

Engenharia de Software II

Métricas de MSR: Exemplos

Prof. André Hora
DCC/UFMG
2019.1

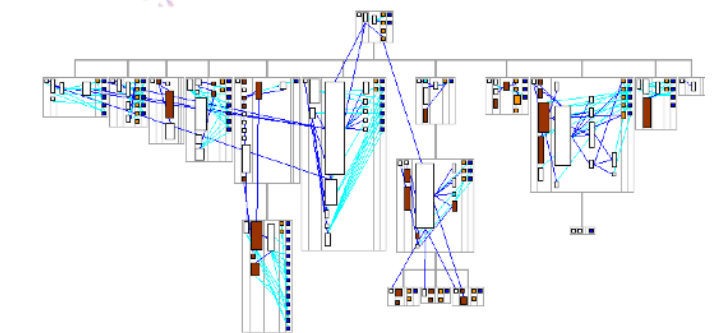
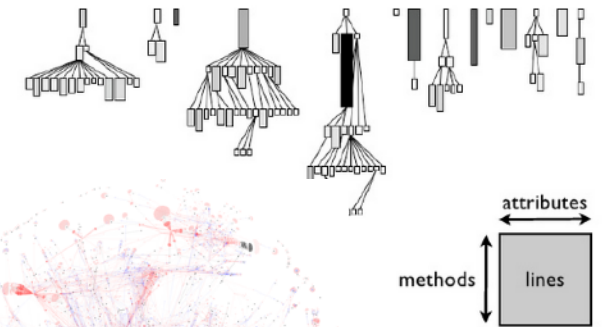


Bugzilla

```
1 (function() {  
2  
3   window.utils = window.utils || {};  
4  
5   /*  
6   Random Number Generator.  
7  
8   Pretty awesome explanation here:  
9   http://stackoverflow.com/a/1527820  
10  */  
11  utils.randomNumber = function(min, max) {  
12    return Math.floor(Math.random() * (max - min + 1)) + min;  
13  };
```



Mineração
de
Software



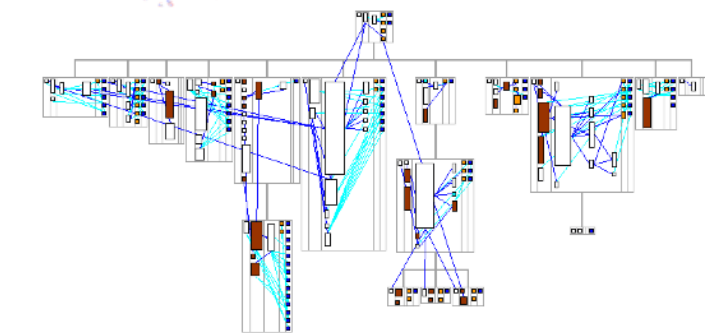
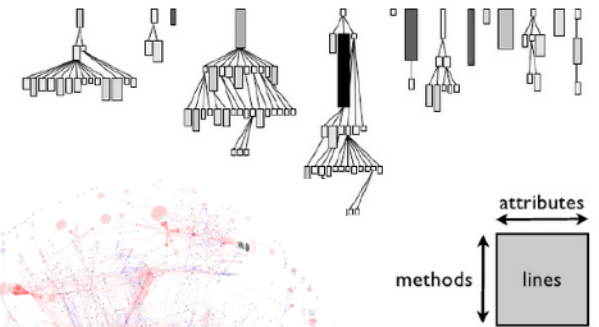


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Mineração
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Software



Commit

Change sort order of shard stats in CCR test

[Browse files](#)

This commit changes the sort order of shard stats that are collected in CCR retention lease integration tests. This change is done so that primaries appear first in sort order.

🔗 master (#140)

 **jason tedor** committed 2 days ago Verified

1 parent [91f69fc](#) commit [14510a933a0b1ecd38033ecc21f2621eba45698a](#)

📄 Showing 1 **changed file** with 1 **addition** and 1 **deletion**.

Unified Split

2  x-pack/plugin/ccr/src/test/java/org/elasticsearch/xpack/ccr/CcrRetentionLeaseIT.java

[View file](#) ▼

| | |
|---|---|
| <pre>@@ -568,7 +568,7 @@ public void testUnfollowFailsToRemoveRetentionLeases() throws Exception { 568 return Arrays.stream(stats.getShards()) 569 .sorted((s, t) -> { 570 if (s.getShardRouting().shardId().id() == 571 t.getShardRouting().shardId().id()) { 572 return 573 Boolean.compare(s.getShardRouting().primary(), 574 t.getShardRouting().primary()); 575 } else { 576 return 577 Integer.compare(s.getShardRouting().shardId().id(), 578 t.getShardRouting().shardId().id()); 579 } 580 }) 581 }</pre> | <pre>568 return Arrays.stream(stats.getShards()) 569 + .sorted((s, t) -> { 570 if (s.getShardRouting().shardId().id() == 571 t.getShardRouting().shardId().id()) { 572 + return - 573 Boolean.compare(s.getShardRouting().primary(), 574 t.getShardRouting().primary()); 575 } else { 576 return 577 Integer.compare(s.getShardRouting().shardId().id(), 578 t.getShardRouting().shardId().id()); 579 } 580 }) 581 }</pre> |
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como?

n commits

git log --pretty=oneline

```
$ git log --pretty=oneline
0e0ea7f00ad2350ff048661d6e99b199fbbc7508 (HEAD -> master, origin/master, origin/HEAD) Fix checkstyle violation
d2164a1ca3195b23ae2c1105c5965b5118901017 Document constructor binding
de21d71e20001e5496c9b5c03c8b9134fdb1d157 Remove support of `@Autowired` for configuration properties bean
fcdc414646ea0851002354b68618d7d608e30f27 Remove use of `@Autowired` for configuration properties bean
c4b8328a2bcd4606c2cba5b7968a5d1701af9c55 Merge pull request #16225 from dreis2211
b39b990a72f045524894e7e4665c6ac4efdd73da Use isEmpty() where possible
223f2be7d2a4be70ee3cceb186637aff2792b95a Inject InfoContributors instead of exposing them on InfoEndpoint
2cdc93cf19a959e1c3a0c25c83cb5d75fed95566 Make TestRestTemplate withBasicAuth fault tolerant
0872eb0dd92129266c3bf396829c3f91e0ec740c Remove use of ReflectionUtils.doWithMethods from ConfigurationBeanFactoryMetadata
210c51e31cf3c04219805f255ff3898d0a301548 Merge pull request #16115 from JWThewes
4d73211c3a65d298580b6379a3ea13a3792ed494 Polish "Check for multiple processors in OnClassCondition"
a96a79ea45b00be34e84b34af96b4bc45f50bcee Check for multiple processors in OnClassCondition
9da20b7e52ec3dc3ef0da0a6761385567ab0cd0d Merge branch '2.1.x'
07d95ce0861638e7a2459a65418ab95d6564d1b3 (origin/2.1.x) Merge pull request #16224 from xak2000
fcde648c50ced4dd9e3f7ca394f528fa0162f25f Fix typo in logging.group property description
ae3ea186e289312a0adce9aa65add54c834c9abb Align test with change to exception in latest Framework snapshots
5a66dc8c6e439d17a5ac859ad572e5732dbb2d78 Merge branch '2.1.x'
9906ef24003f50a98e137b25c0555f0bdea8189c Merge branch '2.0.x' into 2.1.x
8866a25ef79eda30c56c2844152f49cfc476c2d1 (origin/2.0.x) Polish Undertow tests
61380415781bd2341c78017464823eaefc9d9dfc Polish
a6ccdbe19fb27cef6fd08490959849c6fd0bcb53 Handle missing exceptions in WebMvcMetricsFilter
2b4845b3358b5d116d30d82a9318adddcacb2f95 Add dependency needed by javadoc generation on JDK 11
81def1f21d6d183bfdb38250380eeae087fef362 Polish
e8cb75bba88f7fbec3d5b35aee24d06a3e43a4b8 Enable git remote linking automatically on CF
55e5bafcf98da988ab5743e7868443d21a87109 Merge pull request #16165 from mrifni
b2290107db9fdb9ab7c023d67d537c91d8e6903c Polish "Trim trailing whitespace from spring.server.servlet.context-path"
bde2f850b2182dff7ac35223d723d50af4ddc944 Trim trailing whitespace from spring.server.servlet.context-path
347daf69fbd8ad8cd83e641a9a0df8ebfdc34b29 Merge branch '2.1.x'
b7ca103125bff95e9a8013cfc1d1b86ca49cd457 Merge pull request #16213 from orangeroad0922
765801983b814b35795b109b243e1f9f8030812a Polish "Fix typo in spring-boot-features.adoc"
47169436ed8329412ec7548ac2b2441c777d491a Fix typo in spring-boot-features.adoc
39971bbbd388e5fbc392ba8c8174f8b8620dcbd3 Add dependency needed by javadoc generation on JDK 11
68bfb020aad3d98fa57de3c2b31addba0f080e6b Reduce need for bean method proxying and disable where not needed
0f71f22f3c26234f5739f57cdd1aeee8c13980bc Polish
628e44187ff51eaa46b8060ba35a96385a312edb Merge branch '2.1.x'
d77f69cfa9d07da511cf0572b3946a250ec9249f Merge pull request #16166 from viktoriya-kutsarova
f07de1bbe2a5f6c0caed5250f10235aa2c7c97a4 Polish "Update ambiguous documentation about ConfigurationProperties"
6b6ac28430d7892e792248f9609efafe87d69d2c Update ambiguous documentation about ConfigurationProperties
```

:

git log --pretty=short

```
$ git log --pretty=short
commit 0e0ea7f00ad2350ff048661d6e99b199fbbc7508 (HEAD -> master, origin/master, origin/HEAD)
Author: Stephane Nicoll <snicoll@pivotal.io>

    Fix checkstyle violation

commit d2164a1ca3195b23ae2c1105c5965b5118901017
Author: Stephane Nicoll <snicoll@pivotal.io>

    Document constructor binding

commit de21d71e20001e5496c9b5c03c8b9134fdb1d157
Author: Stephane Nicoll <snicoll@pivotal.io>

    Remove support of `@Autowired` for configuration properties bean

commit fcdc414646ea0851002354b68618d7d608e30f27
Author: Stephane Nicoll <snicoll@pivotal.io>

    Remove use of `@Autowired` for configuration properties bean

commit c4b8328a2bcd4606c2cba5b7968a5d1701af9c55
Merge: 223f2be7d2 b39b990a72
Author: Stephane Nicoll <snicoll@pivotal.io>

    Merge pull request #16225 from dreis2211

commit b39b990a72f045524894e7e4665c6ac4efdd73da
Author: dreis2211 <christoph.dreis@freenet.de>

    Use isEmpty() where possible

commit 223f2be7d2a4be70ee3cceb186637aff2792b95a
Author: Madhura Bhav <mbhave@pivotal.io>

    Inject InfoContributors instead of exposing them on InfoEndpoint

commit 2cdc93cf19a959e1c3a0c25c83cb5d75fed95566
Author: Madhura Bhav <mbhave@pivotal.io>
:
```

git log --numstat

```
$ git log --numstat
commit 0e0ea7f00ad2350ff048661d6e99b199fbbc7508 (HEAD -> master, origin/master, origin/HEAD)
Author: Stephane Nicoll <snicoll@pivotal.io>
Date: Thu Mar 14 13:22:43 2019 +0100

    Fix checkstyle violation

1      1      spring-boot-project/spring-boot-actuator-autoconfigure/src/main/java/org/springframework/boot/actuate/
autoconfigure/endpoint/jmx/DefaultEndpointObjectNameFactory.java

commit d2164a1ca3195b23ae2c1105c5965b5118901017
Author: Stephane Nicoll <snicoll@pivotal.io>
Date: Thu Mar 14 12:01:23 2019 +0100

    Document constructor binding

    Closes gh-8762
    linhas adicionadas e removidas
116    19      spring-boot-project/spring-boot-docs/src/main/asciidoc/spring-boot-features.adoc

commit de21d71e20001e5496c9b5c03c8b9134fdb1d157
Author: Stephane Nicoll <snicoll@pivotal.io>
Date: Thu Mar 14 11:16:22 2019 +0100

    Remove support of `@Autowired` for configuration properties bean

    See gh-8762

0      6      spring-boot-project/spring-boot/src/main/java/org/springframework/boot/context/properties/
EnableConfigurationPropertiesImportSelector.java
4      2      spring-boot-project/spring-boot/src/test/java/org/springframework/boot/context/properties/
ConfigurationPropertiesTests.java
2      23      spring-boot-project/spring-boot/src/test/java/org/springframework/boot/context/properties/
EnableConfigurationPropertiesImportSelectorTests.java
3      16      spring-boot-project/spring-boot/src/test/kotlin/org/springframework/boot/context/properties/
KotlinEnableConfigurationPropertiesImportSelectorTests.kt

commit fcdc414646ea0851002354b68618d7d608e30f27
Author: Stephane Nicoll <snicoll@pivotal.io>
:
```

Exercício

- Quais análises podem ser realizadas através da mineração da evolução de software?
- Listar 5 perguntas

Complexidade

1. O projeto está se tornando mais ou menos complexo ao longo do tempo?
2. Qual método se tornou mais complexo?
3. Qual classe se tornou mais complexa?
4. Qual pacote se tornou mais complexo?

Documentação

1. A documentação do projeto está melhorando ou piorando ao longo do tempo?
2. Quais desenvolvedores adicionaram mais documentação?
3. Quais desenvolvedores adicionaram menos documentação?

Autoria

1. Quais os desenvolvedores que mais adicionaram arquivos? E os que mais removeram arquivos?
2. Quais os desenvolvedores que mais adicionaram linhas de código? E os que mais removeram linhas?
3. Quais os desenvolvedores que mais modificaram o arquivo X?
4. Qual desenvolvedor adicionou mais linhas no arquivo X?
5. Quais os principais desenvolvedores do projeto?
(principal \neq mais ativo?)

Modularidade

1. Quais as classes que mais mudam em conjunto (acoplamento temporal)?
2. Quais os pacotes que mais mudam em conjunto?
3. Quais classes ganharam mais dependentes?
4. Quais classes ganharam mais dependências?

Testabilidade

1. Os novos métodos são criados com seus respectivos testes de unidade?
2. Quais desenvolvedores escreveram mais testes?
3. Quais desenvolvedores escreveram menos testes?

Métricas de MSR

- Métricas de evolução
- Acoplamento temporal
- Autoria de código
- Truck-factor
- Evolução de APIs

Métricas de MSR

- **Métricas de evolução**
- Acoplamento temporal
- Autoria de código
- Truck-factor
- Evolução de APIs

Métricas de Evolução

- Métricas independentes de linguagem
- Exemplos:
 - Commits
 - Autores
 - Arquivos modificados
 - Linhas de código adicionadas
 - Linhas de código removidas
- Complexidade:
 - LOC
 - Code shape

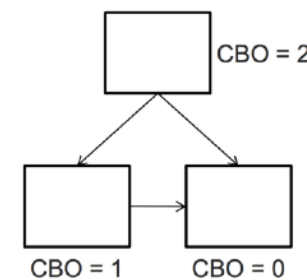
Métricas de MSR

- Métricas de evolução
- **Acoplamento temporal**
- Autoria de código
- Truck-factor
- Evolução de APIs

Acoplamento Temporal

- **Acoplamento:** dependências explícitas entres classes

- Métricas de acoplamento (CK): CBO e RFC



- **Acoplamento temporal:** dependências implícitas entres classes

- Como detectar acoplamento temporal?

CBO?

```
public class Customer {
    private String name;
    private List<Rental> rentals = new ArrayList<Rental>();
    public Customer(String name) {
        this.name = name;
    }
    public String getName() {
        return name;
    }
    public void addRental(Rental rental) {
        rentals.add(rental);
    }
    public String statement() {
        double totalAmount = 0;
        int f = 0;
        String r = "Rental record for " + getName() + "\n";
        for (Rental rental : rentals) {
            double amount = 0;
            switch (rental.getMovie().getPriceCode()) {
                case Movie.REGULAR:
                    amount += 2;
                    if (rental.getDaysRented() > 2)
                        amount += (rental.getDaysRented() - 2) * 1.5;
                    break;
                case Movie.NEW_RELEASE:
                    amount += rental.getDaysRented() * 3;
                    break;
                case Movie.CHILDREN:
                    amount += 1.5;
                    if (rental.getDaysRented() > 3)
                        amount += (rental.getDaysRented() - 3) * 1.5;
                    break;
            }
            f++;
            if (rental.getMovie().getPriceCode() == Movie.NEW_RELEASE)
                f++;
            r += "\t" + rental.getMovie().getTitle() + "\t" + String.valueOf(amount) + "\n";
            totalAmount += amount;
        }
        r += "Amount owed is " + String.valueOf(totalAmount) + "\n";
        r += "You earned " + String.valueOf(f) + " frequent renter points";
        return r;
    }
}
```

CBO?

CBO: 5

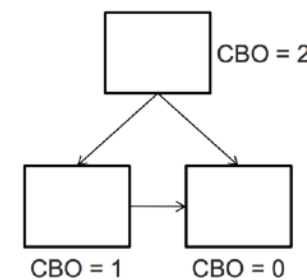
- String
- List
- ArrayList
- Rental
- Movie

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Acoplamento Temporal

- **Acoplamento:** dependências explícitas entre classes

- Métricas de acoplamento (CK): CBO e RFC



- **Acoplamento temporal:** dependências implícitas entre classes

- **Como detectar acoplamento temporal?**

Acoplamiento Temporal

```
commit cfa4ad4132ec34d8a18e6beee1aaa136a2e4f3ba ← Second commit
Author: Adam Tornhill <adam@adamtornhill.com>
Date:   Wed Nov 13 07:20:43 2013 +0100
```

Support multiple grades of fuel (small fix, right).

| | | |
|----|---|------------------------------------|
| 32 | 4 | src/detectors/FuelGradeDetector.cs |
| 22 | 7 | src/engine/FuelInjector.cs |
| 2 | 1 | src/engine/Engine.cs |
| 2 | 1 | src/statistics/Diagnostics.cs |
| 11 | 2 | test/engine/FuelInjectorTest.cs |

Modules that keep
changing together

```
commit 314d56b5d0018dde11aeb8a34521fd8bb1a70aa0 ← First commit
Author: Adam Tornhill <adam@adamtornhill.com>
Date:   Tue Nov 12 17:04:26 2013 +0100
```

More efficient fuel injection by higher pressure.

| | | |
|----|---|---------------------------------|
| 18 | 2 | src/engine/FuelInjector.cs |
| 2 | 1 | src/engine/Engine.cs |
| 2 | 1 | src/statistics/Diagnostics.cs |
| 10 | 3 | test/engine/FuelInjectorTest.cs |

Acoplamiento Temporal

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| 2 | 1 | src/statistics/Diagnostics.cs |
| 10 | 3 | test/engine/FuelInjectorTest.cs |

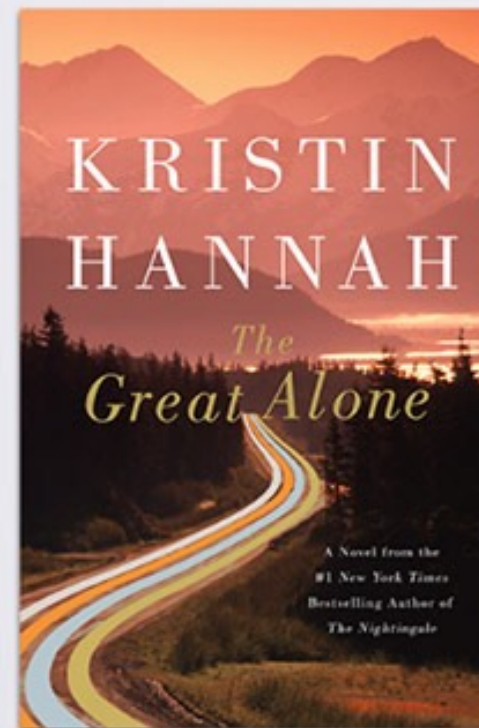
Métricas de MSR

- Métricas de evolução
- Acoplamento temporal
- **Autoria de código**
- Truck-factor
- Evolução de APIs

KRISTIN HANNAH

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*#1 New York Times Bestselling
Author*



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Código fonte?

- Nomes dos autores não estão estampados no código
- Autoria de código pode evoluir ao longo do tempo



Autoria de Código

- Métricas para “descobrir” o dono do código
- Ou seja, aquele desenvolvedor que possui maior conhecimento sobre o código
 - Qual a importância dessa métrica?
 - Solução para detectar autoria de código?

Autoria de Código

| | | |
|---|---|---|
| commit314d56b5d0018dde11aeb8a34521fd8bb1a70aa0 Author: Adam Tornhill <adam@adamtornhill.com> Date: Mon Nov 11 07:04:26 2013 +0100 | | |
| | Churn as removed lines | |
| Churn as added lines | | Churn by author implemented |
| Modifications for each file in the commit | <div><div>12</div><div>18</div><div>2</div><div>2</div><div>7</div><div>7</div></div> | <div><div>0</div><div>2</div><div>1</div><div>1</div><div>0</div><div>0</div></div> <div>README.md src/code_maat/analysis/churn.clj src/code_maat/app/app.clj src/code_maat/core.clj test/code_maat/analysis/churn_test.clj test/code_maat/end_to_end/churn_scenario_test.clj</div> |
| | <div><div>= 48</div><div>(lines added)</div></div> | <div><div>= 4</div><div>(lines removed)</div></div> |
















Métricas de MSR

- Métricas de evolução
- Acoplamento temporal
- Autoria de código
- **Truck-factor**
- Evolução de APIs

Truck-Factor

- *“The number of people on your team who have to be hit with a truck before the project is in serious trouble”*
- Sistemas com baixo Truck-Factor são dependentes de poucos desenvolvedores
- Se esses desenvolvedores saem do projeto, o sistema corre sérios riscos de continuidade

Truck-Factor

| System | TF | |
|----------------------------------|----|---|
| torvalds/linux | 57 |  |
| fzaninotto/Faker | 23 |  |
| android/platform_frameworks_base | 19 |  |
| moment/moment | 19 |  |
| php/php-src | 18 |  |
| odoo/odoo | 14 |  |
| fog/fog | 12 |  |
| git/git | 12 |  |
| webscalesql/webscalesql-5.6 | 11 |  |
| v8/v8 | 11 |  |
| Seldaek/monolog | 11 |  |
| saltstack/salt | 11 |  |
| JetBrains/intellij-community | 9 |  |
| rails/rails | 9 |  |
| puppetlabs/puppet | 9 |  |

A Novel Approach for Estimating Truck Factors. ICPC, 2016.

Métricas de MSR

- Métricas de evolução
- Acoplamento temporal
- Autoria de código
- Truck-factor
- **Evolução de APIs**

Desenvolvimento Moderno: Baseado no Uso de Bibliotecas

MPAndroidChart
created by Philipp Jahoda



glide

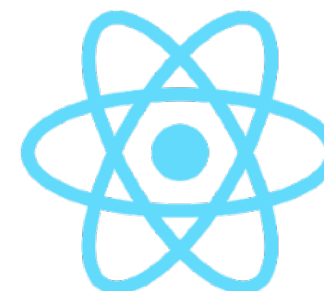


JUnit

Unit testing with
mockito



guava-libraries
Guava: Google Core Libraries for Java 1.6+



React



Bibliotecas de Software

- Utilizadas para apoiar o desenvolvimento
- Disponibilizadas por pequenas e grandes organizações, como Google, Facebook, Apache...

Benefícios

- Reutilização de funcionalidades
- Aumento de produtividade e confiabilidade
- Diminuição dos custos de desenvolvimento

Bibliotecas evoluem...



Cupcake
Android 1.5



Donut
Android 1.6



Eclair
Android 2.0/2.1



Froyo
Android 2.2.x



Gingerbread
Android 2.3.x



Honeycomb
Android 3.x



Ice Cream Sandwich
Android 4.0.x



Jelly Bean
Android 4.1.x



KitKat
Android 4.4.x



Lollipop
Android 5.0



Marshmallow
android 6.0



Nougat
android 7.0



Oreo
Android 8.0



Pie
Android 9.0

...e podem impactar os
seus clientes



versão n

Bibliotecas



Clientes



versão n

Bibliotecas



Clientes



versão n

Bibliotecas



Clientes



versão n+1

Bibliotecas



versão n

versão n+1

Bibliotecas



Bibliotecas



Clientes



versão n

versão n+1

Bibliotecas



Bibliotecas



Clientes



versão n

versão n+1

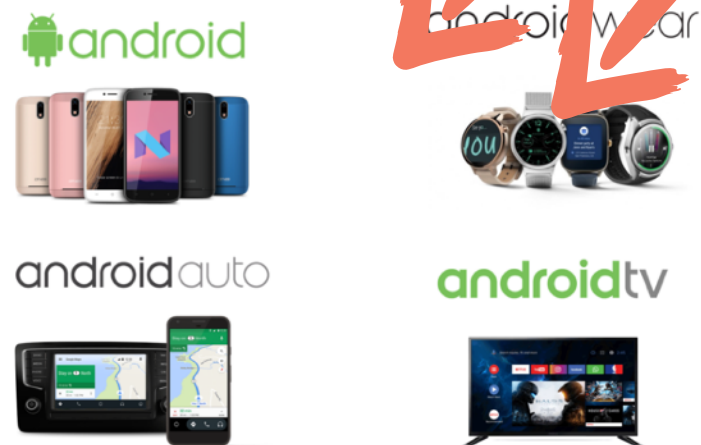
Bibliotecas



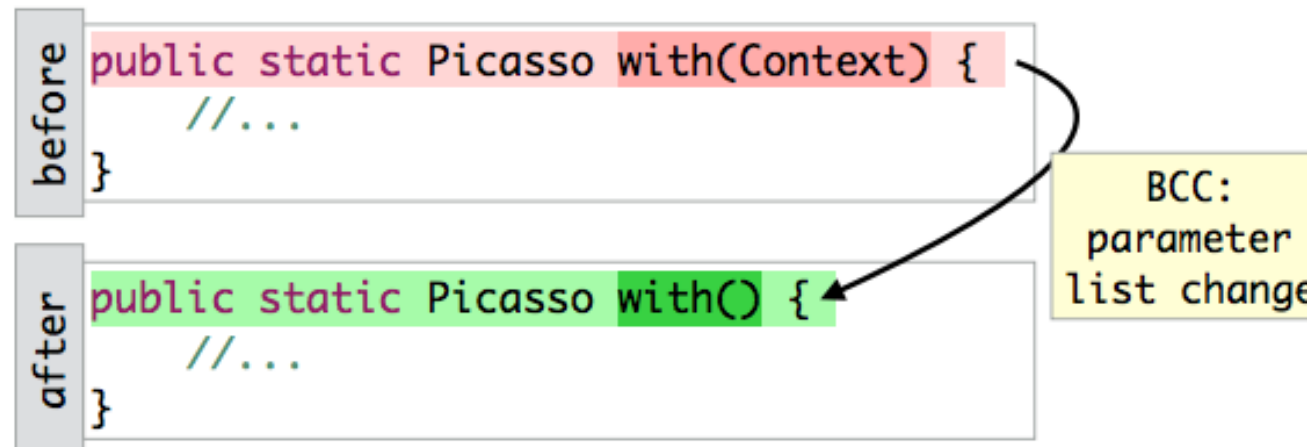
Bibliotecas



Clientes



Quebra de Contrato de APIs



```
2  ...ee/backends/pipeline/DrawableFactory.java → ...agepipeline/drawable/DrawableFactory.java View
@@ -6,7 +6,7 @@
6  * LICENSE file in the root directory of this source tree.
   An additional grant
7  * of patent rights can be found in the PATENTS file in
   the same directory.
8  */
9  -package com.facebook.drawee.backends.pipeline;
10
11  import javax.annotation.Nullable;
12
6  * LICENSE file in the root directory of this source tree.
   An additional grant
7  * of patent rights can be found in the PATENTS file in
   the same directory.
8  */
9  +package com.facebook.imagepipeline.drawable;
10
11  import javax.annotation.Nullable;
12
```


Catálogo de Mudanças

Catalog

The following *Breaking Changes* (BC) are supported:

| Element | Breaking Changes (BC) |
|---------|---|
| Type | Rename Type, Move Type, Move and Rename Type, Remove Type, Lost Visibility, Add Final Modifier, Remove Static Modifier, Change in Supertype, Remove Supertype |
| Method | Move Method, Rename Method, Remove Method, Push Down Method, Inline Method, Change in Parameter List, Change in Exception List, Change in Return Type Method, Lost Visibility, Add Final Modifier, Remove Static Modifier |
| Field | Remove Field, Move Field, Push Down Field, Change in Default Value, Change in Type Field, Lost Visibility, Add Final Modifier |

The following *Non-breaking Changes* (NBC) are supported:

| Element | Non-breaking Changes (NBC) |
|---------|--|
| Type | Add Type, Extract Supertype, Gain Visibility, Remove Final Modifier, Add Static Modifier, Add Supertype, Deprecated Type |
| Method | Pull Up Method, Gain Visibility, Remove Final Modifier, Add Static Modifier, Deprecated Method, Add Method, Extract Method |
| Field | Pull Up Field, Add Field, Deprecated Field, Gain Visibility, Remove Final Modifier |