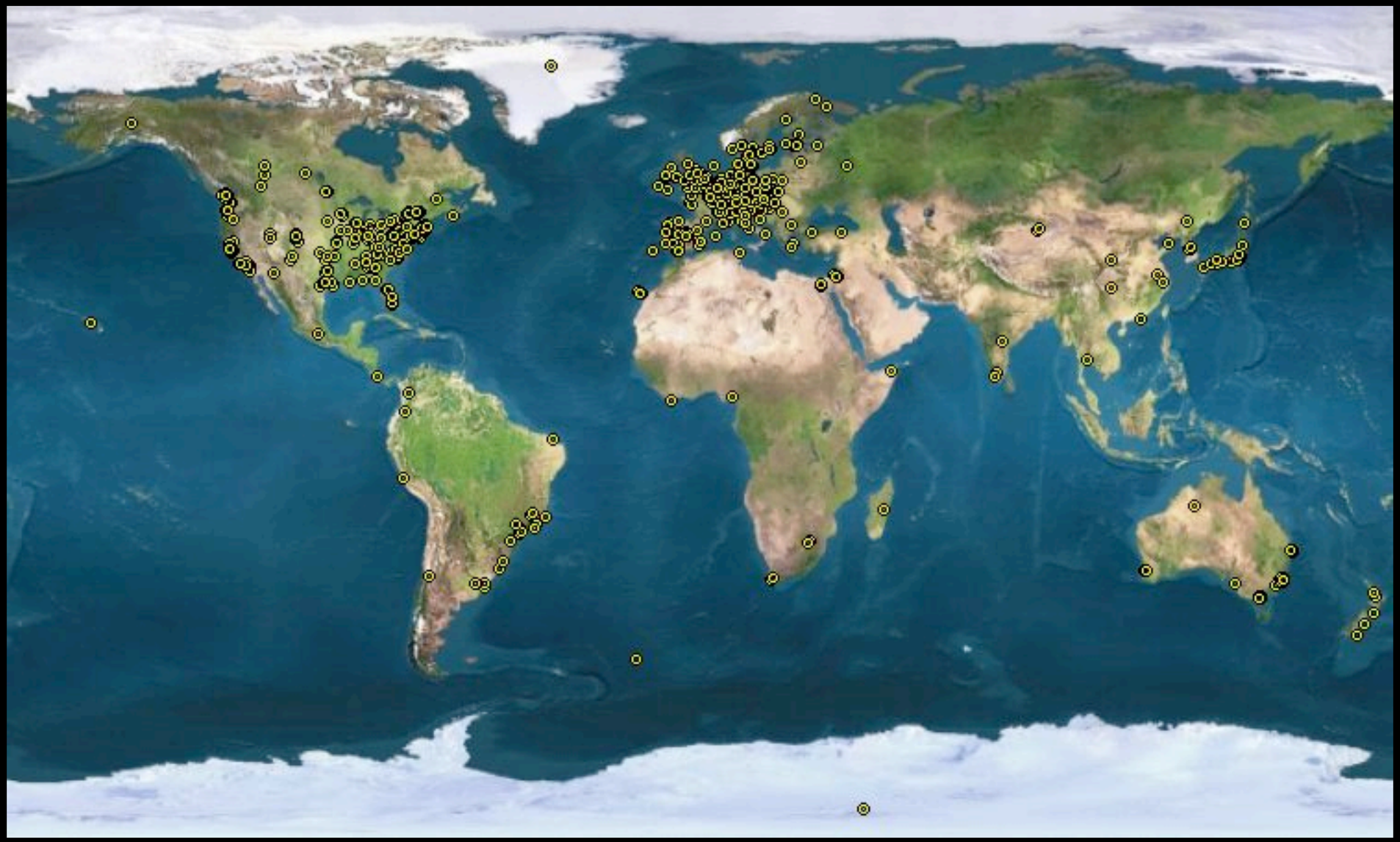
Software Mining

Lecture 2

Pre-processing

Concurrent Versions System Archives

Debian Developer Coordinates



Distributed Development

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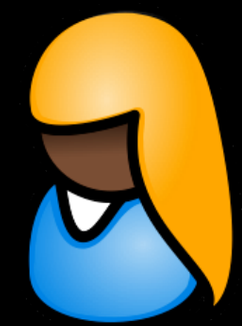

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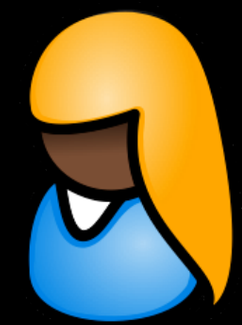

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OK, I have now edited my code and added new classes. How can the others access it?

Am I the only one working on a weekend?

Distributed Development

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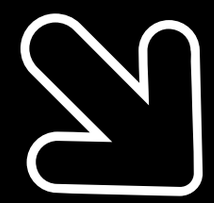

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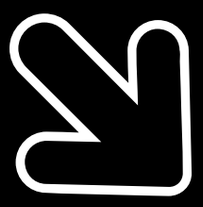

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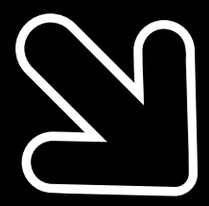

CVS Server

Concurrent Versions System

...a mechanism for storing multiple versions of files.

Concurrent Versions System

...a mechanism for storing multiple versions of files.

Not only for groups, but individuals too! - Back-up - Version - Roll-back - Branches

Concurrent Versions System

- Record the history of all files in the repository.
- Share the files amongst a group of people.
- Have multiple people edit the same files.
- Merge changes from different people.
- Time portal.

How does CVS work?

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current developers

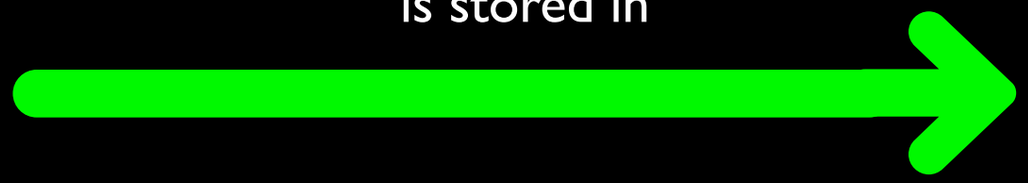
Hello World Project

How does CVS work?

current developers

Hello World Project

is stored in



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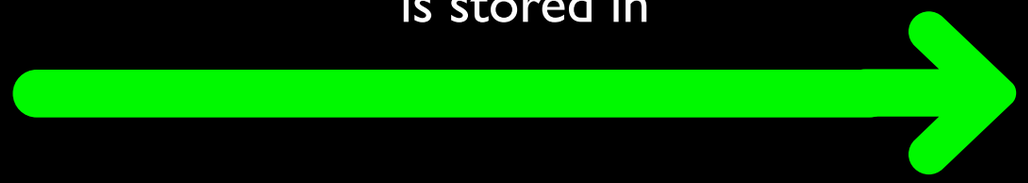

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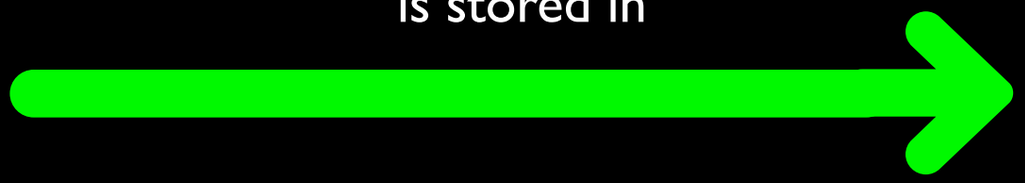

CVS Server

fetch me all files belonging to Hello World Project

New Developer

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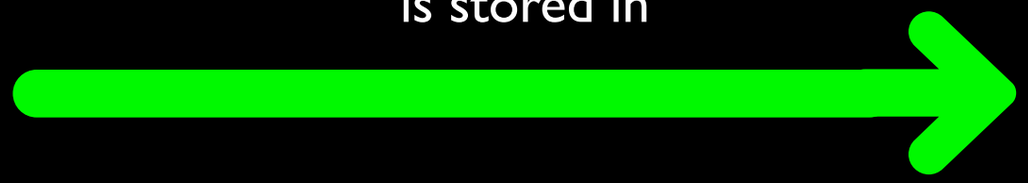

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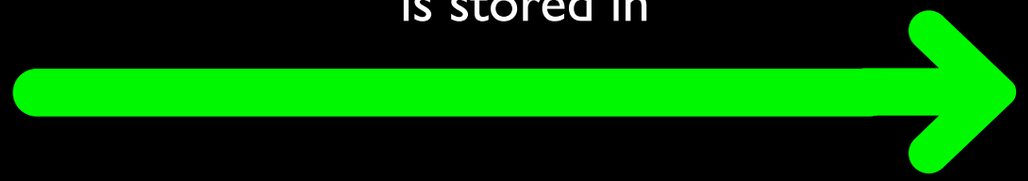

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How does CVS work?

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user changes files

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user changes files

local copy changed

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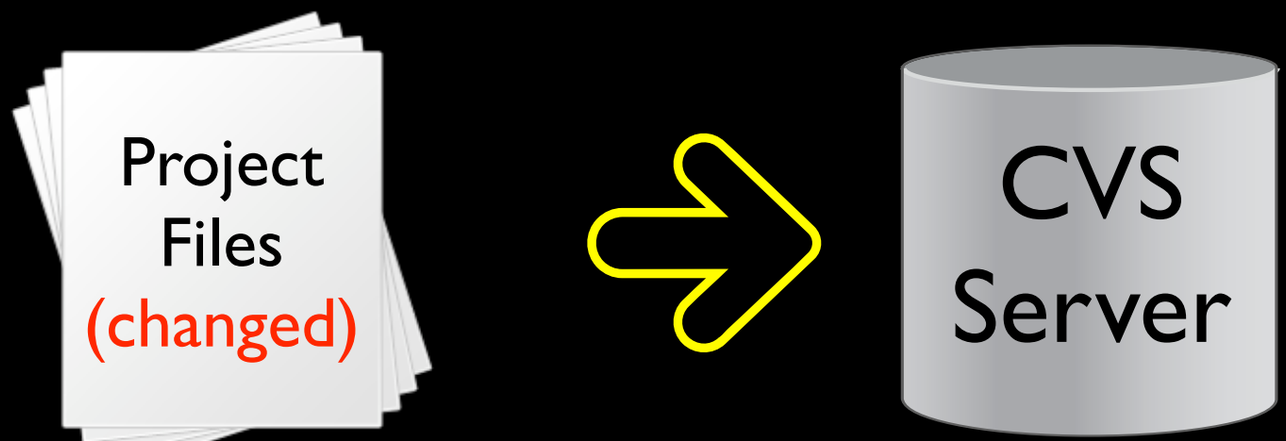

local copy changed

How does CVS work?

local copy changed

server updates project repository

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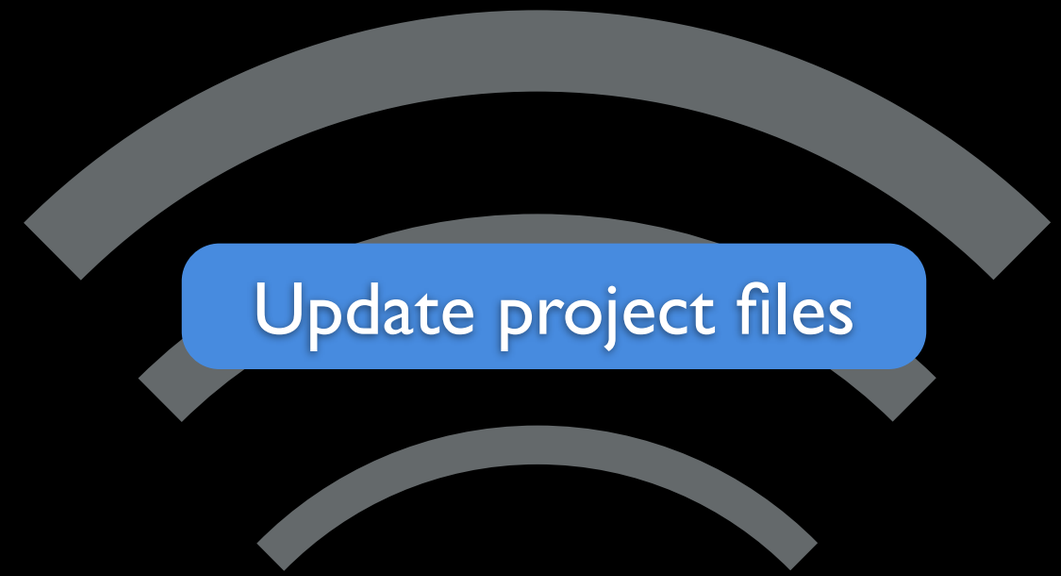

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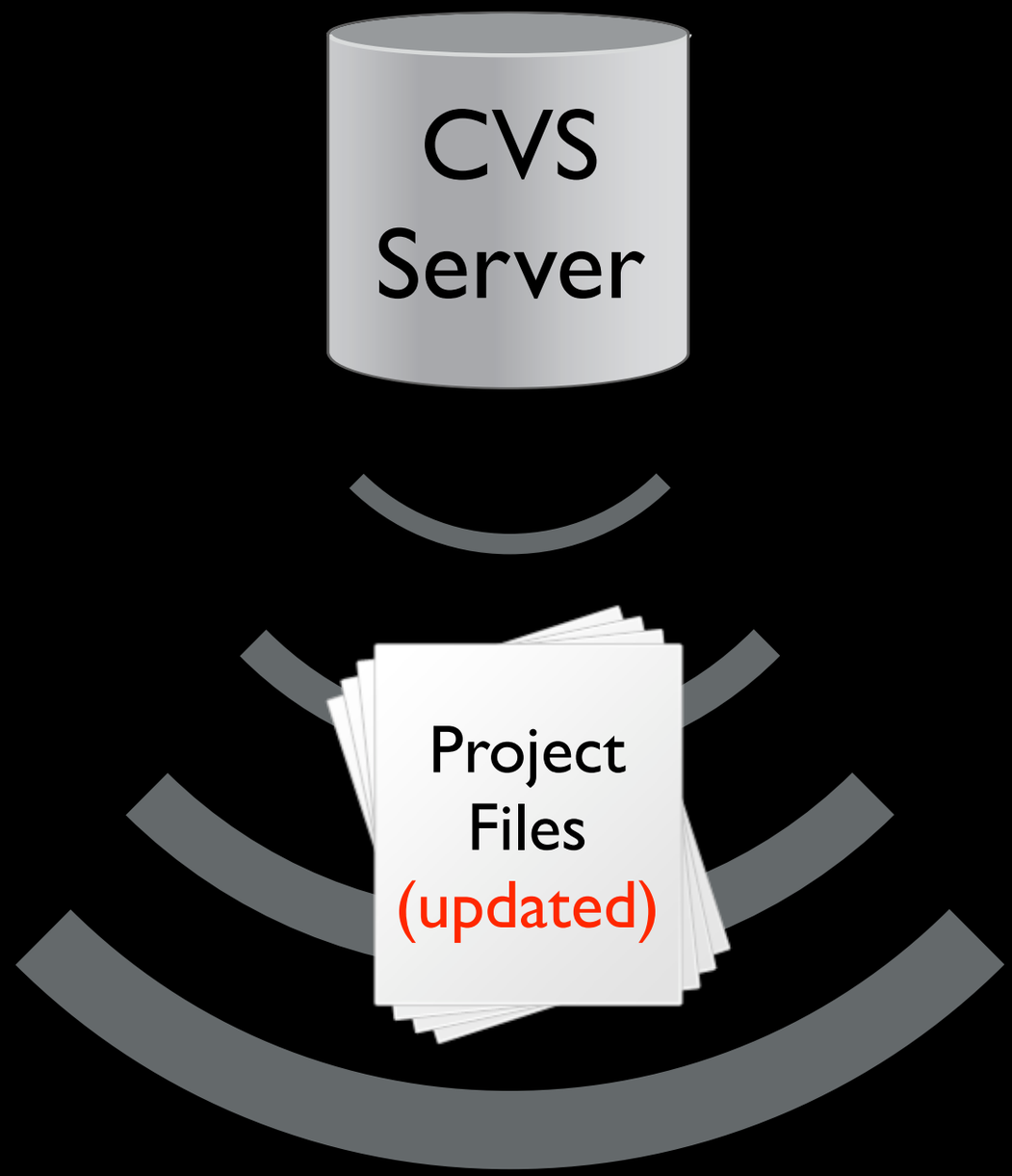

Revision Example

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Revisions to Foo.java

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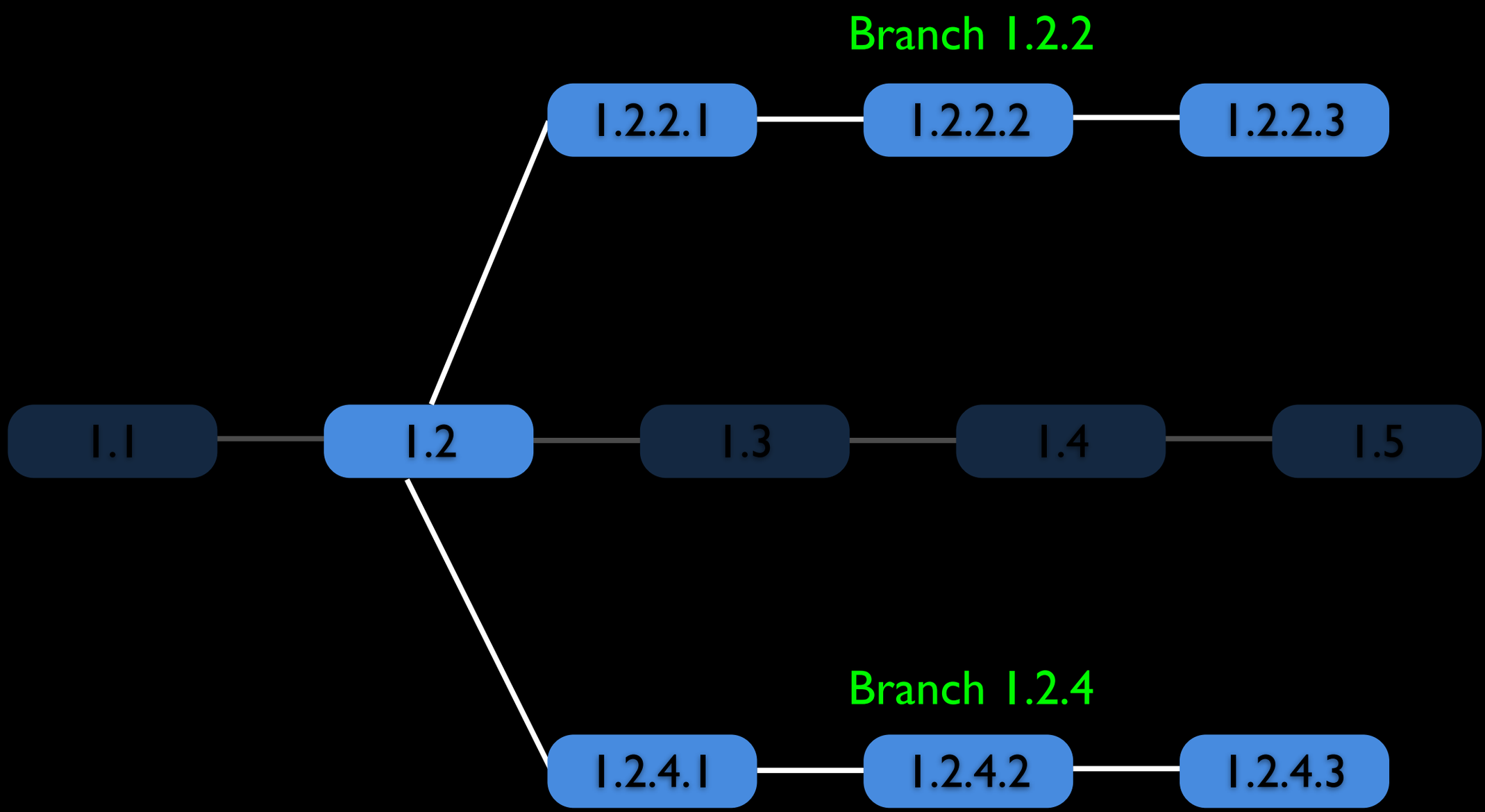
Branches Example



Revisions & Branches

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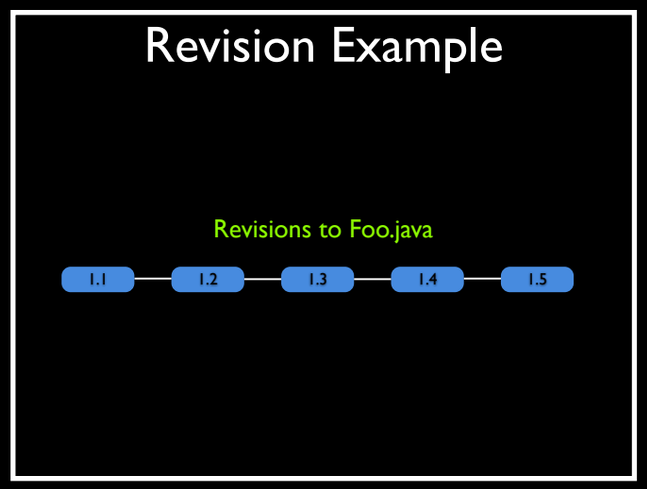

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- Revision number has even number of dot separated integers.
- 1.1 is usually the first revision number.
- Successive revision numbers are incremented by 1.

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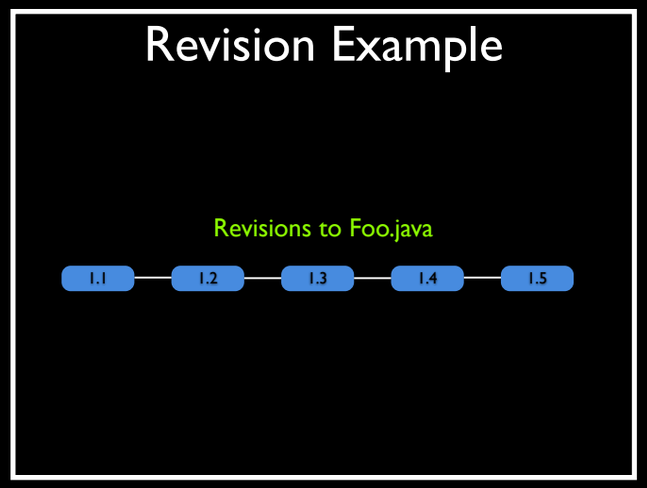

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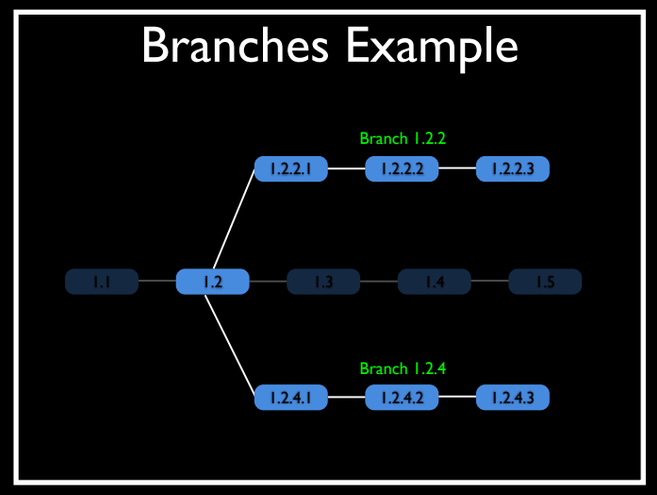

- Each branch has a unique branch number.
- Branch number has odd number of dot separated integers.
- All revisions on a branch have revision numbers formed by appending an ordinal number to the branch number.

Basic CVS Commands

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cvs checkout

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cvs checkout

cvs update

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cvs checkout

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cvs tag

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cvs update

cvs diff

cvs release

cvs remove

cvs add

cvs log

cvs rtag

cvs tag

Basic CVS Commands

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cvs update

cvs diff

cvs release

cvs remove

cvs add

cvs log

cvs rtag

cvs history

cvs tag

Why Pre-process CVS Data?

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So, why is my CVS so silent?

- CVS has limited quer y functionality and is slow.
  ⇒ Copy CVS into a database

- CVS splits up changes on multiple files.
  ⇒ Infer transactions

- CVS knows only files—but what about functions?
  ⇒ Detect fine-grained changes

- CVS contains unreliable data which is noise.
  ⇒ Clean data.

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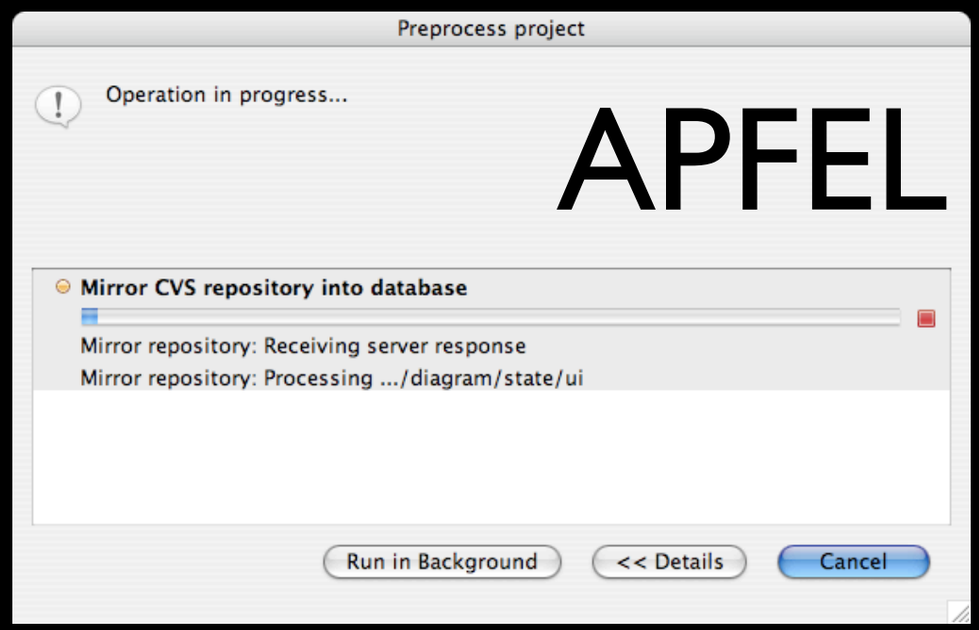
Preprocessing is the key to a talkative version control system.

APFEL collects CVS data

Hello World
Project



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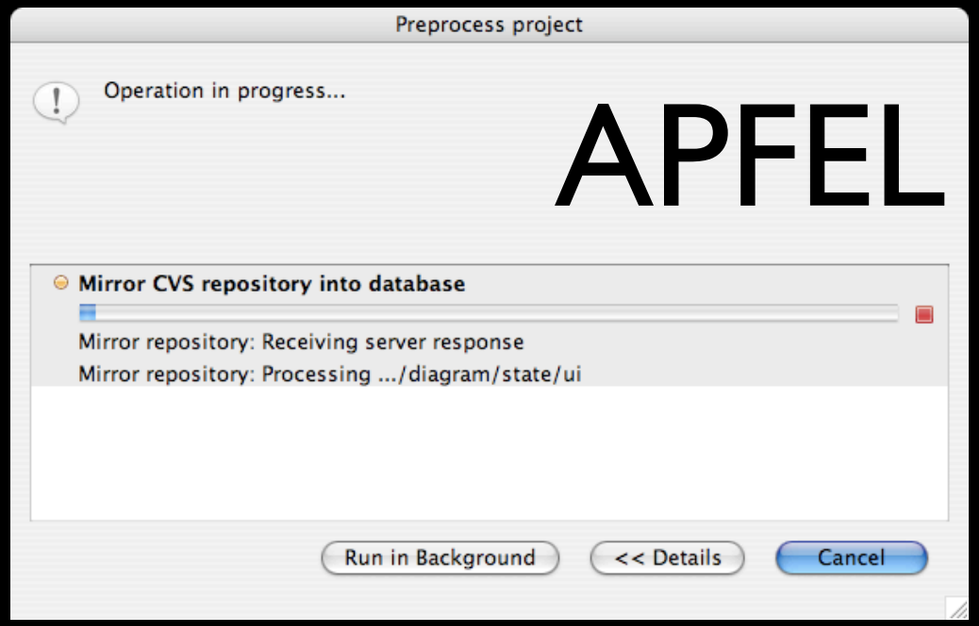

Data Extraction

- What data should be extracted?
- “Filtering should be performed within the analysis, and not during extraction.”

Data Extraction

```
RCS file: /home/eclipse/org.eclipse.jdt.core/model/org/eclipse/jdt/core/IBuffer.java,v
Working file: ./org.eclipse.jdt.core/model/org/eclipse/jdt/core/IBuffer.java
head: 1.17
branch:
locks: strict
access list:
symbolic names:
        v_397: 1.16
        v_396a: 1.16
        ...
        v_382: 1.15
        JDK_1_5: 1.15.0.2
        Root_JDK_1_5: 1.15
        v_381: 1.15
        ...
keyword substitution: o
total revisions: 24;selected revisions: 24
description:
----------------------------
revision 1.17
date: 2004/01/13 15:48:42;  author: jlanneluc;  state: Exp;  lines: +1 -1
Updated copyrights to 2004
----------------------------
revision 1.16
date: 2003/12/15 16:25:37;  author: jlanneluc;  state: Exp;  lines: +15 -26
46040
----------------------------
revision 1.15
date: 2003/05/26 16:13:24;  author: pmulet;  state: Exp;  lines: +5 -1
branches:  1.15.2;
*** empty log message ***
----------------------------
...
----------------------------
revision 1.15.2.1
date: 2004/01/12 19:53:11;  author: othomann;  state: Exp;  lines: +15 -26
Merge with HEAD
============================================================================
```

Files

Directories

Tags

Branches

single revisions

Revisions

+

Transactions

author + log msg.

Create *incremental* copies with *cvs rdiff -s* or *cvs status*.

Commit Mails

All changes listed in a commit mail belong to one transaction.

```
CVSROOT: /cvs/gcc
Module name: gcc
Changes by: zack@gcc.gnu.org 2004-05-01 19:12:47

Modified files:
gcc/cp          : ChangeLog decl.c

Log message:
* decl.c (reshape_init): Do not apply TYPE_DOMAIN to a VECTOR_TYPE.
Instead, dig into the representation type to find the array bound.

Patches:
http://.../cvsweb.cgi/gcc/gcc/cp/ChangeLog.diff?...&r2=1.4042
http://.../cvsweb.cgi/gcc/gcc/cp/decl.c.diff?...&r2=1.1204
```

Commit mails for GCC: http://gcc.gnu.org/ml/gcc-cvs/

Not every project provides useful commit mails.

Infer Transactions: Time Windows

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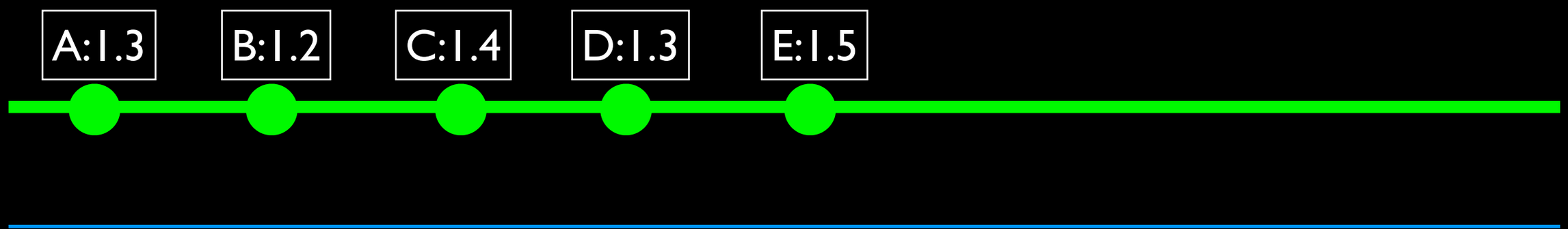

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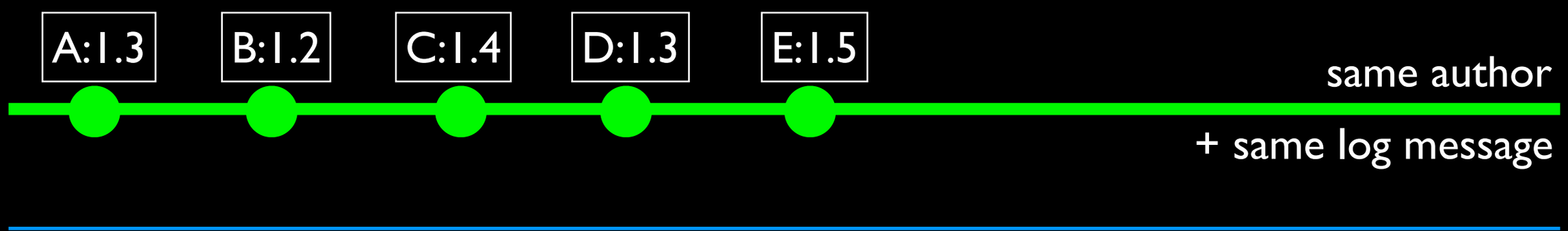

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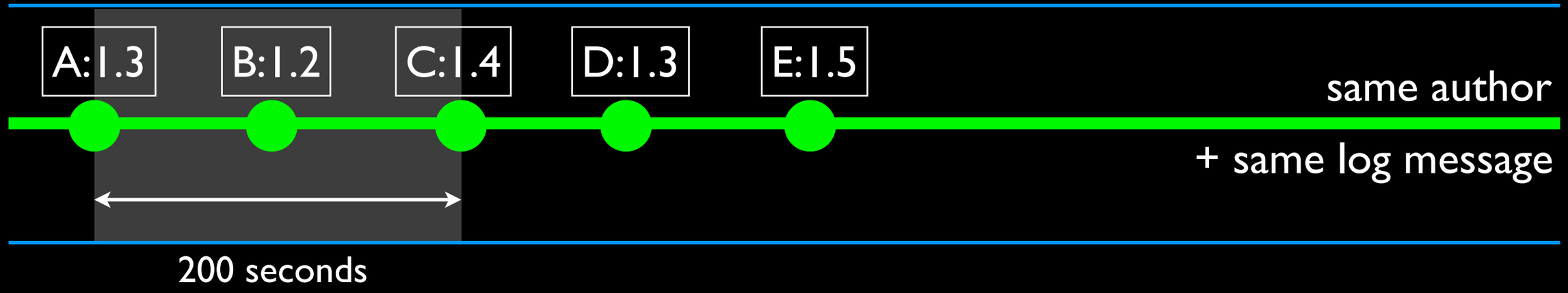

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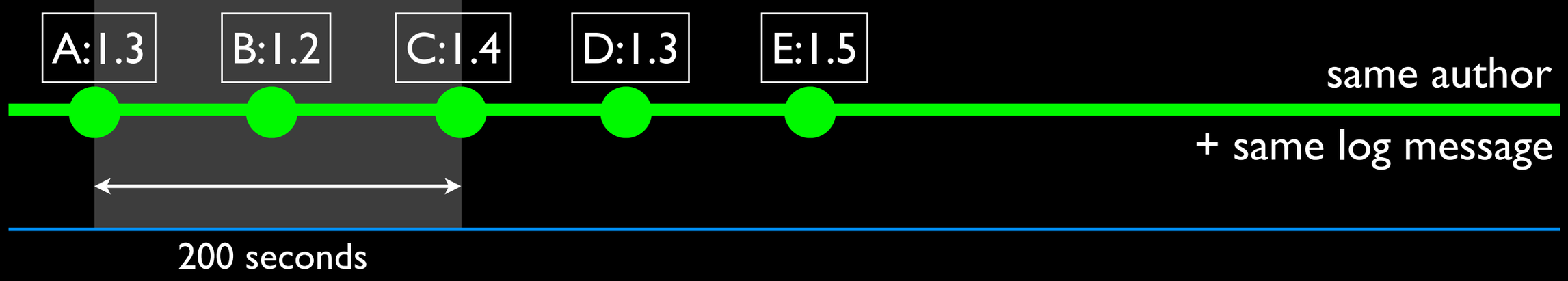

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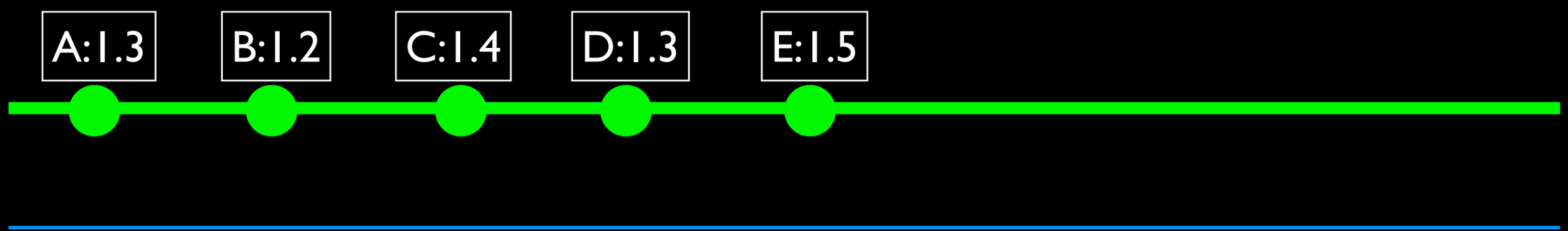

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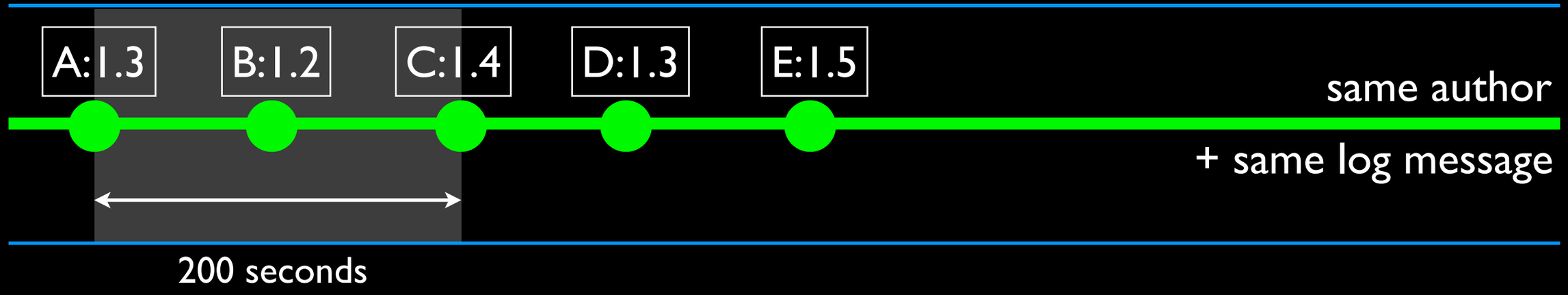

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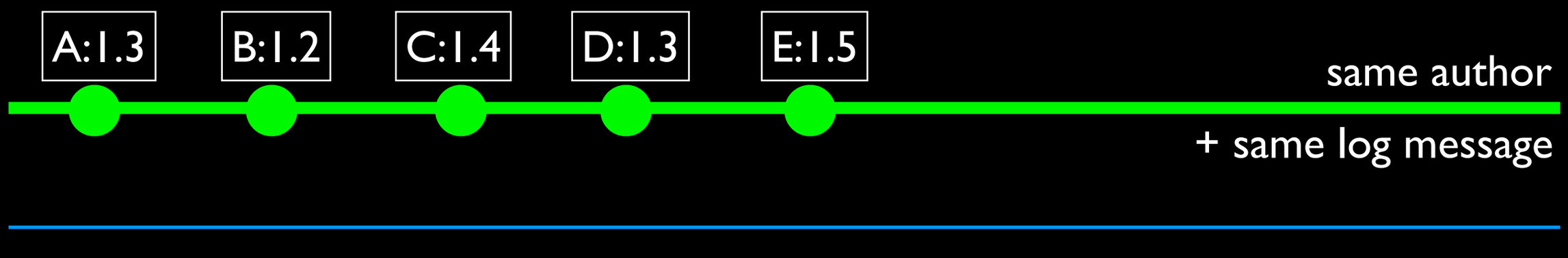

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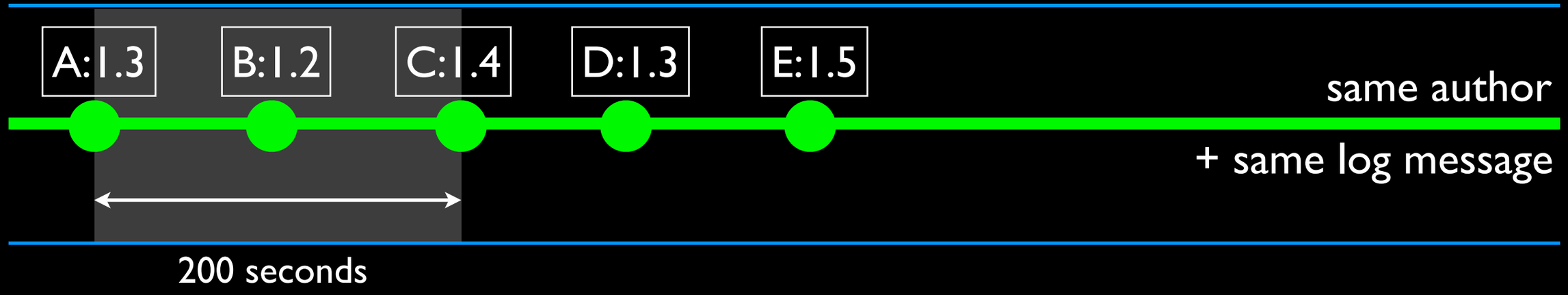

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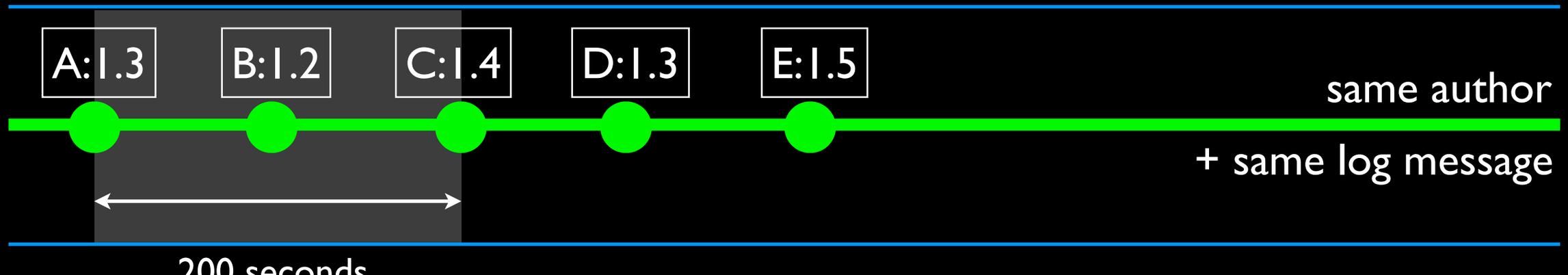

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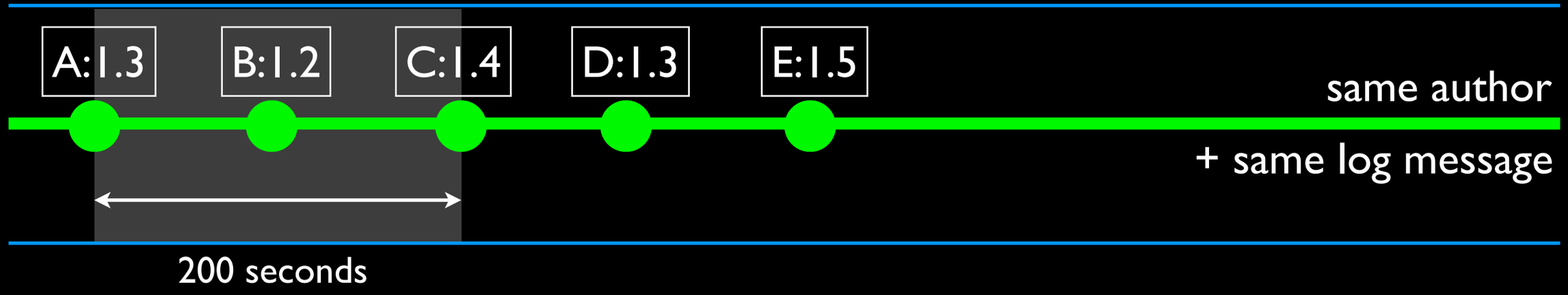

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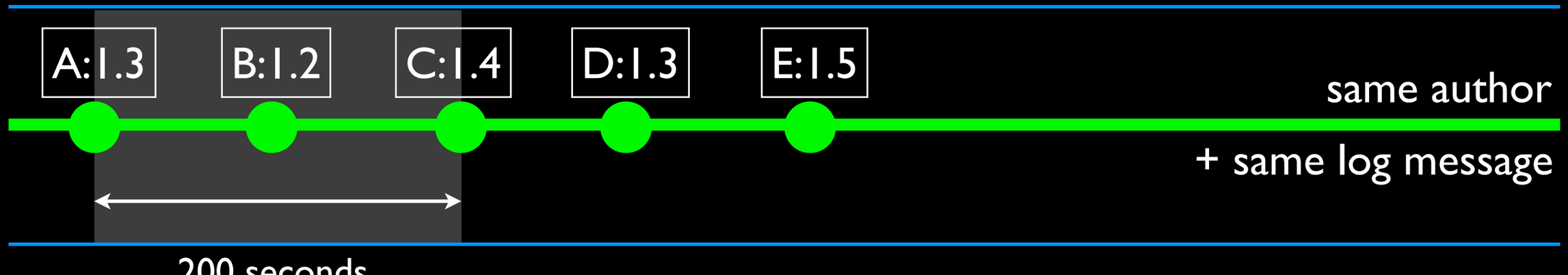

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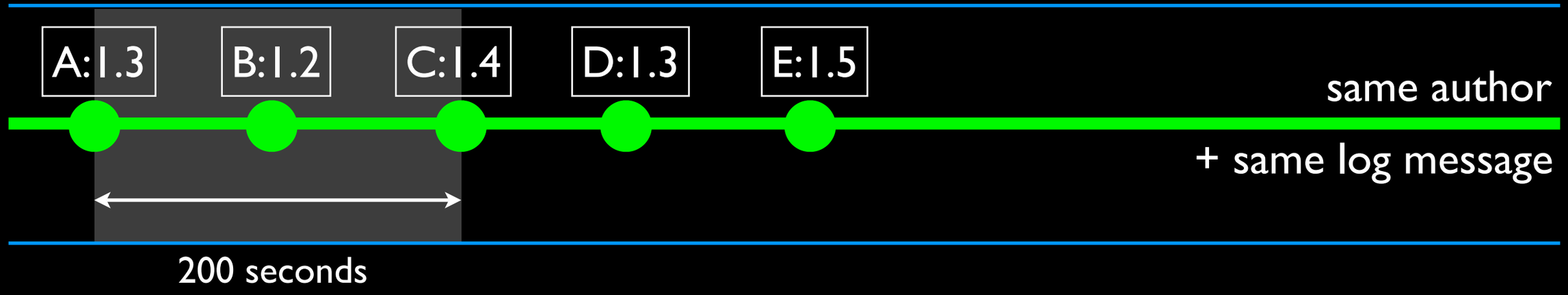

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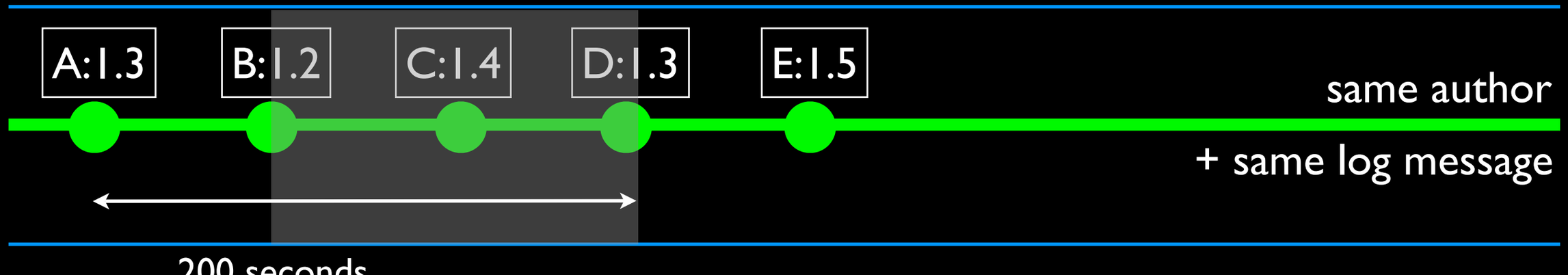

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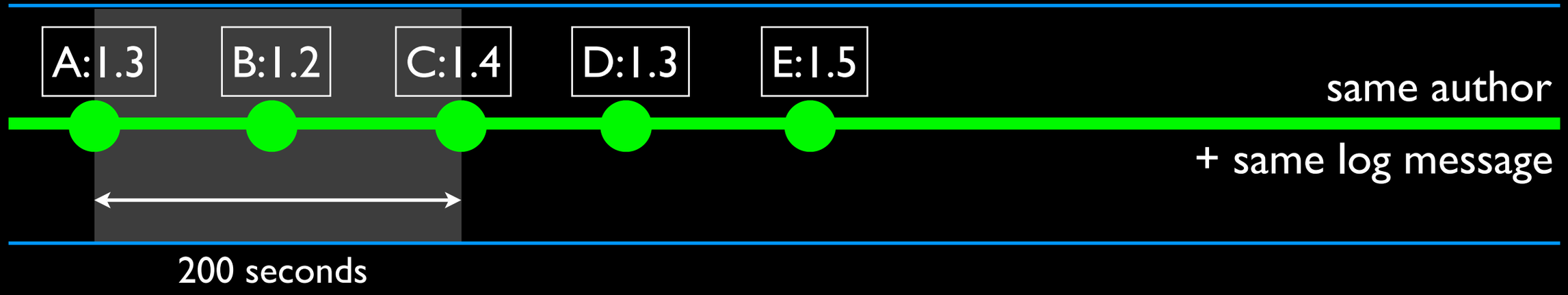

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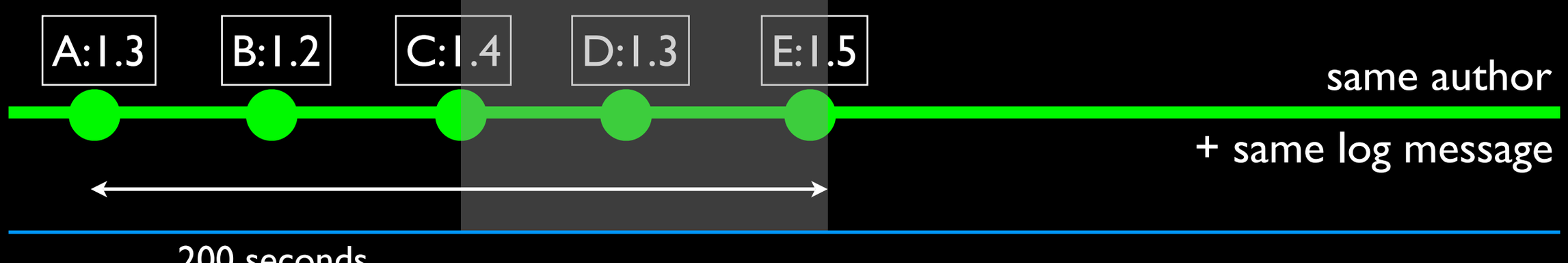
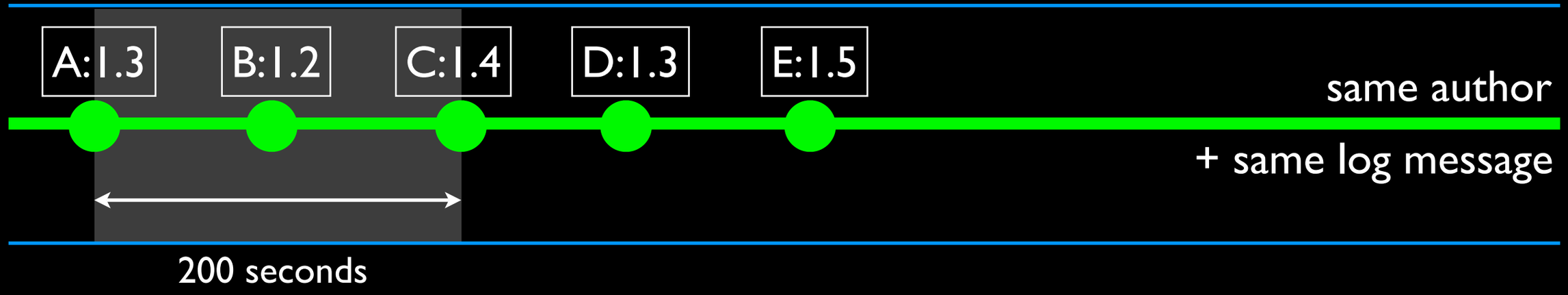


Infer Transactions: Time Windows

All changes by the same developer, with the same message, made at the same time belong to one transaction.

Fixed Time Window $\forall \delta_i : \forall \delta_j : | \mathit{time}(\delta_i) - \mathit{time}(\delta_j) | \leq T$



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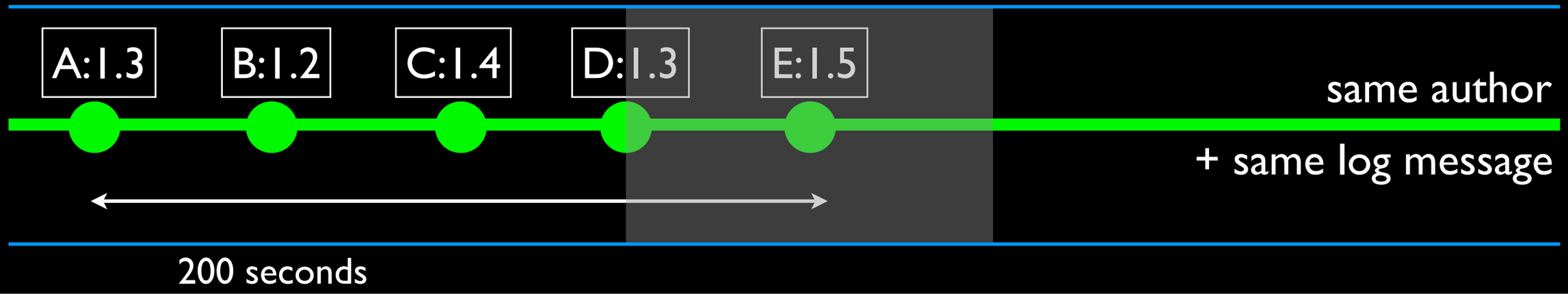

Infer Transactions: Time Windows

All changes by the same developer, with the same message, made at the same time belong to one transaction.

Fixed Time Window

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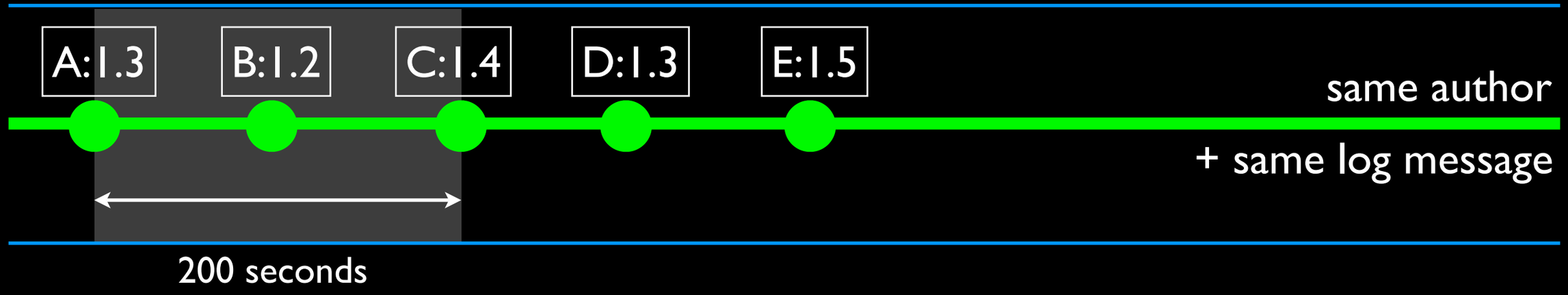

Sliding Time Window

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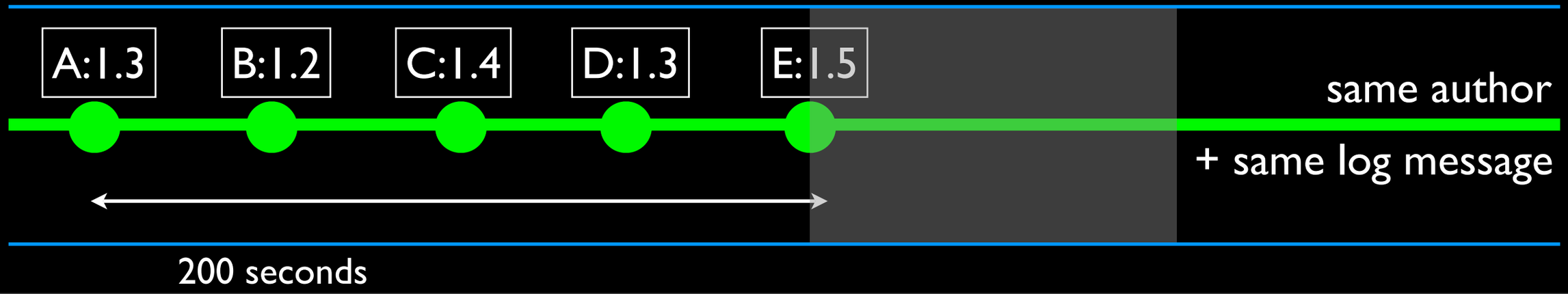
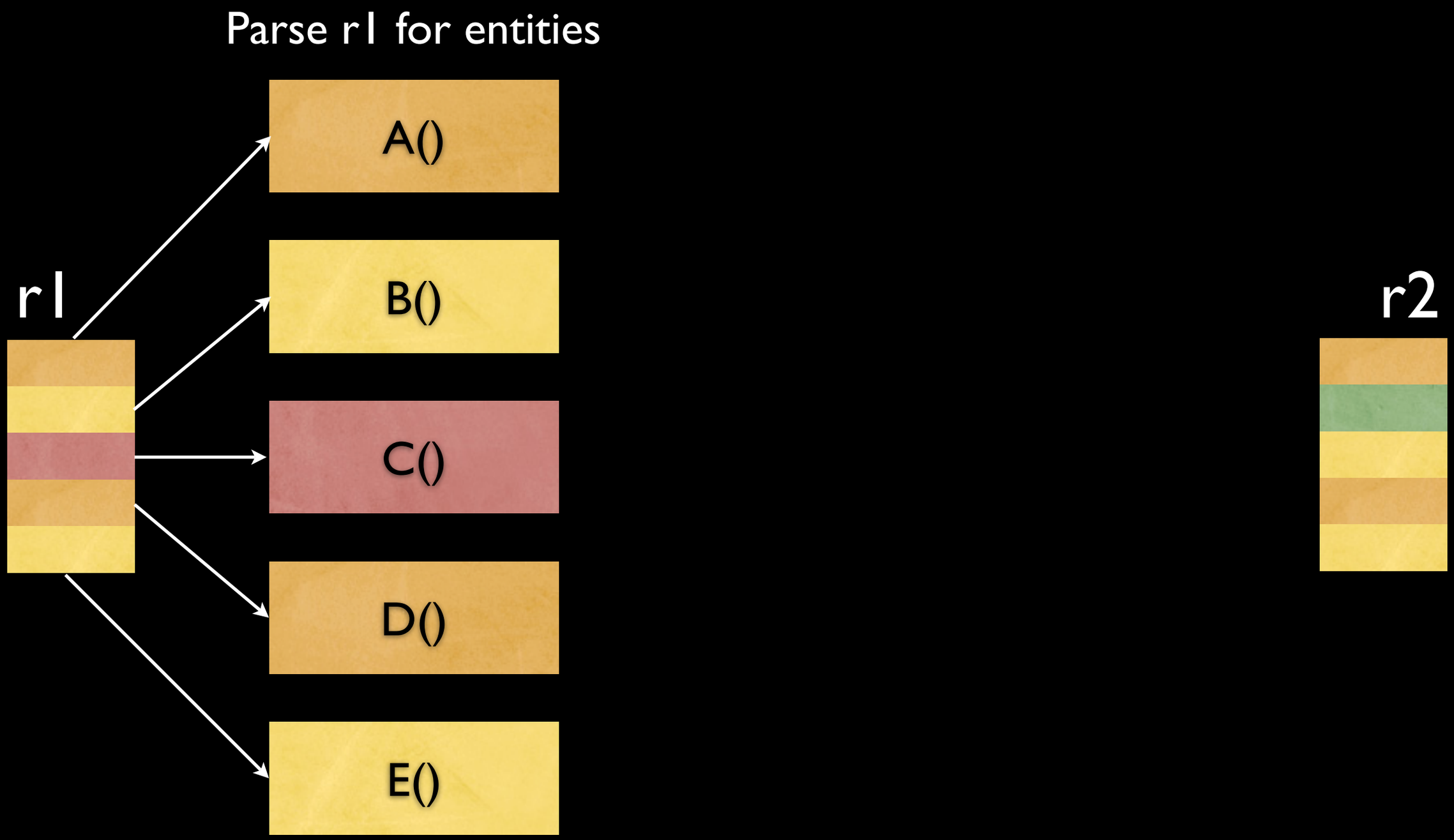


Mapping Changes to Entities

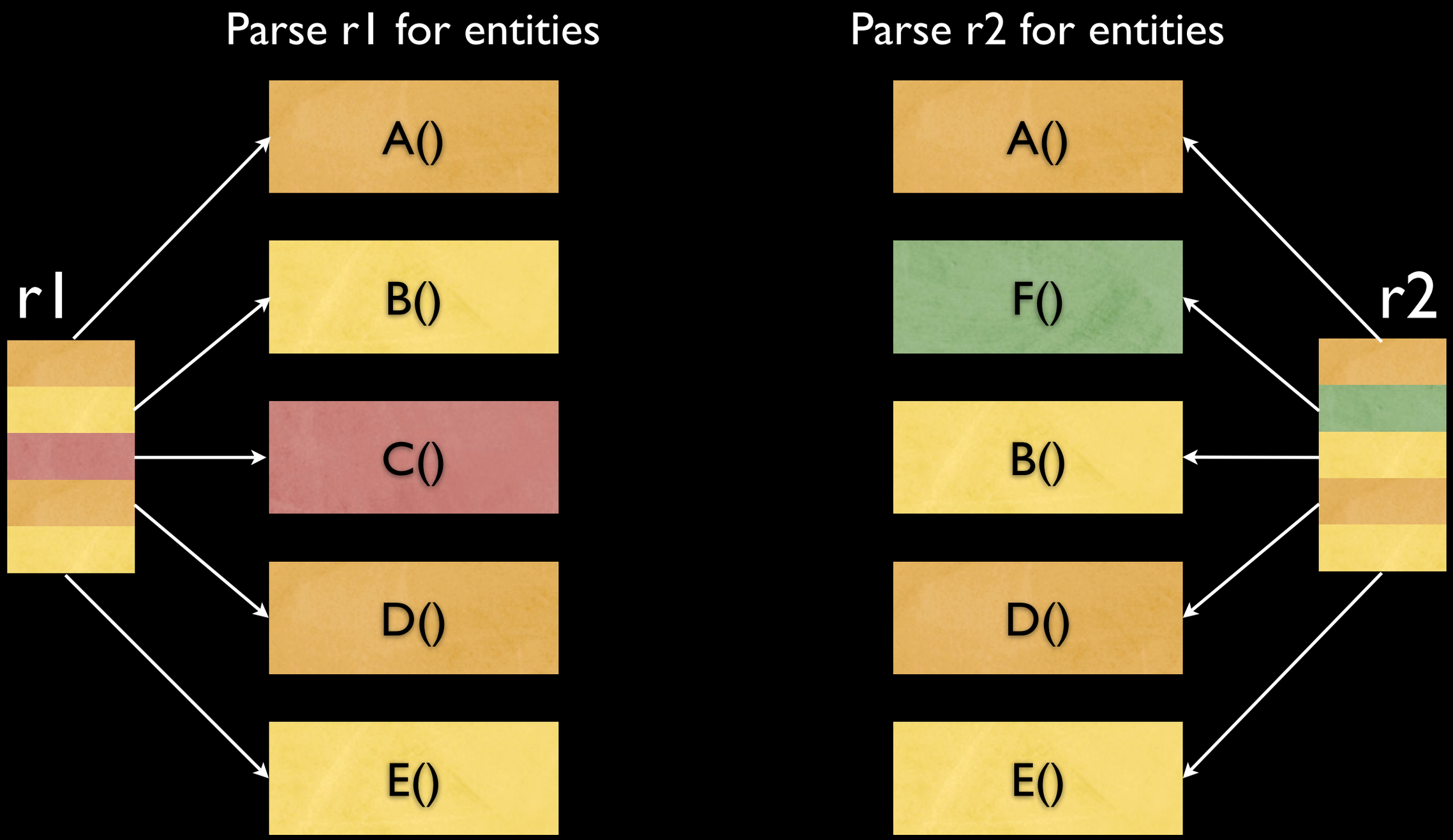
r1

r2

Mapping Changes to Entities



Mapping Changes to Entities



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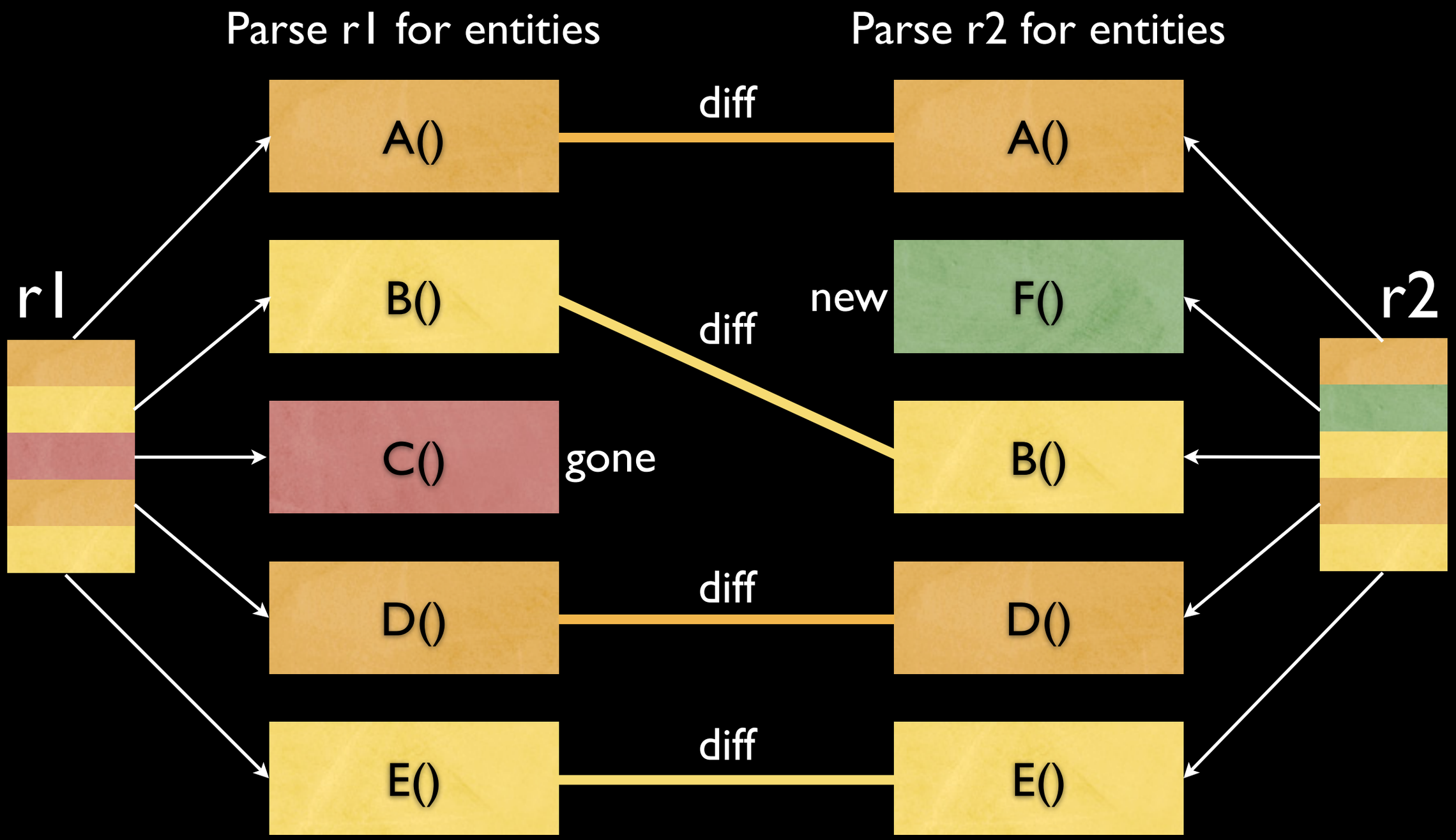


Fine-grained changes

```
public static void initDefaults(IPreferenceStore store) {
  store.setDefault(OPEN_STRUCTURE_COMPARE, true);
  store.setDefault(SYNCHRONIZE_SCROLLING, true);
  store.setDefault(SHOW_PSEUDO_CONFLICTS, false);
  store.setDefault(INITIALLY_SHOW_ANCESTOR_PANE, false);
  store.setDefault(SHOW_MORE_INFO, false);
  store.setDefault(IGNORE_WHITESPACE, false);
  store.setDefault(PREF_SAVE_ALL_EDITORS, false);
  //store.setDefault(USE_SPLINES, false);
  store.setDefault(USE_SINGLE_LINE, true);
  //store.setDefault(USE_RESOLVE_UI, false);
  store.setDefault(PATH_FILTER, ""); //$NON-NLS-1$
}
```

Fine-grained changes

```
public static void initDefaults(IPreferenceStore store) {
  store.setDefault(OPEN_STRUCTURE_COMPARE, true);
  store.setDefault(SYNCHRONIZE_SCROLLING, true);
  store.setDefault(SHOW_PSEUDO_CONFLICTS, false);
  store.setDefault(INITIALLY_SHOW_ANCESTOR_PAN, false);
  store.setDefault(SHOW_MORE_INFO, false);
  store.setDefault(IGNORE_WHITE_SPACE, false);
  store.setDefault(PREFERVE_ALL_EDITORS, false);
  //store.setDefault(USE_ALLIES, false);
  store.setDefault(USE_SINGLE_LINE, true);
  //store.setDefault(USE_RESOLVE_UI, false);
  store.setDefault(PATH_FILTER, ""); //$NON-NLS-1$
}
```

CHANGED

Fine-grained changes

```
publ
   st
   st
   st
   st
   st
   st
   //
   st
   //
   st
}
```

Removed call to setDefault (2x):

```
store.setDefault(USE_SPLINES, false);
store.setDefault(USE_RESOLVE_UI, false);
```

Inserted comments (2x):

```
//store.setDefault(USE_SPLINES, false);
//store.setDefault(USE_RESOLVE_UI, false);
```

Collecting Tokens

```
public static void main(String[] args) {
   System.out.println(“Hello Portland.”);
   System.out.println(“Hello eTX.”);
}
```

P-public	T-String[]
P-static	V-args
T-System	T-System
V-out	V-out
M-println	M-println
Y-“Hello Portland.”	Y-“Hello eTX.”

Collecting Tokens

Modularization	packages, imports
Inheritance	extends, implements
Method calls	inner vs final call
Variable usage	identifiers, types
Exceptions	throws, throw, catch
Comments	Javadoc, blocks, lines
Various	modifiers, literals, operator, keywords

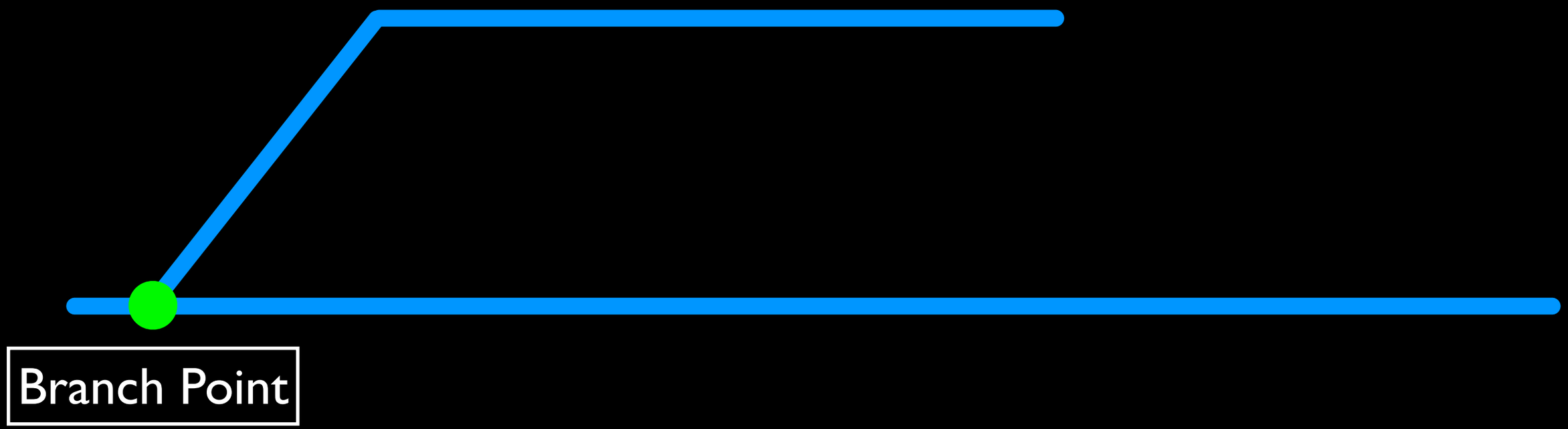
Noise: Large Transactions

- “Change #include filenames from <foo.h> to <openssl.h>.” (552 files)
- “Change functions to ANSI C.” (491 files)

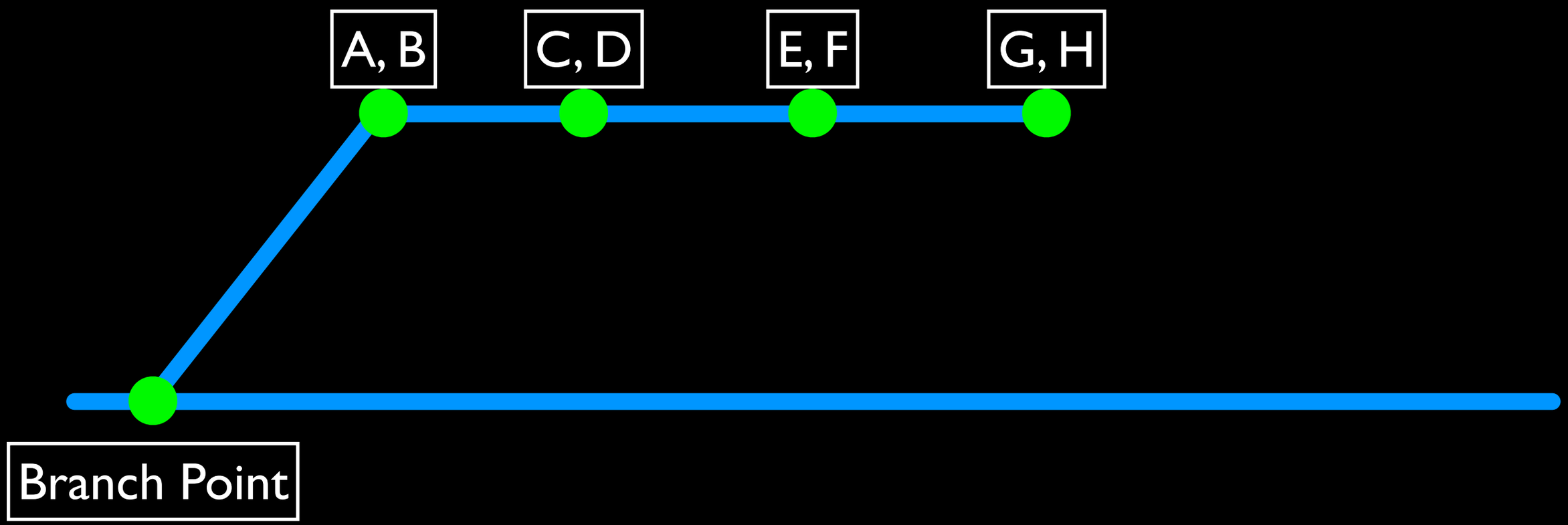
Select an upper bound N for transaction size.

Noise: Merges

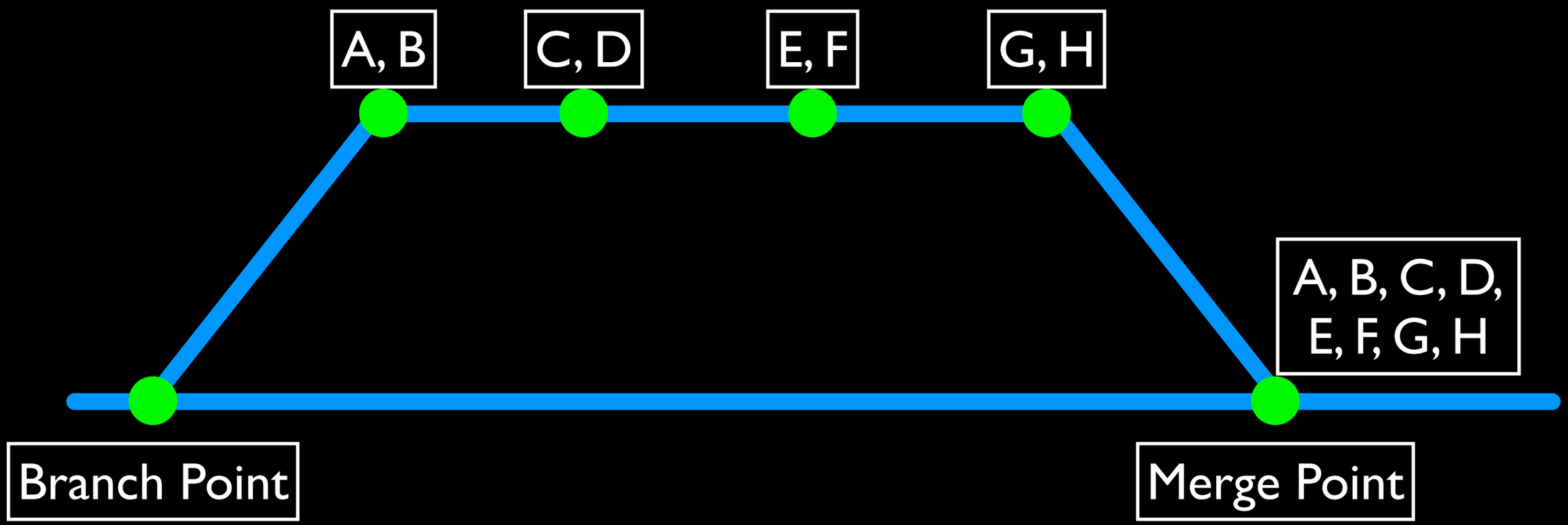
Noise: Merges



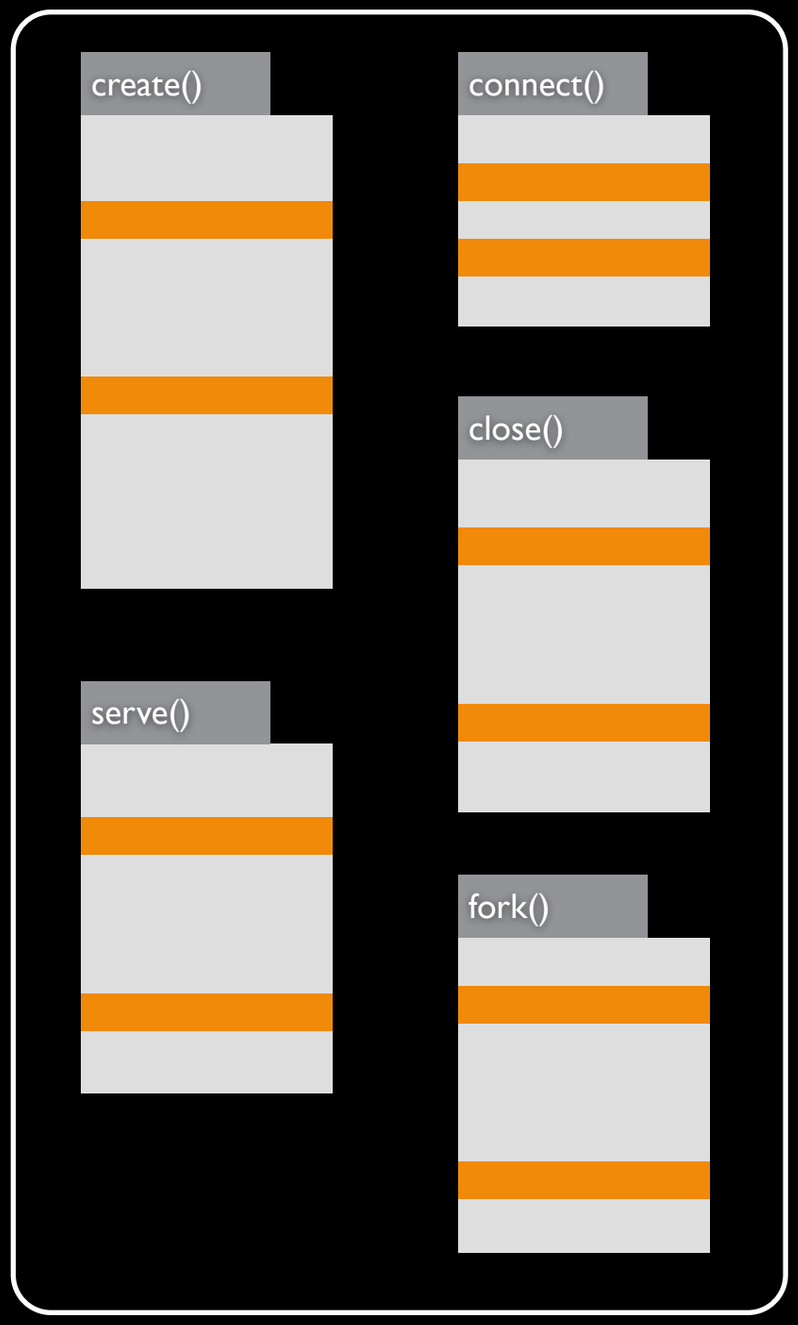
Noise: Merges



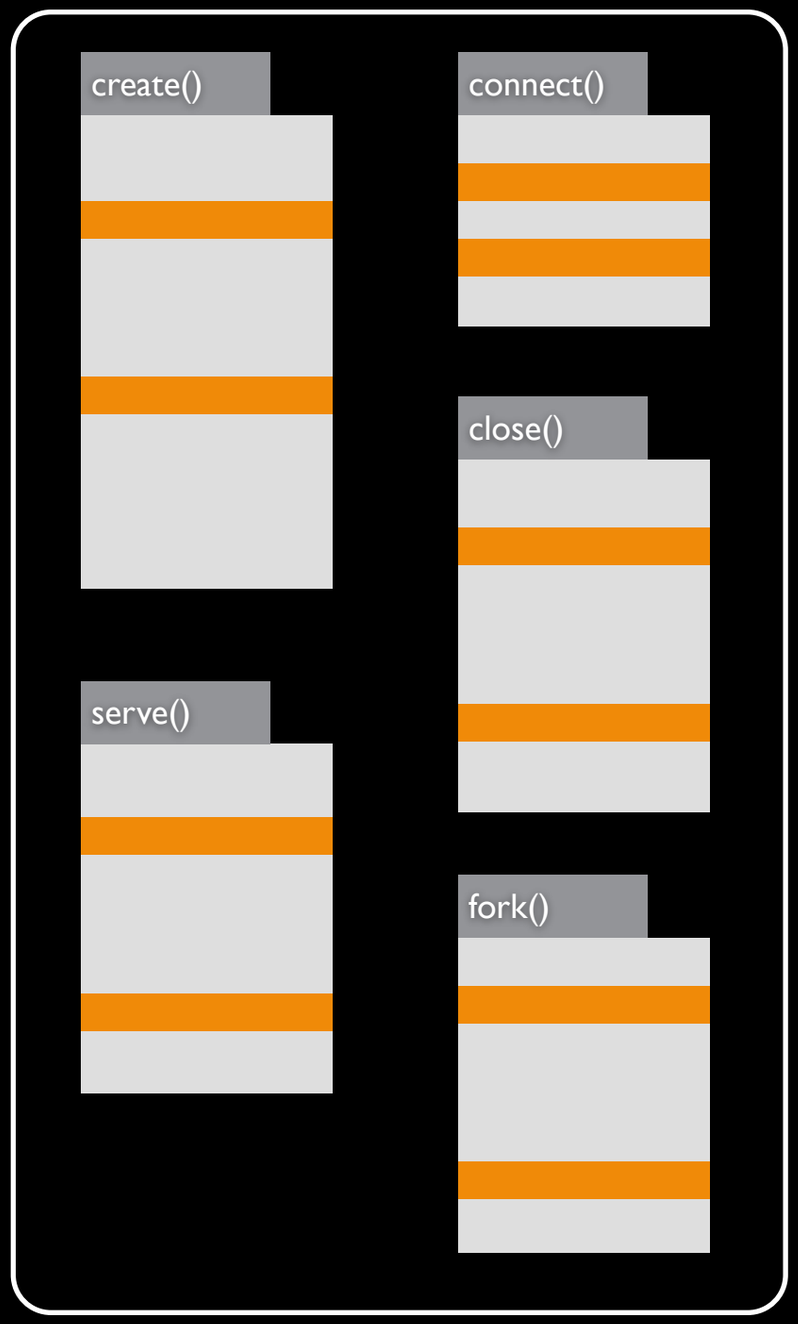
Noise: Merges



Aspects



Aspects



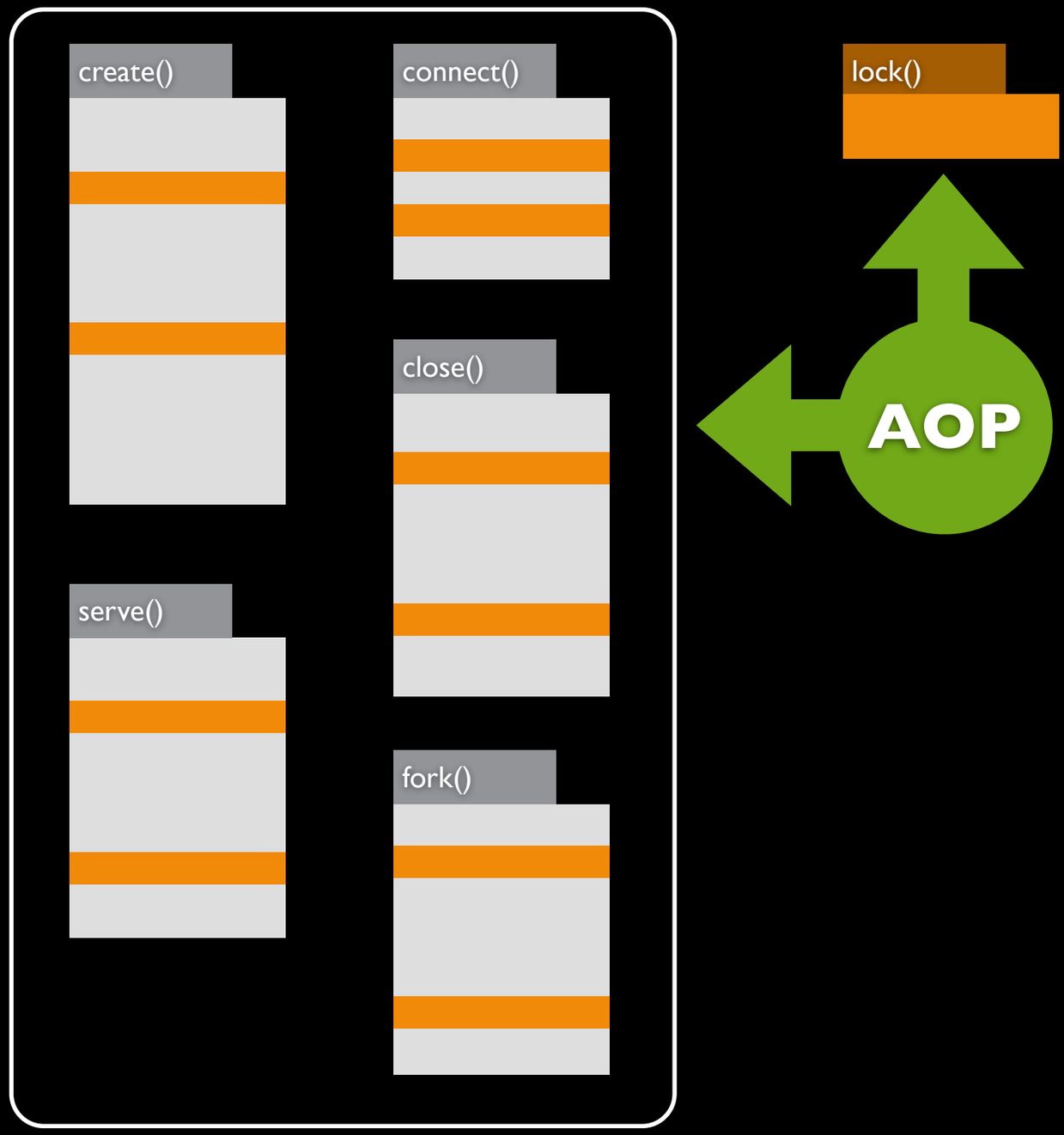
Typical Aspects

enter()/leave()

log()

lock()/unlock()

Aspects



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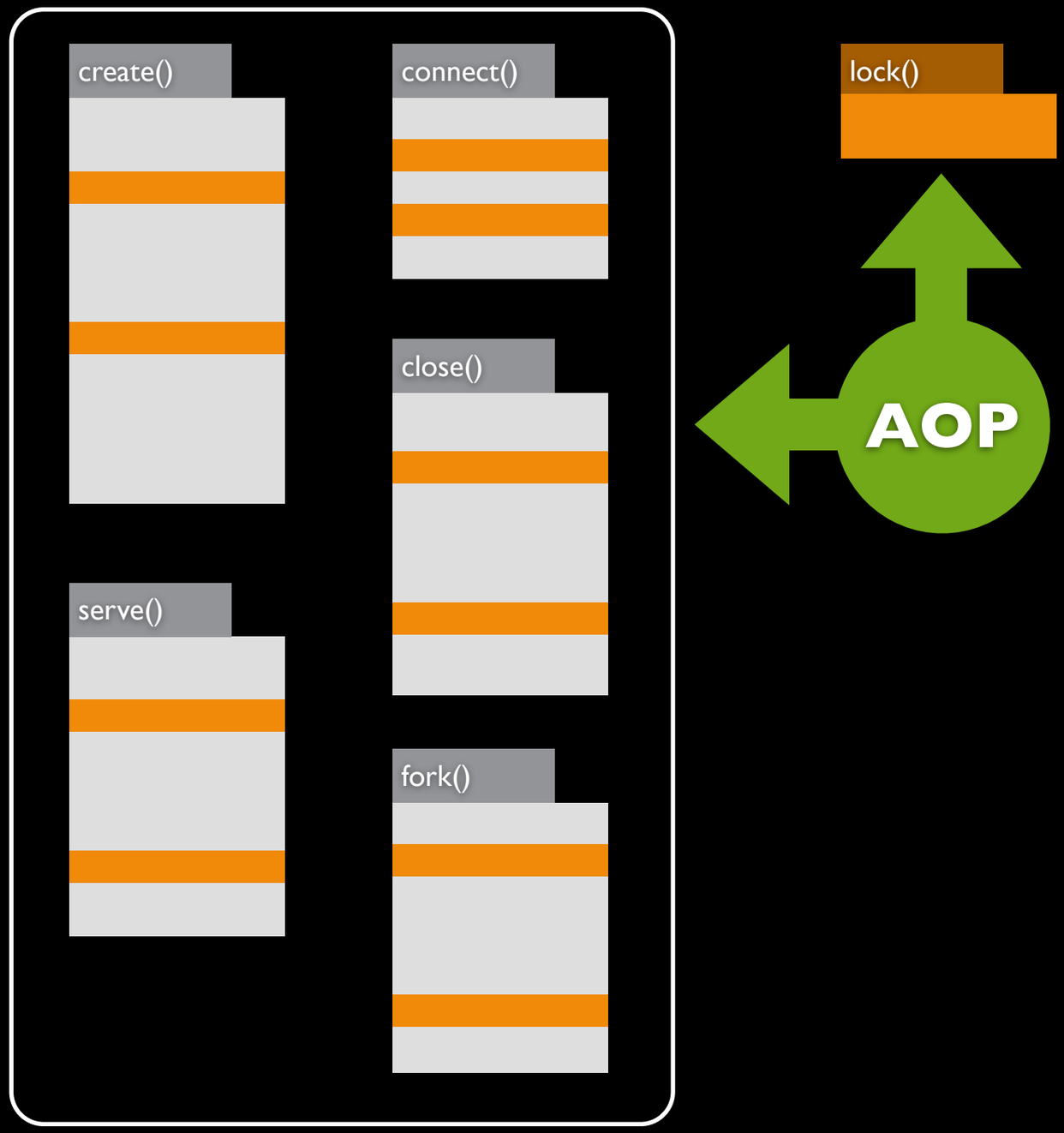
Aspects



Typical Aspects

enter()/leave()

log()

lock()/unlock()

Aspect Mining:
Identifying Aspects in Legacy Code

Cross-cutting changes

Cross-cutting changes

```
SELECT token_name, COUNT(DISTINCT element_id)
FROM cvs_tokens_method NATURAL JOIN cvs_revisions
WHERE token_type='M' AND change_type='CHG'
GROUP BY transaction_id, token_name
ORDER BY COUNT(DISTINCT element_id) DESC;
```

Cross-cutting changes

```
SELECT token_name, COUNT(DISTINCT element_id)
FROM cvs_tokens_method NATURAL JOIN cvs_revisions
WHERE token_type='M' AND change_type='CHG'
GROUP BY transaction_id, token_name
ORDER BY COUNT(DISTINCT element_id) DESC;
```

token_name	count
getString	1462
lock	1284
unlock	1284
error	996
isValidWidget	988

Cross-cutting changes

```
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FROM cvs_tokens_method NATURAL JOIN cvs_revisions
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GROUP BY transaction_id, token_name
ORDER BY COUNT(DISTINCT element_id) DESC;
```

token_name	count
getString	1462
lock	1284
unlock	1284
error	996
isValidWidget	988

Locking Mechanism

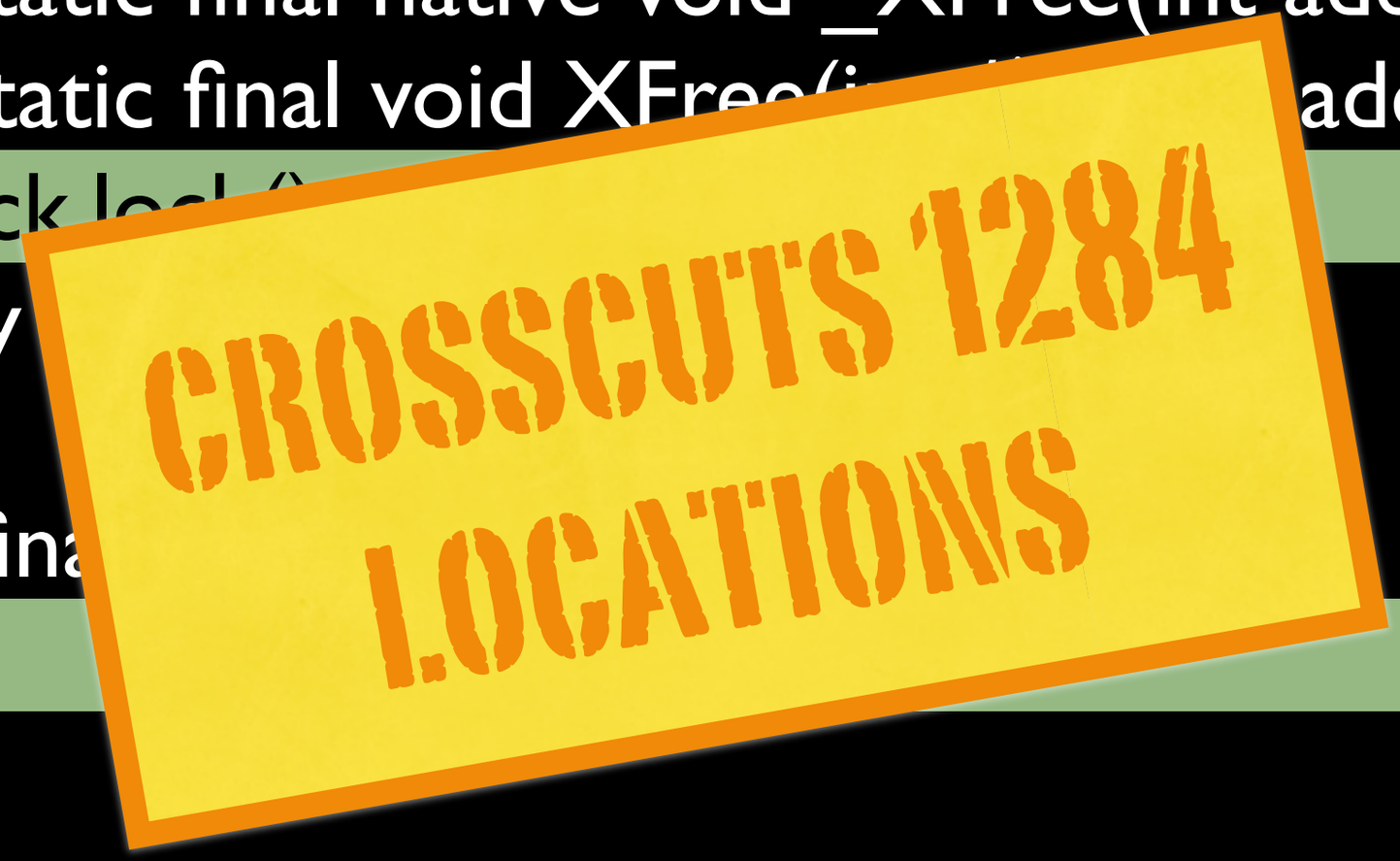
```
public static final native void _XFree(int address);
public static final void XFree(int /*long*/ address) {
        lock.lock();
        try {
                _XFree(address);
        } finally {
                lock.unlock();
        }
}
```

Locking Mechanism

```
public static final native void _XFree(int address);
public static final void XFree(i                address) {
    lock lock()
    try

    } fina

    }
}
```



One line fixes

>301	Expression
150	Method call
120	Literal (boundaries, constants)
73	Keyword (true/false confusion)
60	Operator
39	Identifier
39	Comment (!!)

One line fixes

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39	Comment (!!)

One line fixes

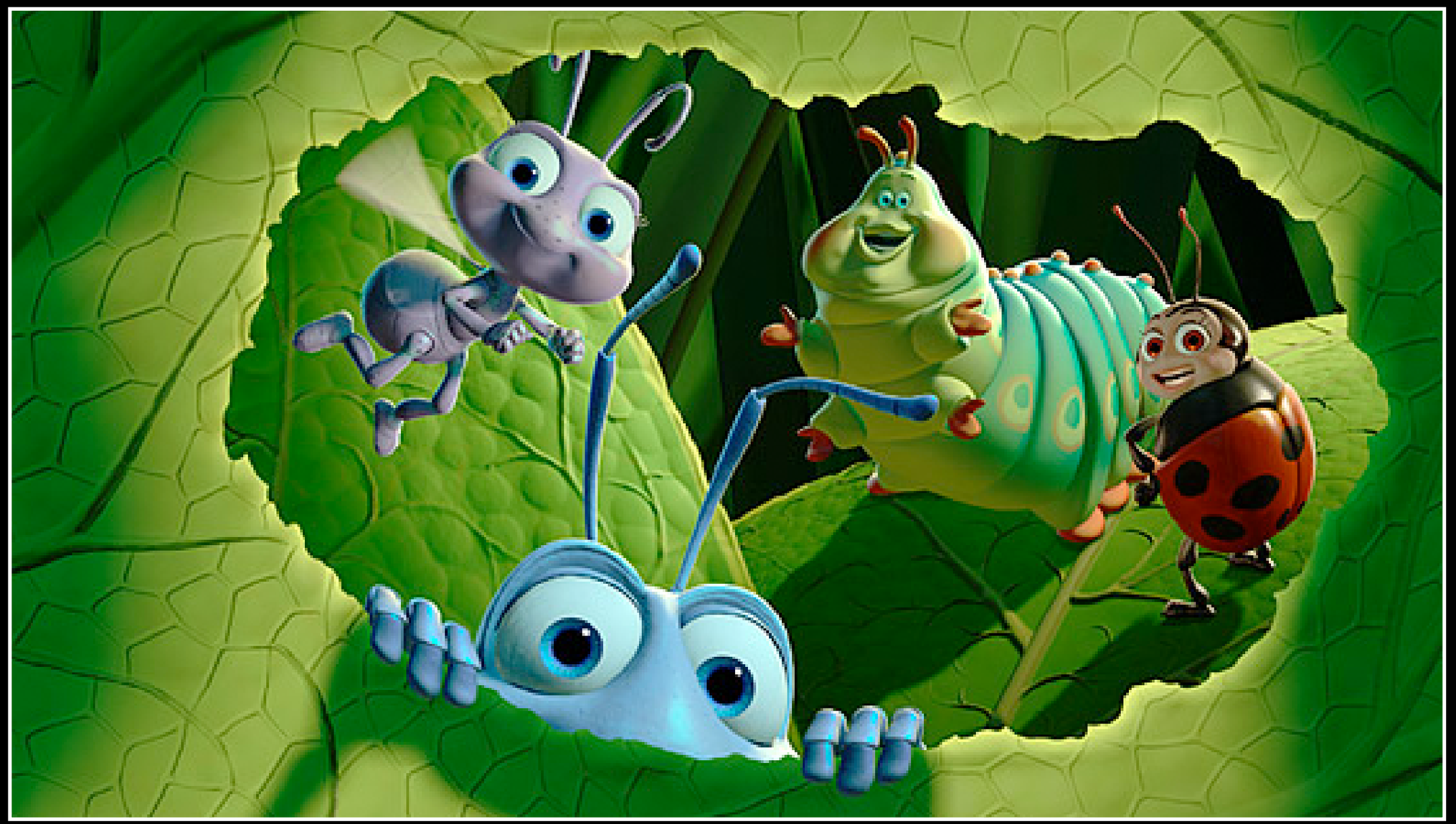
>301	Expression
150	Method call

Bug report: 119638 - Typo in ToolItem.getControl

```
252c252
<  * the item when the items is a <code>SEPARATOR</code>.
---
>  * the item when the item is a <code>SEPARATOR</code>
```

39	Comment (!!)

A Bug's Life



A Bug's Life

A Bug's Life

User encounters an error

A Bug's Life

User encounters an error

No idea what to do?

A Bug's Life

User encounters an error

Take slightly extreme measures

A Bug's Life

User encounters an error

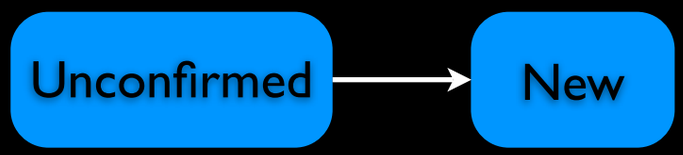
Report the bug!

A Bug's Life

A Bug's Life

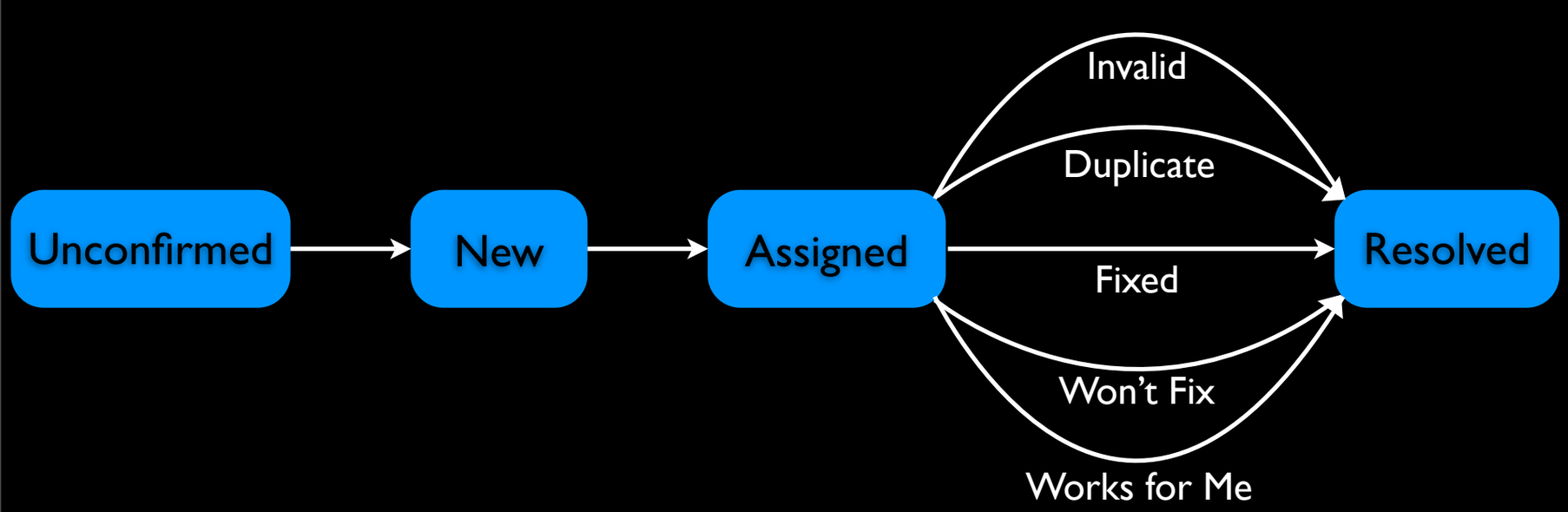
Unconfirmed

A Bug's Life

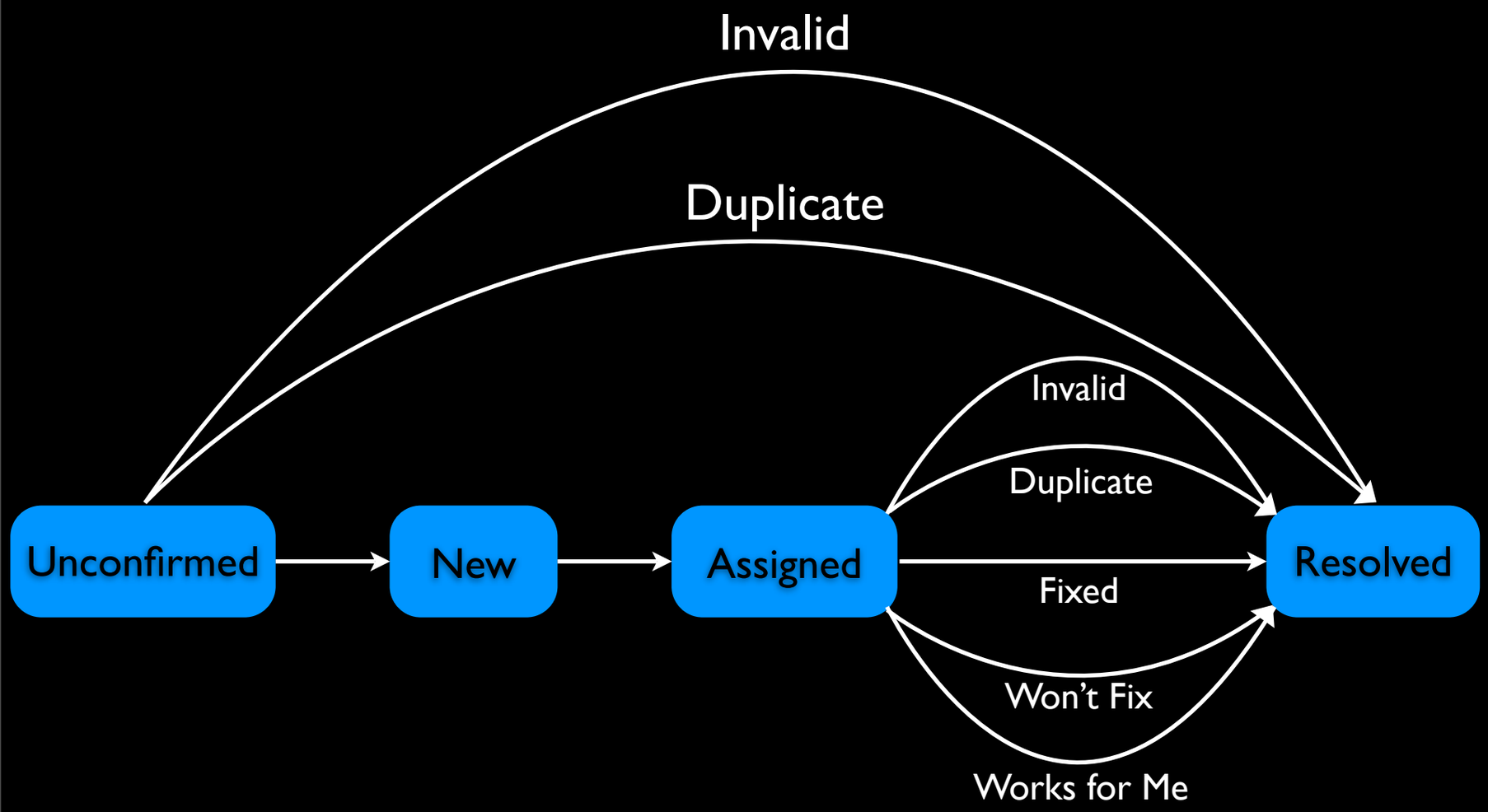


A Bug's Life

A Bug's Life


Unconfirmed
New
Assigned
Invalid
Duplicate
Fixed
Won't Fix
Works for Me
Resolved

A Bug's Life


Invalid
Duplicate
Invalid
Duplicate
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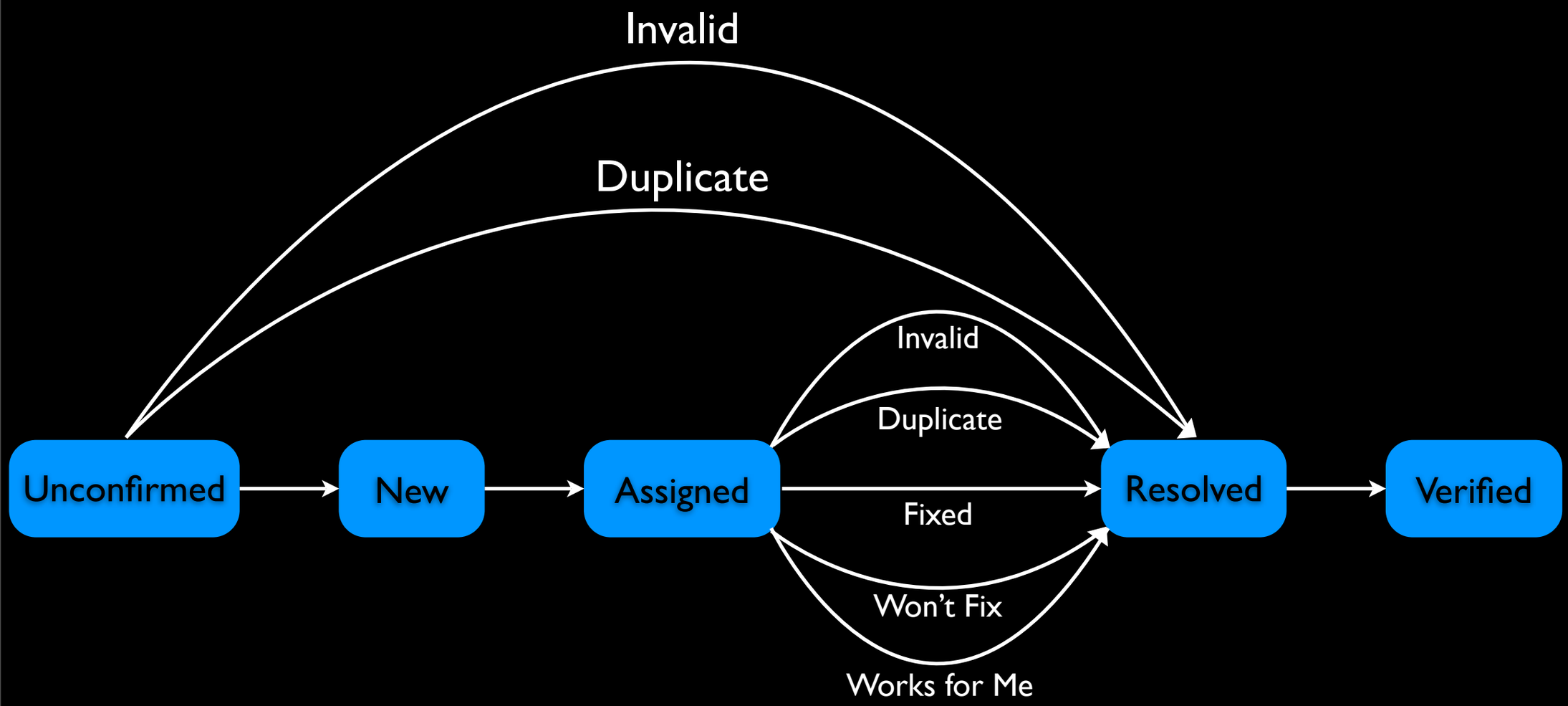
New
Assigned
Fixed
Resolved
Won't Fix
Works for Me

A Bug's Life


Invalid
Duplicate
Invalid
Duplicate
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New
Assigned
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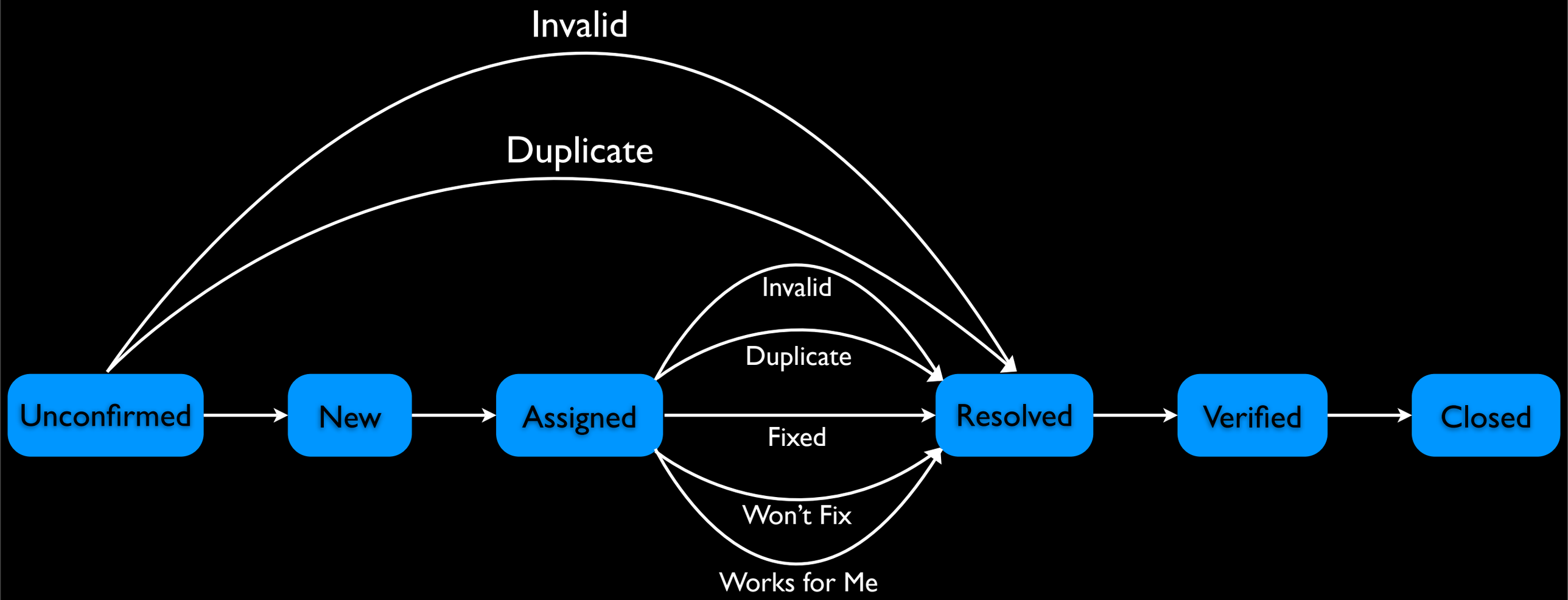
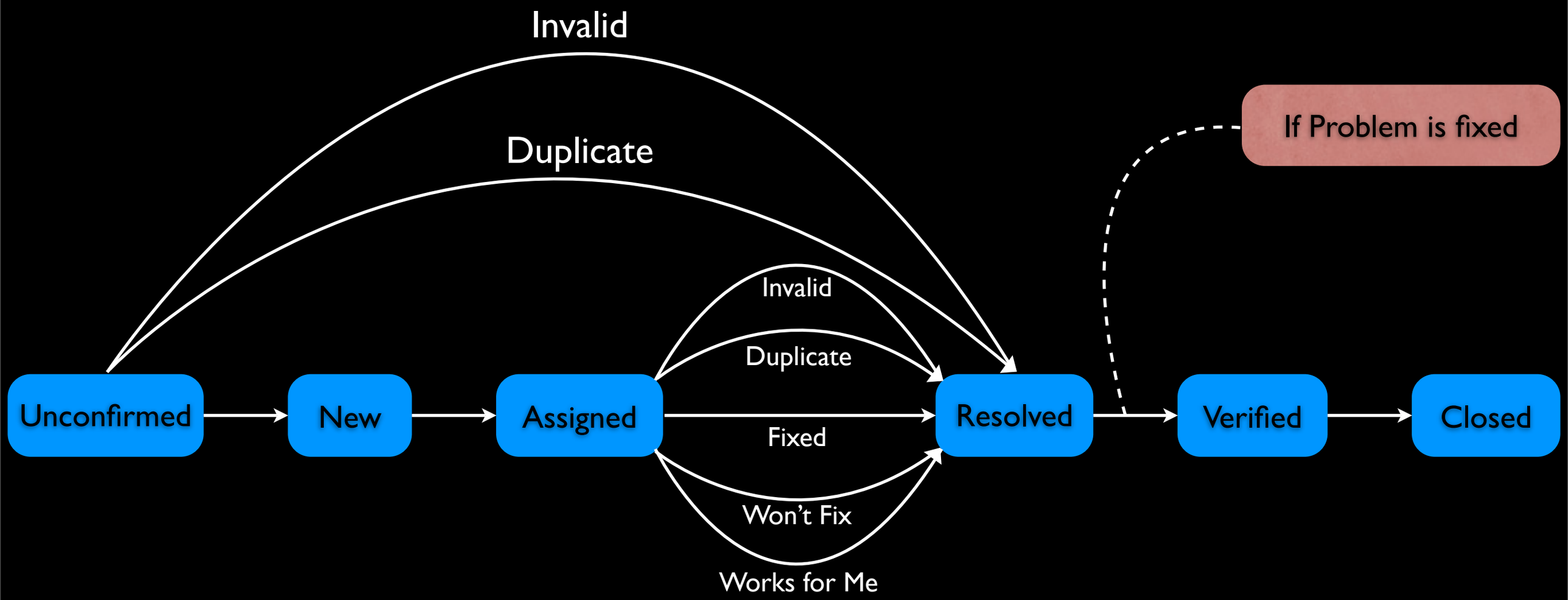
Verified
Fixed
Won't Fix
Works for Me

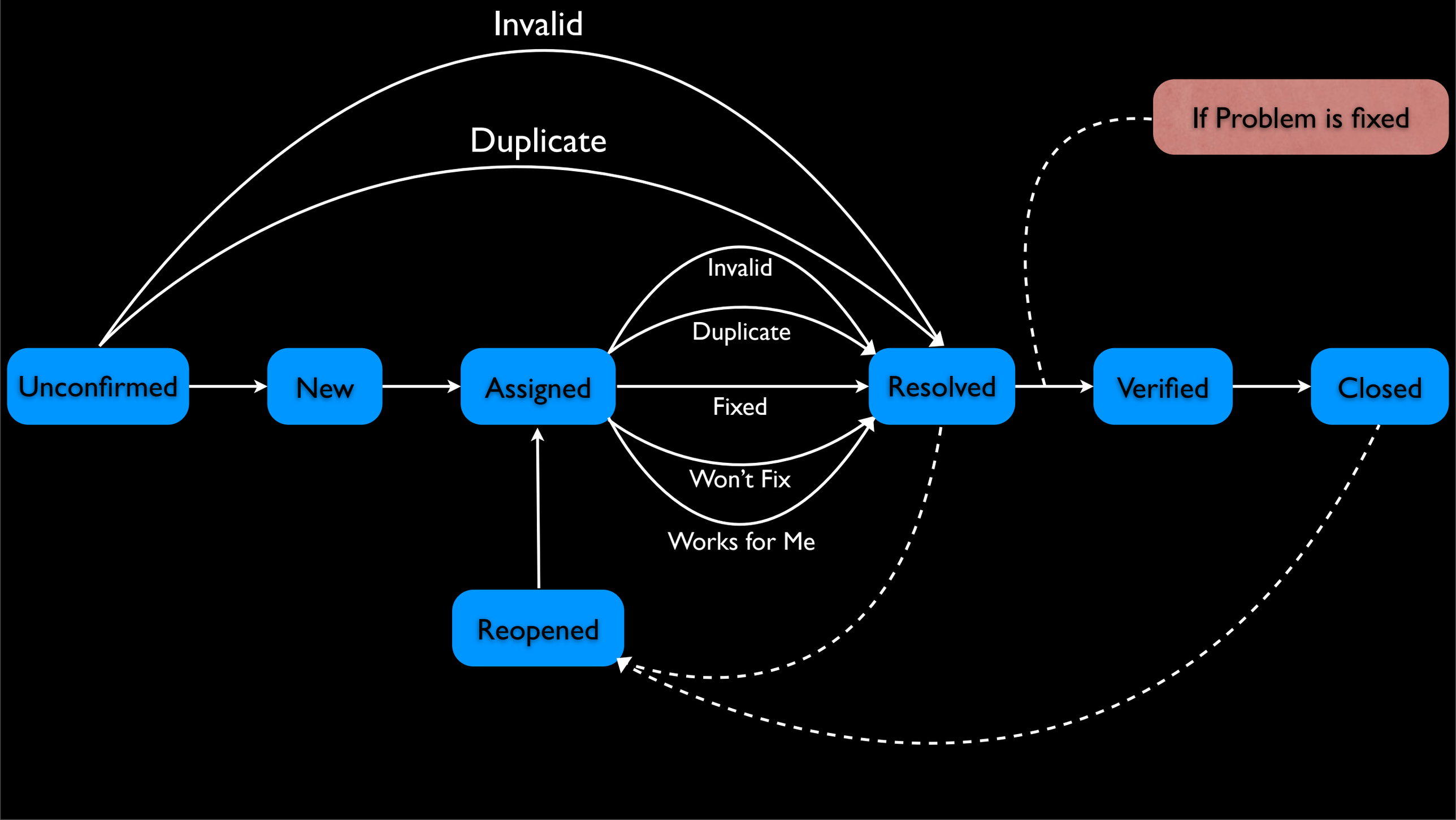
A Bug's Life


Invalid
Duplicate
Invalid
Duplicate
Unconfirmed
New
Assigned
Resolved
Verified
Closed
Fixed
Won't Fix
Works for Me

A Bug's Life


Invalid
Duplicate
If Problem is fixed
Invalid
Duplicate
Unconfirmed
New
Assigned
Resolved
Verified
Closed
Fixed
Won't Fix
Works for Me

A Bug's Life


Invalid
Duplicate
If Problem is fixed
Invalid
Duplicate
Unconfirmed
New
Assigned
Fixed
Resolved
Verified
Closed
Won't Fix
Works for Me
Reopened

JIRA

JIRA

JIRA

A commercial tool for

Bug Tracking, Issue Tracking and Project Management

Developed by Atlassian

www.atlassian.com/software/jira

JIRA

Other popular bug trackers...

Bugzilla

PRTRACKER™

Bug ment

Developed by Atlassian

www.atlassian.com/software/jira

Sample Bug Report

JBoss

History | Log In

HOME BROWSE PROJECT FIND ISSUES QUICK SEARCH:

Issue Details (XML | Word)

Key:	JBAS-3054
Type:	Bug
Status:	Resolved
Resolution:	Done
Priority:	Major
Assignee:	Anil Saldhana
Reporter:	Scott M Stark
Votes:	0
Watchers:	0

Operations

If you were logged in you would be able to see more operations.

JBoss Application Server

Use of isUserInRole from jsp does not work for JACC

Return to search

Created: 04/Apr/06 03:17 PM Updated: 22/Apr/06 02:37 AM

Component/s:	Security, Web (Tomcat) service
Affects Version/s:	JBossAS-4.0.4.CR2
Fix Version/s:	JBossAS-5.0.0.Beta, JBossAS-4.0.4.GA
Security Level:	Public (Everyone can see)

Original Estimate:	4 hours	**Remaining Estimate:**	0 minutes	**Time Spent:**	1 day, 2 hours
Environment:	org.jboss.test.web.test.UserInRoleUnitTestCase(JACC).testConflictingUserInRole				

JBoss Forum Reference:	http://www.jboss.com/index.html?module=bb&op=viewtopic&t=81475

Description « Hide

Use of isCallerInRole from a jsp page is failing because the (javax.security.jacc.WebRoleRefPermission jsp X) permission references the page as via the name "jsp" and there is no default mapping for this. We need to create such a permission mapping for every web.xml security-role element.

All | Comments | Work Log | Change History | FishEye Sort Order:

Dimitris Andreadis [14/Apr/06 05:50 AM] [Permlink | « Hide]

Anil, wanna take it?

Anil Saldhana [20/Apr/06 02:13 PM] [Permlink | « Hide]

The problem does not exist because of the permission mapping based on the servlet-name, but rather due to the way the jacc permissions are created based on the metaData while the roles applicable to the caller exist in the JBossGenericPrincipal.

Please refer to the forum thread for more details.

Anil Saldhana [21/Apr/06 02:17 PM] [Permlink | « Hide]

Resolved for 4.0.4.GA.
Needs to be resolved for jboss-head.

Anil Saldhana [21/Apr/06 04:19 PM] [Permlink | « Hide]

Resolved in HEAD.

Anil Saldhana [21/Apr/06 05:58 PM] [Permlink | « Hide]

Scott pointed out something that was addressed in the Appendix B section of the Jacc specification. So this issue needs a short revisit.

Anil Saldhana [22/Apr/06 02:32 AM] [Permlink | « Hide]

Resolved in 4.0 and HEAD with the Appendix (B.19) guideline in the jacc spec.

Sample Bug Report

Details

History | Log In

HOME | FIND ISSUES | QUICK SEARCH:

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Status:	Resolved
Resolution:	Done
Priority:	Major
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Reporter:	Scott M Stark
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Anil Saldhana [22/Apr/06 02:32 AM] [Permlink | « Hide]

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Sample Bug Report

One Line Summary

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Status:	Resolved
Resolution:	Done
Priority:	Major
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Anil Saldhana [20/Apr/06 02:13 PM] [Permlink | « Hide]

The problem does not exist because of the permission mapping based on the servlet-name, but rather due to the way the jacc permissions are created based on the metaData while the roles applicable to the caller exist in the JBossGenericPrincipal.

Please refer to the forum thread for more details.

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Resolved for 4.0.4.GA.
Needs to be resolved for jboss-head.

Anil Saldhana [21/Apr/06 04:19 PM] [Permlink | « Hide]

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Scott pointed out something that was addressed in the Appendix B section of the Jacc specification. So this issue needs a short revisit.

Anil Saldhana [22/Apr/06 02:32 AM] [Permlink | « Hide]

Resolved in 4.0 and HEAD with the Appendix (B.19) guideline in the jacc spec.

Sample Bug Report

JBoss

History | Log In

HOME | BROWSE PROJECT | FIND ISSUES | QUICK SEARCH:

Issue Details (XML | Word)

Key:	JBAS-3054
Type:	Bug
Status:	Resolved
Resolution:	Done
Priority:	Major
Assignee:	Anil Saldhana
Reporter:	Scott M Stark
Votes:	0
Watchers:	0

Operations

If you were logged in you would be able to see more operations.

JBoss Application Server

Use of isUserInRole from jsp does not work for JACC

Return to search

Created: 04/Apr/06 03:17 PM Updated: 22/Apr/06 02:37 AM

Component/s:	Security, Web (Tomcat) service
Affects Version/s:	JBossAS-4.0.4.CR2
Fix Version/s:	JBossAS-5.0.0.Beta, JBossAS-4.0.4.GA
Security Level:	Public (Everyone can see)

Original Estimate:	4 hours	**Remaining Estimate:**	0 minutes	**Time Spent:**	1 day, 2 hours
Environment:	org.jboss.test.web.test.UserInRoleUnitTestCase(JACC).testConflictingUserInRole				
JBoss Forum Reference:	http://www.jb				

Description and Comments

Description « Hide

Use of isCallerInRole from a jsp page is failing because the (javax.security.jacc.WebRoleRefPermission jsp X) permission references the page as via the name "jsp" and there is no default mapping for this. We need to create such a permission mapping for every web.xml security-role element.

All | Comments | Work Log | Change History | FishEye — Sort Order:

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Linking Bug Reports to Changes

teicher 2003-10-29 16:11:01

fixes issues mentioned in bug 45635: [hovering] rollover hovers
- mouse exit detection is safer and should not allow for loopholes any more, except for shell deactiviation
- hovers behave like normal ones:
    - tooltips pop up below the control
    - they move with subjectArea
    - once a popup is showing, they will show up instantly

TA-RE

An exchange language for mining software repositories

- Results are difficult to reproduce since different tools extract data using different methods.
- Benckmarking is virtually impossible.
- Other domains have repositories or corpora (plural of corpus) of data sets, e.g. PROMISE, UCI Repository, Reuters corpus.
- TA-RE presents software evolution data including CVS transactions and bug data in an XML format.

Summary

- Databases simplify the exploration of CVS.
- Sliding time windows are superior to fixed ones.
- Fine-grained analyses are feasible and worthwhile.
- Outlook: CVS mapped with bug data facilitates research in defect analysis and prediction, code clone investigation, cost estimation drivers, code decay and many more topics.