

The Impact of Systematic Edits in History Slicing

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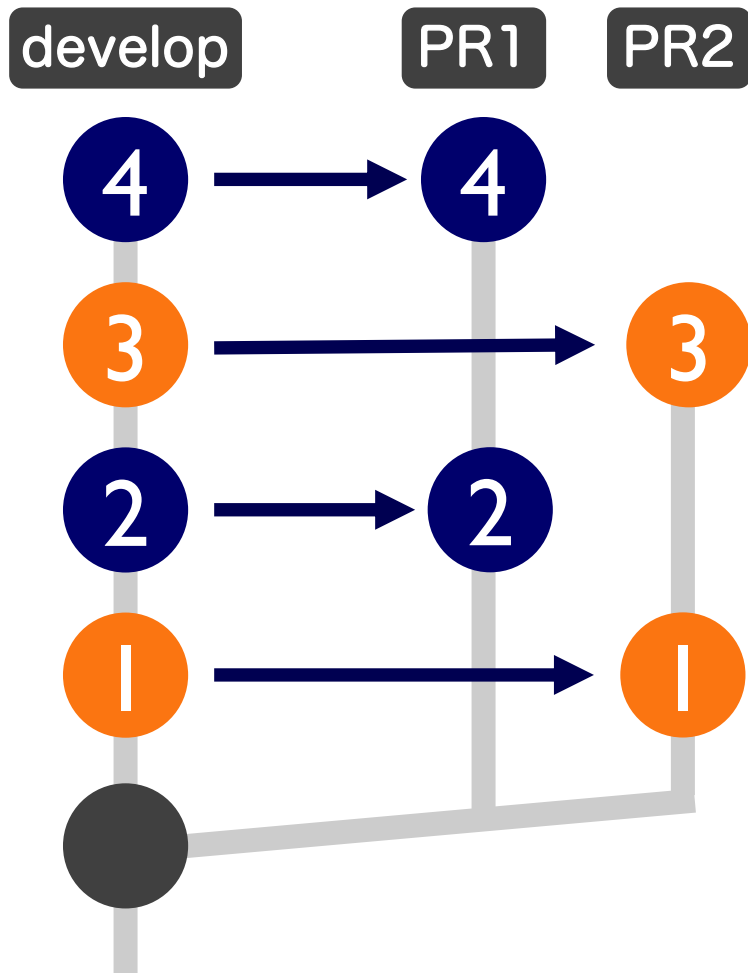
Similar edits applied to multiple locations of source code

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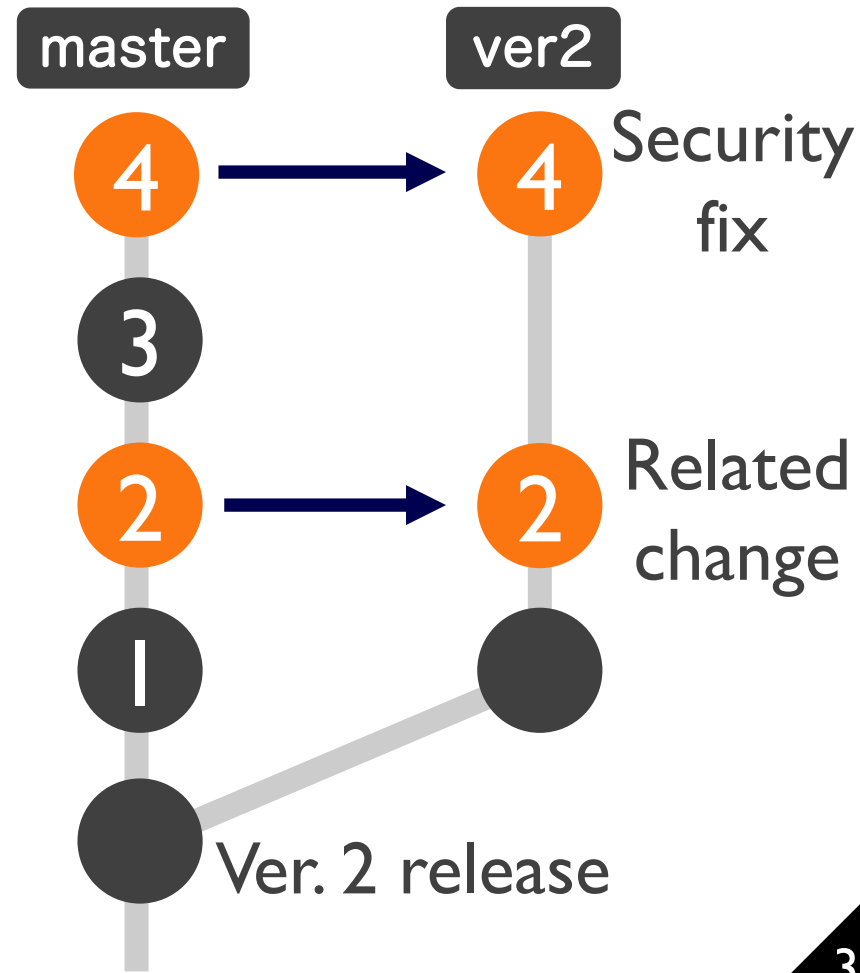
Extracting sub-history based on dependency among change elements

Motivation: Sub-history Extraction

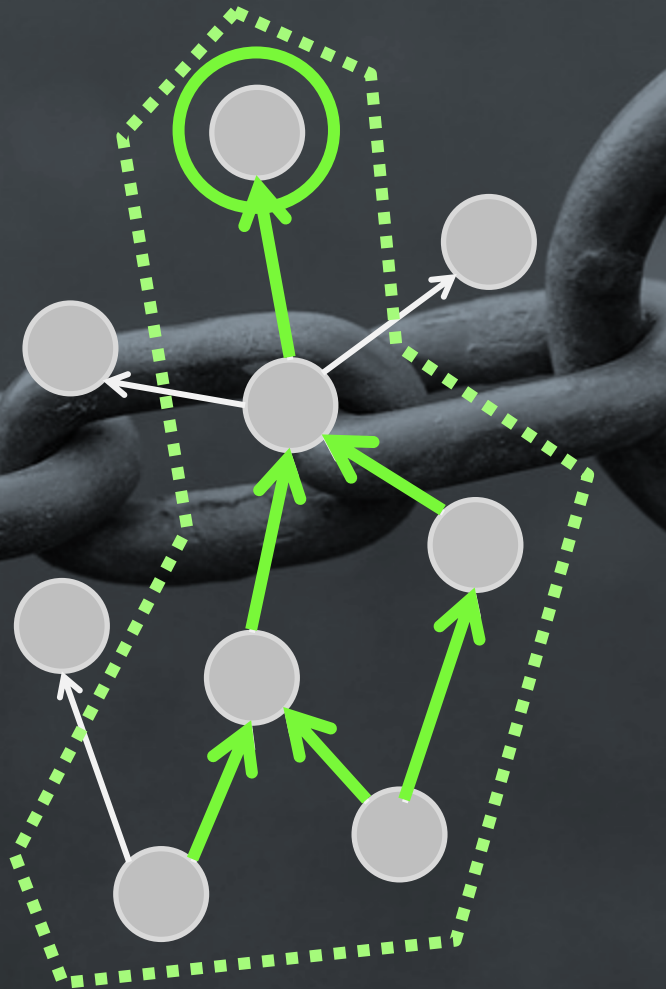
Branch Refactoring



Backporting



History Slicing



Line-based

[Servant et al.]

Edit-based

[Maruyama et al.]

Commit-based

[Li et al.]

“ developers often perform **systematic edits**—similar, but not identical, changes to many locations.

Use final.

[Browse files](#)

master commons-collections-4.2 ... collections-4.3-RC1

Showing 82 changed files with 592 additions and 588 deletions.

Unified Split

12 src/main/java/org/apache/commons/collections4/CollectionUtils.java

```
@@ -951,7 +951,7 @@ public int hashCode() {
```

```
951     * @since 4.1
952     */
953     public static <O, R extends Collection<? super O>> R
select(final Iterable<? extends O> inputCollection,
954 -         final Predicate<? super O> predicate, R
outputCollection, R rejectedCollection) {
```

```
951     * @since 4.1
952     */
953     public static <O, R extends Collection<? super O>> R
select(final Iterable<? extends O> inputCollection,
954 +         final Predicate<? super O> predicate, final
R outputCollection, final R rejectedCollection) {
```

- long offset

+ final long offset

```
956         if (inputCollection ==
null) {
957         f
```

```
@@ -1273,7 +1273,7 @@
@@ -1273,7 +1273,7 @@
```

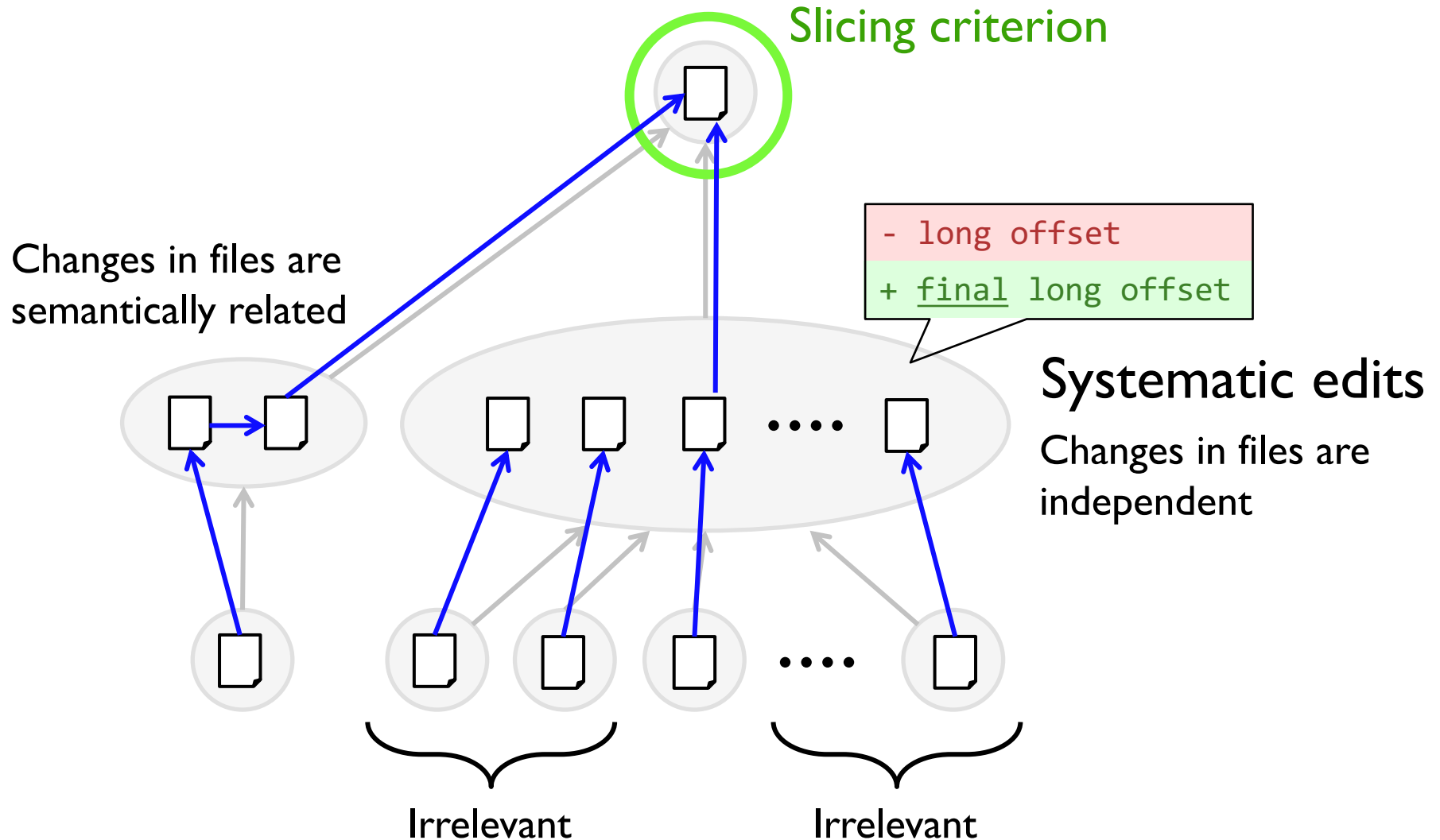
```
1273     * @throws IllegalArgumentException if the object
type is invalid
1274     */
1275     public static Object get(final Object object, final
int index) {
1276 -         int i = index;
1277         if (i < 0) {
1278             throw new IndexOutOfBoundsException("Index
cannot be negative: " + i);
1279         }
```

```
        && predicate != null) {
inputCollection) {
tion if the object
type is invalid
1274     */
1275     public static Object get(final Object object, final
int index) {
1276 +         final int i = index;
1277         if (i < 0) {
1278             throw new IndexOutOfBoundsException("Index
cannot be negative: " + i);
1279         }
```

```
@@ -1534,8 +1534,8 @@ public static int maxSize(final Collection<? extends Object> coll) {
```

<https://github.com/apache/commons-collections/commit/059c468>

Systematic edits lead to enlarging commit-based history slices



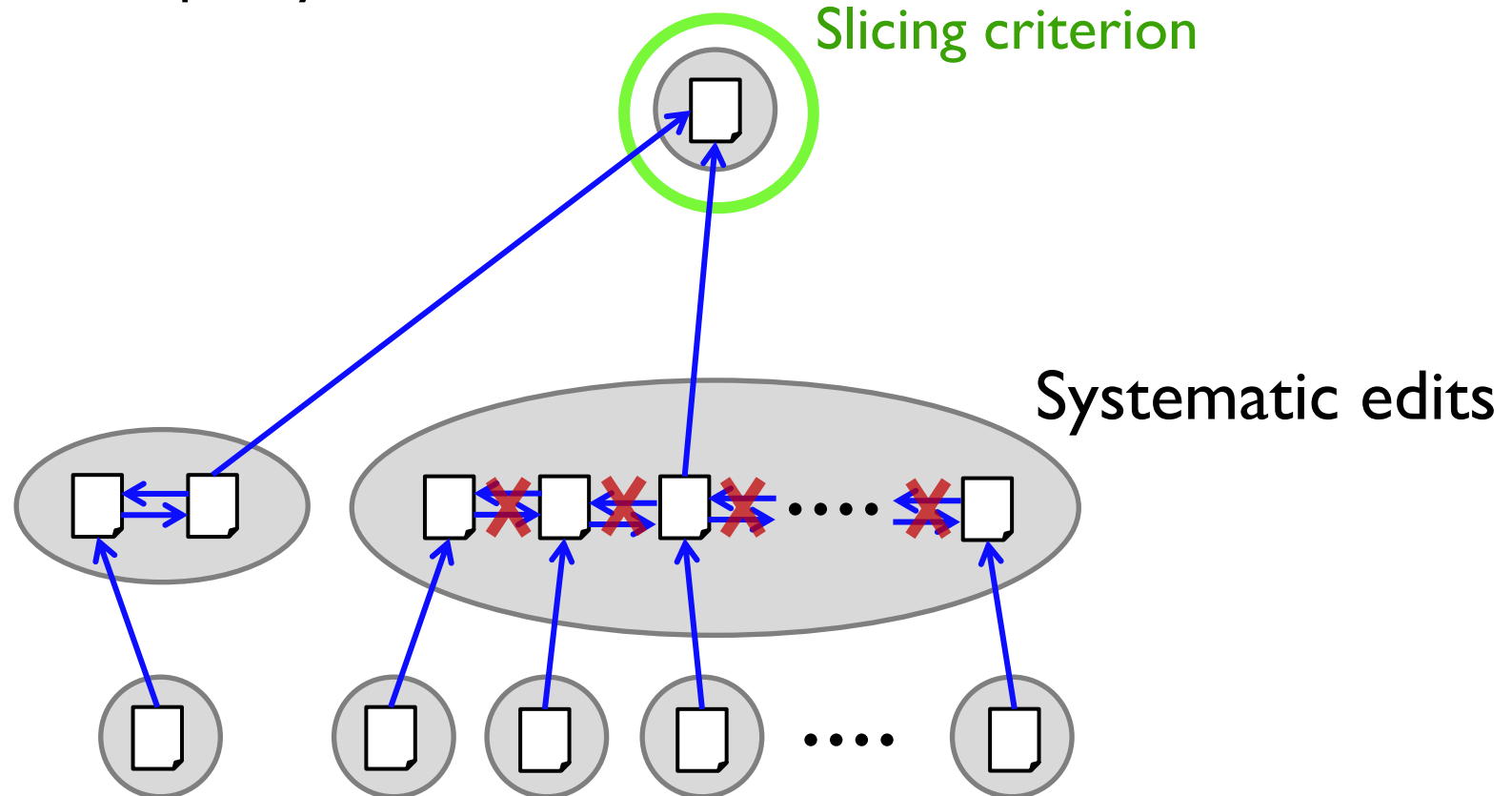


Research Question

***How much do
systematic-edit-
based commits
impact
the size of
commit-based
history slices?***

Dependency among Changed Files

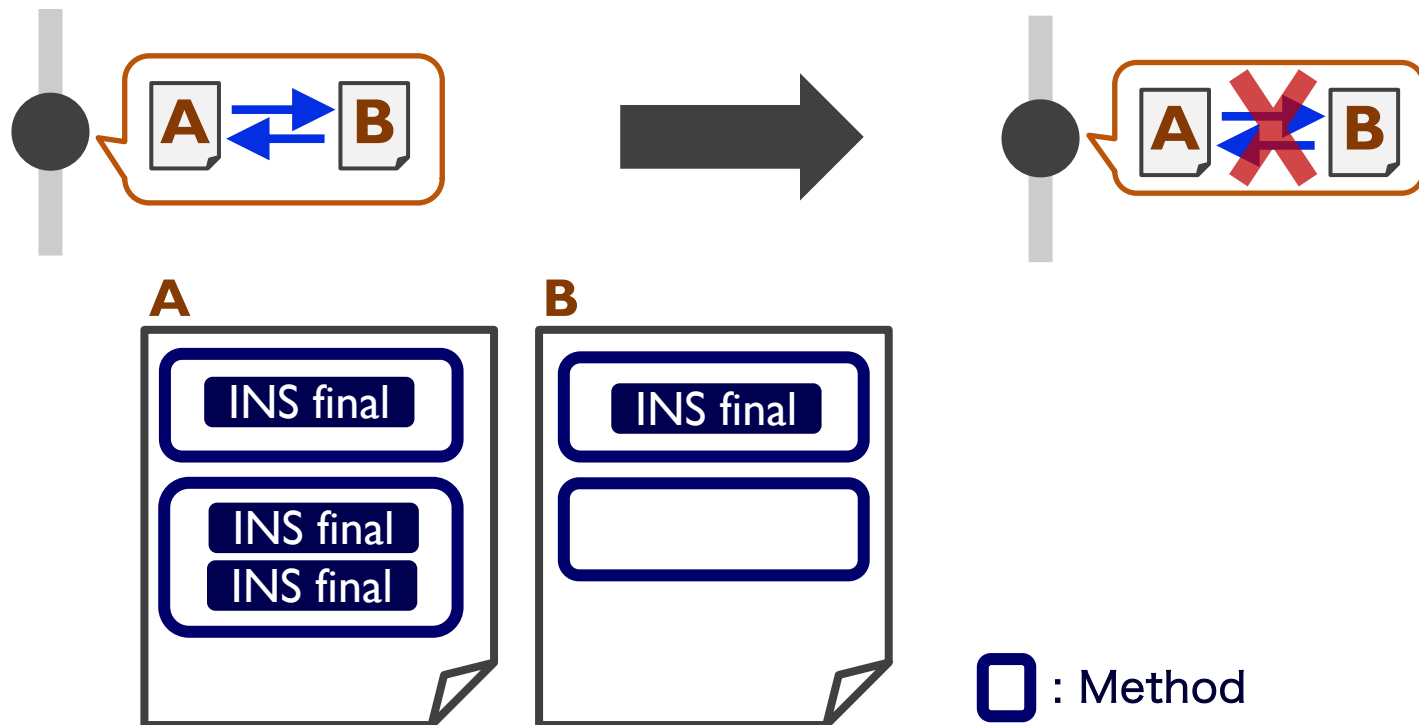
- Introduces “Commit dependency”
- Remove them if the commit is regarded as systematic
 - Systematic edits are detected using an extended version of technique by Molderez et al.



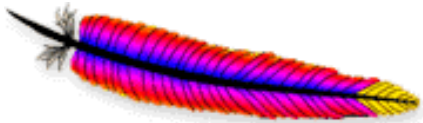
Detecting Systematic Edits

Arranged the technique by Molderez et al.

- Calculates AST edit scripts
- Detects systematic edits *if* the script pattern for each method is all the same

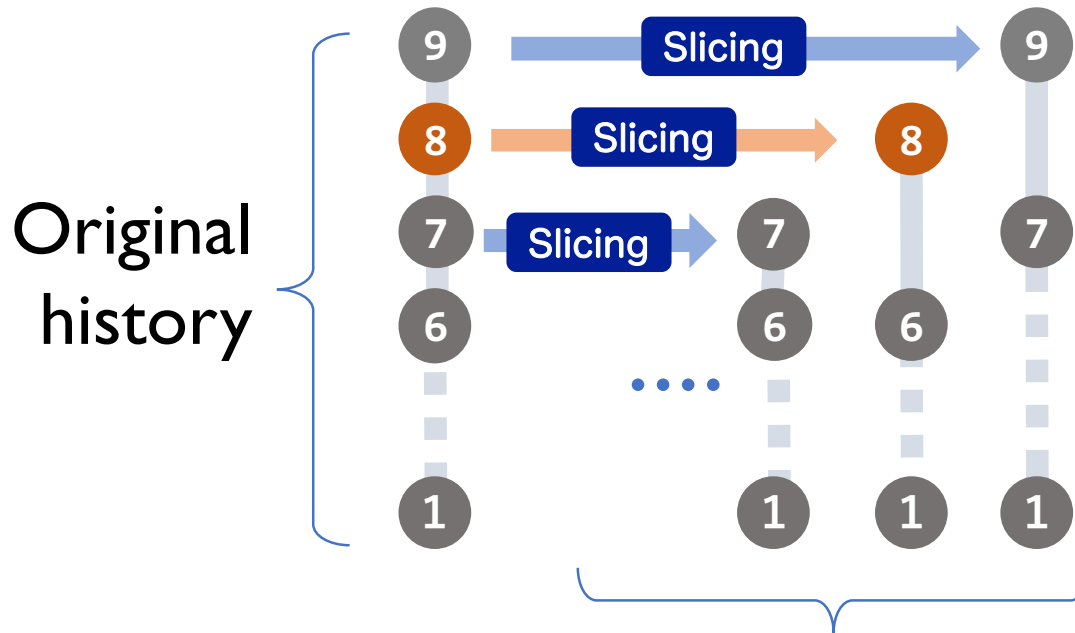


Empirical Study: Setup



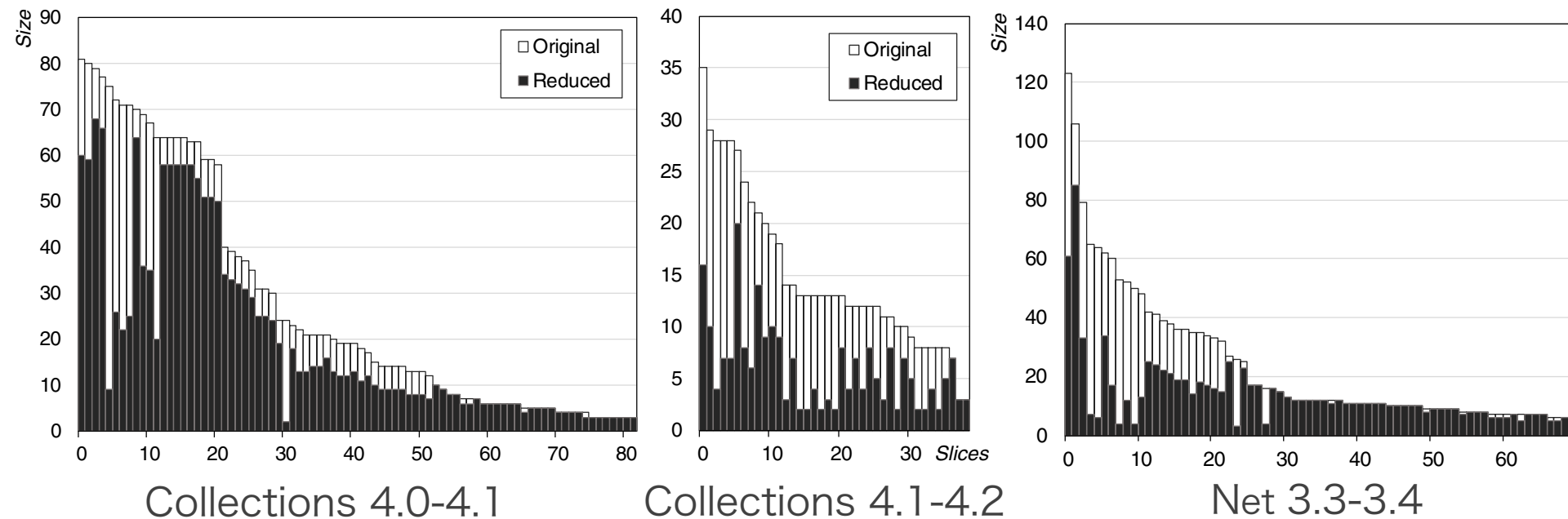
Apache Commons
<http://commons.apache.org/>

commons	4.0 – 4.1 (164 slices)
<i>collections</i>	4.1 – 4.2 (83 slices)
commons net	3.3 – 3.4 (211 slices)



Extracted slices using each commit in the original history as a slicing criterion

RQ: Slice size when splitting commits consisting of *systematic edits*

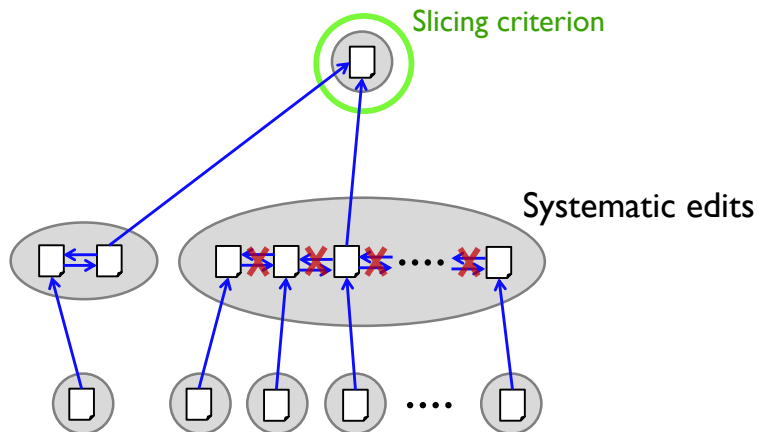


*The size of history slices decreased by **13.3-57.2%** on average when splitting commits consisting of systematic edits.*

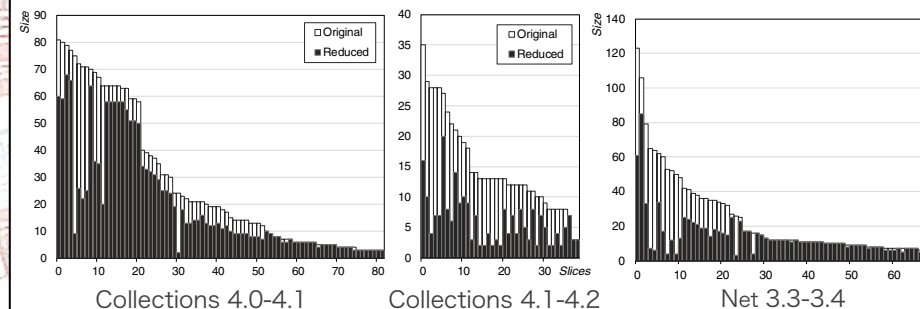
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Dependency among Changed Files

- Introduces “Commit dependency”
- Remove them if the commit is regarded as systematic



RQ: Slice size when splitting commits consisting of systematic edits



*The size of history slices decreased by **13.3-57.2%** on average when splitting commits consisting of systematic edits.*