of(C_LONG, C_POINTER)
);

MemoryAddress hello = CLinker.toCString("Hello World!").address();
Object text = strlen.invoke(hello);
System.out.println("Length: " + text);
```

See Standard C Library Functions

JEP 380: Unix-Domain Socket Channels

A new Socket Channel which supports unix sockets, to make inter-process communication in same machine.

Unix sockets are just internal file paths which bring less latency than the tcp/ip.

Sample code: https://github.com/rahmanusta/java16-edu/tree/master/src/main/java/com/kodedu/socket

```
var address = UnixDomainSocketAddress.of("/usta/socketFile");
var serverChannel = ServerSocketChannel.open(UNIX);
serverChannel.bind(address);
```

JEP 338: Vector API (Incubator)

“Provide an initial iteration of an incubator module, jdk.incubator.vector, to express vector computations that reliably compile at runtime to optimal vector hardware instructions on supported CPU architectures and thus achieve superior performance to equivalent scalar computations.”
(See https://openjdk.java.net/jeps/338)

```
--add-modules jdk.incubator.vector
```

OR

```
module modulename {
    requires jdk.incubator.vector;
}
```

Benchmark VectorPerformance

Stream API changes

- Stream#toList
  - An alternative to Stream#collect(Collectors#toList())
  - Creates an immutable list
- Stream#mapMulti
  - N input -> M output

Sample code: https://github.com/rahmanusta/java16-edu/tree/master/src/main/java/com/kodedu/stream

Try Java 16

Open-source builds

- https://jdk.java.net/16

Online Java Shell

- https://tryjshell.org/

Code samples

- https://github.com/rahmanusta/java16-edu

Thank you!