Document Refactorings

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I. Rename Refactorings

RENAME Refactoring provides an easy way to change the name of identifiers for code symbols without changing its behavior. There are five types of Rename Refactoring:

1) Rename Class Declarations
2) Rename Method Declarations
3) Rename Field Declarations
4) Rename Local Variables
5) Rename Package Declarations

II. Preconditions of Rename Class Refactoring

Rename Class Refactoring (RcR) changes the name of the class and all references to that class to the new name without changing its behavior. There are certain preconditions required for RcR.

1) The target class cannot be duplicate with any existing class within same package after rename.
2) The target class cannot be duplicate with any imported class from different package after rename.

A. The target class cannot be duplicate with any existing class within same package after rename.

When we rename a class with any existing class name, the Java compiler produces error message: *"duplicate class: p.B"*. The classes will be conflicted if we run rename refactor on the target class using the name of an existing class in the same package. So, we can not have duplicate class names in the same package.

For example, if we run rename refactor on the class name from *A* to *B* as in Fig. 1, then the Java compiler produces an error that B.java already exists as shown in Fig. 2.

```
package p;

class A{
}

class B{
}

class C{
}
```

(a) Before

```
package p;

class B{
}

class B{
}

class C{
}
```

(b) After

Fig. 1. **Example of RcR from A to B**

```
C:\Users\User\Desktop>java test.java
test.java:6: error: duplicate class: p.B
class B{
^
1 error
```

Fig. 2. **Compile error for using same class name after RcR**

Also, this precondition is applicable even if the classes are defined in separate java files or any file is empty but are within the same folder. In Fig. 3, we try to apply RcR from *A to C* or *B to C* where C.java is an empty file, the compiler produces an error as shown in Fig. 4.

```
A.java

public class A{
}

class B{
}


C.java
//empty file
```

(a) Before

```
A.java

public class A{
}

class C{
}


C.java
//empty file
```

(b) After

Fig. 3. **RcR from B to C even if C.java is empty**

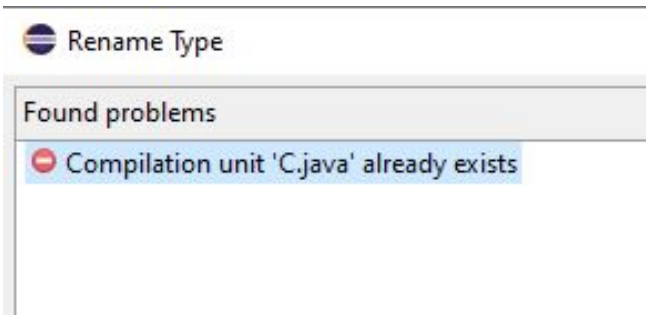

Fig. 4. **Compile error for same file name after RcR**

Furthermore, the same situation occurs in nested classes. The examples below show that for RcR we can not use the same name either as inner or as outer class for nested classes like Fig. 5.

Example 1: In order to implement RcR for inner class, we should pre-check that we do not use the same name as any of other inner class name. From Fig. 6, when we try to

```
package p;

public class A{

  class M{
  }

  class N{
  }
}
```

Fig. 5. **Nested Class before RcR**

rename refactor the inner class from M to N, the Java compiler produces an error as shown in Fig. 7.

```
package p;

public class A{

  class N{
  }

  class N{
  }
}
```

Fig. 6. **Example 1 for Nested Class after RcR from M to N**

```
C:\Users\User\Desktop>java test.java
test.java:8: error: class A.N is already defined in class A
  class N{
  ^
1 error
error: compilation failed
```

Fig. 7. **Compile error for duplicate inner class name after RcR**

Example 2: In order to implement RcR for outer class, we should pre-check that we do not use the same name as any of the inner class name and vice-versa. From Fig. 8, when we try to use same name for outer class and inner class, the Java compiler produces an error as shown in Fig. 9 and Fig. 10.

```
package p;

public class M{

  class M{
  }

  class N{
  }
}
```

(a) After RcR on Outer Class A to M

```
package p;

public class A{

  class A{
  }

  class N{
  }
}
```

(b) After RcR on Inner Class N to A

Fig. 8. **Example 2 of Nested Class after RcR**

```
C:\Users\User\Desktop>java test.java
test.java:5: error: class M is already defined in package p
  class M{
  ^
1 error
error: compilation failed
```

Fig. 9. **Compile error for RcR outer class same as inner class name**

```
C:\Users\User\Desktop>java test.java
test.java:5: error: class A is already defined in package p
  class A{
  ^
1 error
error: compilation failed
```

Fig. 10. **Compile error for RcR inner class same as outer class name**

Therefore, checking whether a class with the same name already exists in a package should be the first precondition for RcR.

B. The target class cannot be duplicate with any imported class from different package after rename.

If a class is imported from different package, we have to pre-check that the new name of the target class is not duplicate with the imported class after rename refactoring.

```
package q;
import p.C;

class A{
}

class B{
}
```

(a) Before

```
package q;
import p.C;

class A{
}

class C{
}
```

(b) After

Fig. 11. **RcR from B to C**

In Fig. 11 (a), we see that class B is not duplicate with class A and we can implement RcR on class B to any other name except 'A' as mentioned in section II-A. However, in Fig. 11 (b), when we try to implement RcR from *B to C*, Java compiler produces an error *"a compilation unit must not import and declare a type with the same name"* [1] as shown in Fig. 12. This is because the compiler cannot distinguish between the *imported class C* of package 'p' and the *existing class C* of package 'q'.

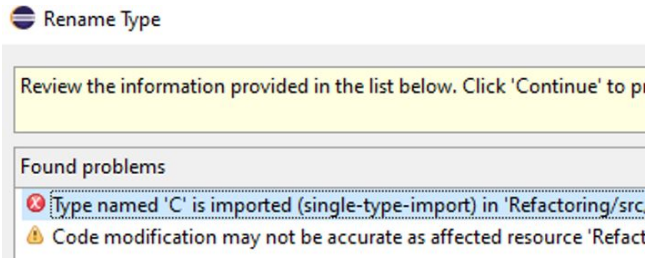

Fig. 12. **Compilation Unit Error**

Therefore, it is essential to pre-check that the target class should not have duplicate name with any of imported class after RcR.

As mentioned in section II-B, the same precondition also holds good for renaming a child class. Suppose a Java file has a class and its children classes as shown in Fig. 13. We see that if parent class A imports a class C from package 'p' and if we try to rename the child class from B to C or D to C, Java compiler produces an error as "C is already defined".This

precondition is applicable for all ancestor class and we have to trace back and check if any of the parent class is importing a class with same name before renaming the child class within the same java file.

```
//A.java

package q;
import p.C;

public class A{
}

class B extends A{
}

class D extends B{
}
```

(a) Before

```
//A.java

package q;
import p.C;

public class A{
}

class C extends A{
}

class D extends B{
}
```

(b) After

Fig. 13. **RcR from B to C**

If a parent class imports a class from different package and if the child class is defined in a separate java file, then in that case we can refactor and rename the child class to the imported class name.

REFERENCES

[1] "Eclipse Refactorings Properties," https://git.eclipse.org.