



DR-Tools

A tool quality suite to help the
developers to maintain health and code evolution

drtools.site



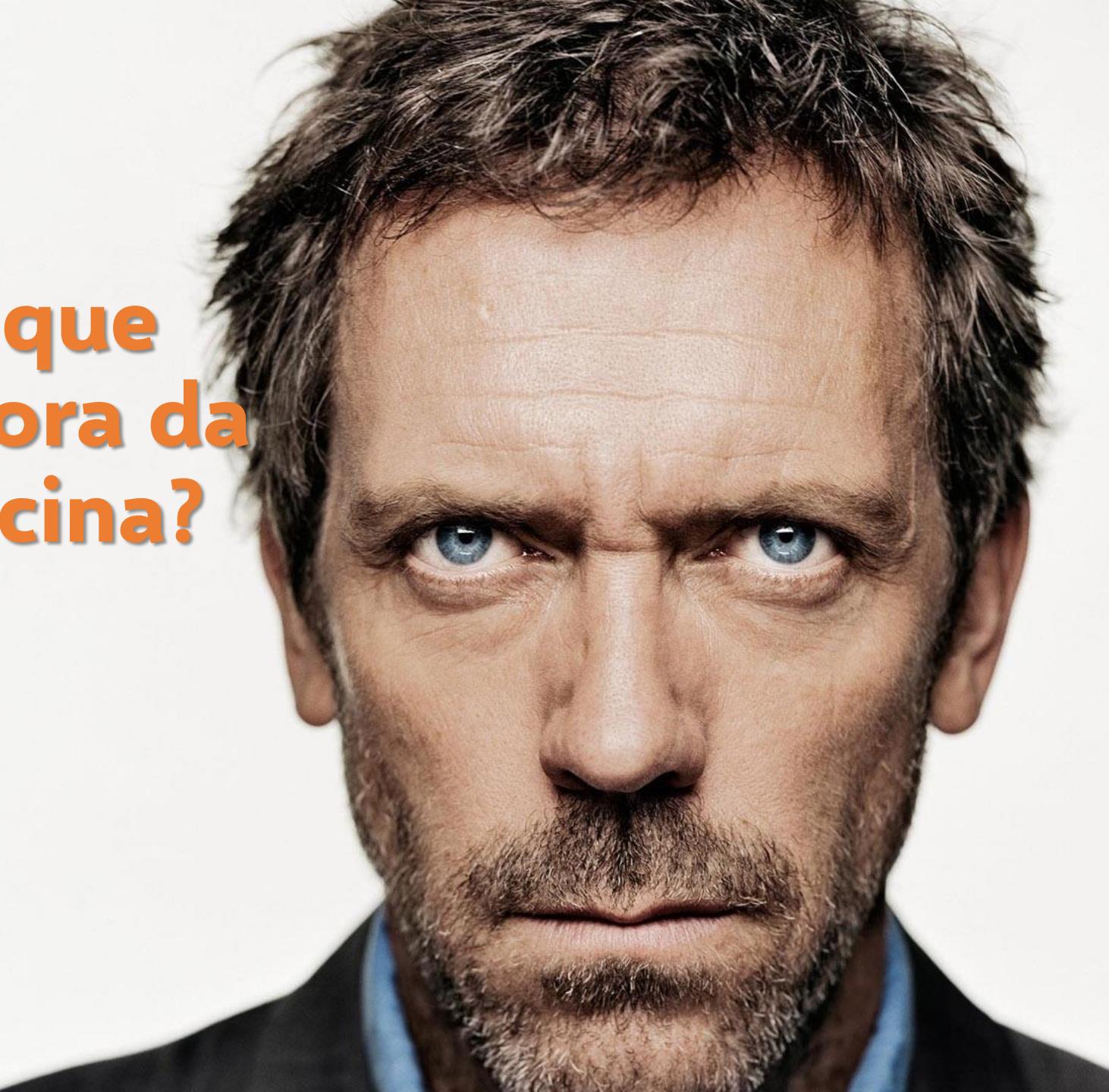
Quem sou eu?

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- ✓ Mestre e Doutorando em Ciência da Computação (UFRGS)
- ✓ Professor de Graduação e Pós-Graduação (Unisinos)
- ✓ Consultor associado da Wildtech
- ✓ Pioneiro em Metodologias Ágeis no Brasil
- ✓ Fundador do XP-RS/GUMA
- ✓ Membro da ScrumAlliance , IASA, SBC e ACM



**Por que
metáfora da
medicina?**



Família de Produtos DR-Tools

✓ **metric**

✓ **metric visualization**

✓ **smell-detection**



✓ **refactoring-recommender (plugin IDE)**



✓ **smell-refactoring dashboard**



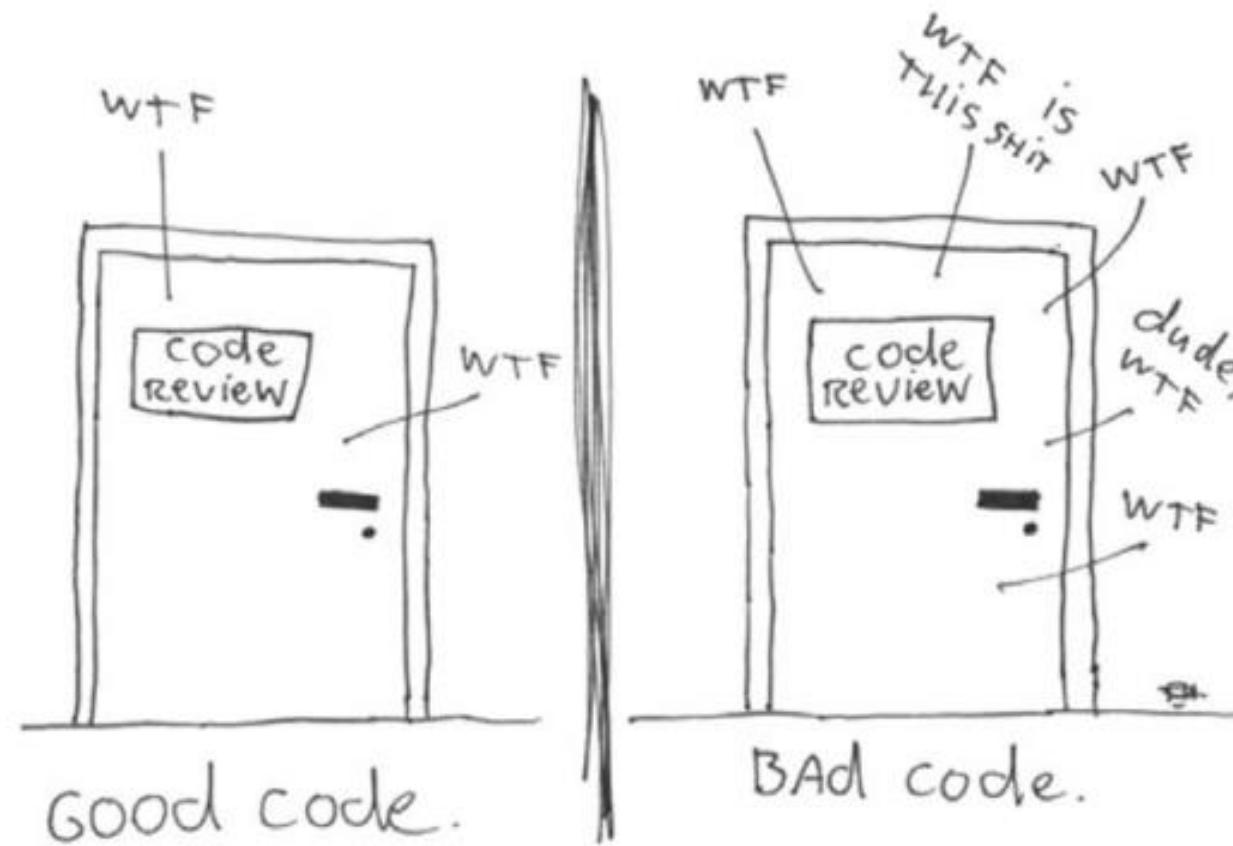
DR-Tools



metric
DR-Tools

Como você mede a qualidade do código?

The ONLY VALID MEASUREMENT
OF Code QUALITY: WTFs/MINUTE



“ah... Nós temos o SonarQube”

Screenshots of the SonarQube interface showing various project dashboards and analysis results.

Left Dashboard:

- Helicopter View:** SQALE Rating A, Technical Debt 28,874.9 days, Lines of Code 10,508K.
- All Projects:** Issues 668,081, Technical Debt 28,874.9 days. Issues breakdown: Blocker 4,362, Critical 35,468, Major 503,908, Minor 107,690, Info 16,653.
- Forges:** List of forges with LOCs and SQALE Rating:
 - Forge 7,662,358 A
 - Apache 4,209,599 A
 - Others 1,966,714 A
 - JBoss 560,876 A
 - Sourceforge 344,112 A
 - Codehaus 267,568 C
 - OW2 164,683 A
 - OPS4J 71,965 A
 - SpringSource 51,192 A
 - GoogleCode 25,649 A9 results

Right Dashboard:

- All Projects:** Heatmap showing project size (LOCs) and rules compliance (0.0% to 100.0%) across various Apache projects like CXF, Jena, Jackrabbit, etc.
- All Projects:** Line chart showing trends from Jan 30, 2014, comparing Lines of code (10,508,578), Duplicated lines (1,389,498), and Unit tests (568,101) over time from 2010 to 2014.

SonarQube™ technology is powered by [SonarSource SA](#)
Version 4.1.1 - [Community](#) - [Documentation](#) - [Get Support](#) - [Plugins](#)



**Se eu baixar um projeto do
GitHub,
onde estão os maiores
problemas?**

Características

- ✓ Simplicidade, valor do XP
- ✓ CLI (*command line interface*)
- ✓ Versatilidade
- ✓ Download and run! (pré-requisito: JRE 8)
- ✓ Seleção de métricas, correlacionadas e ordenadas
- ✓ Visualizações usando Google Chart e D3.js
- ✓ Atualmente analisa projetos Java



Funções

- ✓ **Resultados em diferentes formatos**

Console, JSON, CSV

- ✓ **Filtragem dos 'Top X'**

- ✓ **Resultados contextualizados**

*Projeto, Namespaces, Classes, Métodos, Acoplamento,
Dependências*



DR-Tools

Métricas Contextualizadas



Sumário do Projeto

Total de Namespaces, Classes, SLOC, Métodos e CYCLO



Namespaces

NOC, NAC



Classes

SLOC, NOM, WMC/CYCLO, DEP, I-DEP/Fan-Out, NPM, NOA, LCOM3



Métodos

MLOC, CYCLO, CALLS, NBD, PARAM



Acoplamento

CA, CE, Instability, Abstractness, Normalized Distance



Dependências

Externas, Internas, Cyclic Dependency



DR-Tools

Uso

```
C:\Program Files\cmder
λ drtools-metric

Usage: drtools-metric <project-directory> <OPTIONS> <OUTPUT> [--top <number>]
OPTIONS = <-a|-ac|-s|-n|-t|-m|-d|-cd|-id|-nc|-tc|-mt|-i|-mv> OUTPUT = <--console|--csv|--json|--save>

Where
-a      list ALL metrics (namespaces/types/methods)          --console    show the results to console
-ac     list ALL metrics about COUPLING/DEPENDENCIES        --csv       generate results in CSV format
-s      list SUMMARY of project                            --json       generate results in JSON format
-n      list information about NAMESPACES (packages)       --save       generate file results to drtools-metric-visualization tool
-t      list information about TYPES (classes)
-m      list information about METHODS (functions)
-d      list information about DEPENDENCIES of types
-cd     list information about CYCLIC DEPENDENCIES of types
-id     list information about INTERNAL DEPENDENCIES of types
-nc     list information about NAMESPACE COUPLING
-tc     list information about TYPE COUPLING
-mt     list information about METRIC THRESHOLDS
-i      list INFORMATION about tool development team
-mv     generate files to drtools-metric-visualization tool (use only with --save output option)

Metrics
CA     - Number of types outside this component that depends on types inside this component (Afferent Coupling)
CE     - Number of types inside this component that depends on types outside this component (Efferent Coupling)
I      - Instability of namespace (range between 0=Maximally stability and 1=Maximally instability)
A      - Abstractness degree of namespace (range between 0=Minimally abstractness and 1=Maximally abstractness)
D      - Normalized distance of namespace
NAC    - Number of abstract types inside namespaces
NOC    - Number of types inside namespaces
DEP    - Number of external types dependencies
FAN-IN - Number of other types that depend on a given type
NOA    - Number of attributes/variables
NBD    - Number of nested block depth of a method
PARAM  - Number of parameters of a method
CALLS  - Number of invocations made from within a method

NOM    - Number of methods of a type
WMC    - Weighted methods per types (sum the CYCLO of each method)
SLOC   - Number of lines of source code
I-DEP  - Number of internal types dependencies
FAN-OUT - Number of other types referenced by a type
NPM    - Number of public methods of a type
MLOC   - Number of lines of a method
CYCLO  - Cyclomatic complexity (McCabe) of a method
LCOMB  - Lack of cohesion in methods

Usage examples:
Example 1 : # drtools-metric \Project\Java\src -a --console
Example 2 : # drtools-metric \Project\Java\src -t --csv
Example 3 : # drtools-metric \Project\Java\src -m --console --top 10
```

Uso

```
C:\Program Files\cmder translate.google.com.br/m/p-0/001-en/pt-text-hierarchical&cid=Adopt-translate
λ drtools-metric D:\JavaApps\Plugins\drtools-metric\src -s --console
----- Trans Refactoring Histórico Documentação Agile Ferramentas TIRS Prof. Humberto César webmail.info.Bem... Clube TRES
SUMMARY OF METRICS
-----
Total of Namespaces: 11
Total of Types: 45 - 4,09 (number of types/namespaces - median: 3,00 - std dev: 4,14)
Total of SLOC: 3006 - 66,80 (number of SLOC/types - median: 25,00 - std dev: 81,66)
Total of Methods: 418 - 9,29 (number of methods/types - median: 3,00 - std dev: 5,82)
Total of CYCLO: 667 - 14,82 (number of CYCLO/types)
Processing time: 2 seconds

C:\Program Files\cmder
λ drtools-metric D:\JavaApps\Plugins\drtools-metric\src -mt --console
----- INGLÊS PORTUGUÊS ESPANHOL
INFORMATION ABOUT METRIC THRESHOLDS
----- As medições variam de acordo com o gênero das palavras. SAIBA MAIS
----- small project with < 50 KLOC or 200 < classes
----- medium project with (50 KLOC <= project <= 250 KLOC) or (200 <= classes <= 1000)
----- large project with > 250 KLOC or > 1000 classes
----- Good: <= 11; Regular: between 11 and 28; Bad: > 28
----- without references
----- Bad: > 500
----- Good: <= 6; Regular: between 6 and 14; Bad: > 14
----- Good: <= 20; Regular: between 20 and 100; Bad: > 100
----- Bad: > 20
----- Bad: > 15
----- Bad: > 10
----- Bad: > 15
----- Good: <= 10; Regular: between 11 and 40; Bad: > 40
----- Good: <= 3; Regular: between 3 and 8; Bad: > 8
----- Good: = 0; Regular: between 0 and 1; Bad: > 1
----- Good: <= 10; Regular: between 10 and 30; Bad: > 30
----- Good: <= 2; Regular: between 2 and 4; Bad: > 4
----- Bad: > 5
----- Good: <= 1; Regular: between 1 and 3; Bad: > 3
----- Good: <= 2; Regular: between 2 and 4; Bad: > 4
----- Good: <= 7; Regular: between 7 and 39; Bad: > 39
----- Good: <= 6; Regular: between 6 and 16; Bad: > 16
----- range between 0=Maximally stability and 1=Maximally instability
----- range between 0=Minimally abstractness and 1=Maximally abstractness
----- range between 0=exactly located in the main sequence and 1=far from the main sequence

C:\Program Files\cmder Exemplos de hierarchical
λ |
```

Uso

```
C:\Program Files\cmder
λ drtools-metric D:\JavaApps\Doutorado\repos\hibernate-orm-master\ -a --console --top 5
```

SUMMARY OF METRICS

```
Total of Namespaces: 1371
Total of Types: 9954 - 7,26 (number of types/namespaces - median: 4,00 - std dev: 10,47)
Total of SLOC: 738683 - 74,21 (number of SLOC/types - median: 40,00 - std dev: 155,79)
Total of Methods: 75730 - 7,61 (number of methods/types - median: 3,00 - std dev: 14,53)
Total of CYCLO: 106331 - 10,68 (number of CYCLO/types)
```

NAMESPACES

	NOC	NAC
org.hibernate.test.legacy	126	9
org.hibernate.annotations	110	0
org.hibernate.type	110	19
org.hibernate.dialect	102	6
org.hibernate.test.hql	91	5

TYPES

	SLOC	NOM	NPM	WMC	DEP	I-DEP	FAN-IN	FAN-OUT	NOA	LCOM3
--	------	-----	-----	-----	-----	-------	--------	---------	-----	-------

org.hibernate.persistor.entity.AbstractEntityPersistor	4529	398	220	877	138	110	17	134	114	0,87
org.hibernate.test.legacy.FooBarTest	4490	110	109	221	79	44	0	54	0	0,00
org.hibernate.boot.model.source.internal.hbm.ModelBinder	3602	151	77	421	144	125	2	142	31	0,94
org.hibernate.test.hql.ASTParserLoadingTest	3318	127	118	170	82	50	0	67	4	1,00
org.hibernate.cfg.AnnotationBinder	3101	61	13	504	160	37	11	43	2	0,99

METHODS

	MLOC	CYCLO	CALLS	NBD	PARAM
--	------	-------	-------	-----	-------

nSecondPass, MetadataBuildingContext context, Map<XClass, InheritanceState> inheritanceStatePerClass)	762	99	362	8	10
org.hibernate.hql.internal.ast.SqlASTFactory.getASTNodeType(int tokenType)	122	66	0	2	1
, XClass returnedClass, String declaringClassName, ConverterDescriptor attributeConverterDescriptor)	175	55	95	4	4
r, XProperty property, PropertyHolder parentPropertyHolder, MetadataBuildingContext buildingContext)	372	53	185	7	14
org.hibernate.hql.internal.classic.FromParser.token(String token, QueryTranslatorImpl q)	244	52	44	4	2

Processing time: 51 seconds

```
C:\Program Files\cmder
```

λ |

Uso

```
C:\Program Files\cmder
λ drtools-metric D:\JavaApps\Doutorado\repos\hibernate-orm-master\ -s --console
```

SUMMARY OF METRICS

```
Total of Namespaces: 1371
Total of Types: 9954 - 7,26 (number of types/namespaces)
Total of SLOC: 738683 - 74,21 (number of SLOC/types)
Total of Methods: 55503 - 5,58 (number of methods/types)
Total of CYCLO: 76955 - 7,73 (number of CYCLO/types)
```

```
Processing time: 14 seconds
```

```
C:\Program Files\cmder
λ drtools-metric D:\JavaApps\Doutorado\repos\hibernate-orm-master\ -c --console | more
```

NAMESPACES	CA	CE	I	A	D
org.hibernate.test.legacy	2	41	0,953	0,071	0,025
org.hibernate.annotations	7	1	0,125	0,000	0,875
org.hibernate.type	681	29	0,041	0,173	0,786
org.hibernate.dialect	731	51	0,065	0,059	0,876
org.hibernate.test.hql	3	38	0,927	0,055	0,018
org.hibernate.boot.model.source.spi	87	8	0,084	0,876	0,039
org.hibernate.boot.model.source.internal.hbm	7	31	0,816	0,186	0,002
org.hibernate	2047	27	0,013	0,329	0,658
org.hibernate.hql.internal.ast.tree	29	26	0,473	0,333	0,194
org.hibernate.event.spi	139	7	0,048	0,563	0,389
org.hibernate.engine.spi	1099	64	0,055	0,524	0,421
org.hibernate.cfg	851	41	0,046	0,186	0,768
org.hibernate.mapping	294	40	0,120	0,316	0,564
org.hibernate.type.descriptor.java	165	13	0,073	0,113	0,814
org.hibernate.criterion	103	12	0,104	0,196	0,700
org.hibernate.test.annotations.entity	0	12	1,000	0,045	0,045
org.hibernate.userguide.mapping.basic	1	12	0,923	0,023	0,054
org.hibernate.event.internal	11	35	0,761	0,163	0,076
org.hibernate.id	73	33	0,311	0,326	0,363
org.hibernate.test.schemaupdate	1	34	0,971	0,047	0,018
org.hibernate.test.annotations.onetomany	0	13	1,000	0,000	0,000
org.hibernate.test.bytecode.enhancement.lazy.proxy	0	16	1,000	0,125	0,125
org.hibernate.test.criteria	0	17	1,000	0,077	0,077
org.hibernate.internal	374	97	0,206	0,243	0,551
org.hibernate.jpa.test.metamodel	18	4	0,182	0,108	0,710
org.hibernate.type.descriptor.sql	128	6	0,045	0,167	0,789
org.hibernate.boot.model.naming	146	9	0,058	0,657	0,285

Uso

C:\Program Files\cmder
λ drtools-metric D:\JavaApps\Doutorado\repos\hibernate-orm-master\ -n --console --top 35

NAMESPACES	NOC	NAC
org.hibernate.test.legacy	126	9
org.hibernate.annotations	110	0
org.hibernate.type	110	19
org.hibernate.dialect	102	6
org.hibernate.test.hql	91	5
org.hibernate.boot.model.source.spi	89	78
org.hibernate.boot.model.source.internal.hbm	86	16
org.hibernate	85	28
org.hibernate.hql.internal.ast.tree	72	24
org.hibernate.event.spi	71	40
org.hibernate.engine.spi	63	33
org.hibernate.cfg	59	11
org.hibernate.mapping	57	18
org.hibernate.type.descriptor.java	53	6
org.hibernate.criterion	51	10
org.hibernate.test.annotations.entity	44	2
org.hibernate.userguide.mapping.basic	43	1
org.hibernate.event.internal	43	7
org.hibernate.id	43	14
org.hibernate.test.schemaupdate	43	2
org.hibernate.test.annotations.onetomany	40	0
org.hibernate.test.bytecode.enhancement.lazy.proxy	40	5
org.hibernate.test.criteria	39	3
org.hibernate.internal	37	9
org.hibernate.jpa.test.metamodel	37	4
org.hibernate.type.descriptor.sql	36	6
org.hibernate.boot.model.naming	35	23
org.hibernate.test.ops	35	1
org.hibernate.cache.spi.support	32	11
org.hibernate.sql	31	4
org.hibernate.test.annotations	31	2
org.hibernate.test.annotations.lob	31	2
org.hibernate.test.annotations.embedded	30	0
rg.hibernate.envers.test.integration.modifiedflags	30	2
org.hibernate.userguide.mapping.identifier	29	0

Processing time: 15 seconds

Uso

C:\Program Files\cmder
 λ drtools-metric D:\JavaApps\Doutorado\repos\hibernate-orm-master\ -t --console --top 35

TYPES	SLOC	NOM	NPM	WMC	DEP	I-DEP	FAN-IN	FAN-OUT	NOA	LCOM3
org.hibernate.persister.entity.AbstractEntityPersister	4529	398	220	877	138	110	17	134	114	0,87
org.hibernate.test.legacy.FooBarTest	4490	110	109	221	79	44	0	54	0	0,00
org.hibernate.boot.model.source.internal.hbm.ModelBinder	3602	151	77	421	144	125	2	142	31	0,94
org.hibernate.test.hql.ASTParserLoadingTest	3318	127	118	170	82	50	0	67	4	1,00
org.hibernate.cfg.AnnotationBinder	3101	61	13	504	160	37	11	43	2	0,99
org.hibernate.internal.SessionImpl	3031	317	235	535	170	121	18	156	36	0,97
ate.cfg.annotations.reflection.JPAOverriddenAnnotationReader	2709	117	11	552	124	7	3	21	15	0,94
nate.test.querycache.AbstractQueryCacheTransformerTest	2256	269	178	95	35	21	2	34	7	0,99
org.hibernate.loader.Loader	2136	106	16	287	86	69	15	79	10	0,96
org.hibernate.userguide.hql.HQLTest	1868	147	143	148	46	17	0	18	0	0,00
org.hibernate.boot.internal.InFlightMetadataCollectorImpl	1861	168	129	376	99	79	2	93	65	0,90
g.hibernate.persister.collection.AbstractCollectionPersister	1855	167	114	287	90	78	8	88	93	0,72
org.hibernate.test.criteria.CriteriaQueryTest	1750	34	32	52	54	29	0	33	1	1,00
org.hibernate.engine.internal.StatefulPersistenceContext	1708	132	113	324	64	42	5	51	27	0,90
org.hibernate.cfg.annotations.CollectionBinder	1567	66	43	289	105	41	6	46	44	0,68
org.hibernate.test.readonly.ReadOnlyProxyTest	1507	44	42	45	19	9	0	12	0	0,00
org.hibernate.internal.CoreMessageLogger	1421	392	392	392	41	15	284	16	0	0,00
hibernate.internal.util.collections.BoundedConcurrentHashMap	1364	157	118	116	20	0	3	30	58	0,83
org.hibernate.query.internal.AbstractProducedQuery	1357	151	104	255	94	40	6	53	22	0,93
org.hibernate.jpa.test.query.QueryTest	1356	60	59	115	39	13	0	18	0	0,00
org.hibernate.test.immutable.ImmutableTest	1353	36	32	39	23	13	0	17	1	1,00
org.hibernate.dialect.AbstractHANADialect	1316	156	128	168	98	65	59	81	30	0,93
org.hibernate.test.hql.BulkManipulationTest	1301	58	54	67	34	14	0	22	6	0,96
org.hibernate.test.hql.HQLTest	1295	188	181	222	62	40	0	45	0	0,00
org.hibernate.test.readonly.ReadOnlySessionLazyNonLazyTest	1280	19	16	26	18	5	0	7	0	0,00
org.hibernate.internal.SessionFactoryImpl	1269	145	123	214	126	94	11	112	50	0,87
org.hibernate.dialect.Dialect	1198	216	199	251	111	85	312	92	25	0,99
hancement.lazy.proxy.DeepInheritanceWithNonEntitiesProxyTest	1191	47	37	79	24	9	0	17	9	0,91
org.hibernate.test.readonly.ReadOnlyCriteriaQueryTest	1133	19	18	26	25	16	0	18	0	0,00
org.hibernate.cfg.annotations.EntityBinder	1131	68	51	207	87	31	12	40	41	0,75
org.hibernate.test.legacy.ParentChildTest	1126	25	25	37	43	20	0	24	0	0,00
org.hibernate.hql.internal.ast.HqlSqlWalker	1122	93	36	195	88	66	39	79	26	0,89
org.hibernate.boot.internal.SessionFactoryOptionsBuilder	1102	156	150	184	122	37	2	43	80	0,75
org.hibernate.test.readonly.ReadOnlySessionTest	1102	25	25	79	17	6	0	8	0	0,00
org.hibernate.query.criteria.internal.CriteriaBuilderImpl	1098	171	170	226	75	45	69	54	1	1,00

Processing time: 54 seconds

C:\Program Files\cmder

λ

Uso

```
C:\Program Files\cmder
λ drttools-metric D:\JavaApps\Doutorado\repos\hibernate-orm-master\ -m --console --top 3
```

METHODS		MLOC	CYCLO	CALLS	NBD	PARAM
nSecondPass, MetadataBuildingContext context, Map<XClass, InheritanceState> inheritanceStatePerClass)	org.hibernate.hql.internal.ast.SqlASTFactory.getASTNodeType(int tokenType)	762	99	362	8	10
, XClass returnedClass, String declaringClassName, ConverterDescriptor attributeConverterDescriptor)	org.hibernate.hql.internal.ast.SqlASTFactory.getASTNodeType(int tokenType)	122	66	0	2	1
r, XProperty property, PropertyHolder parentPropertyHolder, MetadataBuildingContext buildingContext)	org.hibernate.hql.internal.ast.SqlASTFactory.getASTNodeType(int tokenType)	175	55	95	4	4
org.hibernate.hql.internal.classic.FromParser.token(String token, QueryTranslatorImpl q)	org.hibernate.hql.internal.ast.SqlASTFactory.getASTNodeType(int tokenType)	372	53	185	7	14
te(String sqlWhereString, String placeholder, Dialect dialect, SQLFunctionRegistry functionRegistry)	org.hibernate.hql.internal.ast.SqlASTFactory.getASTNodeType(int tokenType)	244	52	44	4	2
zzToProcess, Map<XClass, InheritanceState> inheritanceStatePerClass, MetadataBuildingContext context)	org.hibernate.hql.internal.ast.SqlASTFactory.getASTNodeType(int tokenType)	320	44	151	8	3
entClass persistentClass, EntityPersister persister, final PersisterCreationContext creationContext)	org.hibernate.hql.internal.ast.SqlASTFactory.getASTNodeType(int tokenType)	312	42	132	5	3
org.hibernate.hql.internal.classic.SelectParser.token(String token, QueryTranslatorImpl q)	org.hibernate.hql.internal.ast.SqlASTFactory.getASTNodeType(int tokenType)	152	40	67	4	2
tadata, ExecutionOptions options, Dialect dialect, Formatter formatter, GenerationTarget... targets)	org.hibernate.hql.internal.ast.SqlASTFactory.getASTNodeType(int tokenType)	203	37	81	4	5
l NaturalIdDataAccess naturalIdRegionAccessStrategy, final PersisterCreationContext creationContext)	org.hibernate.engine.query.spi.ParameterParser.parse(String sqlString, Recognizer recognizer)	450	36	253	6	4
llectionBinding, CollectionDataAccess cacheAccessStrategy, PersisterCreationContext creationContext)	org.hibernate.cfg.annotations.EntityBinder.bindEntity()	143	36	43	5	2
org.hibernate.cfg.annotations.EntityBinder.bindEntity()	org.hibernate.cfg.annotations.EntityBinder.bindEntity()	378	35	176	6	3
org.hibernate.dialect.TeradataDialect.getSelectClauseNullString(int sqlType)	org.hibernate.cfg.annotations.EntityBinder.bindEntity()	186	31	140	4	0
org.hibernate.cfg.annotations.CollectionBinder.bind()	org.hibernate.cfg.annotations.EntityBinder.bindEntity()	44	31	0	0	1
org.hibernate.test.legacy.FooBarTest.createQuery()	org.hibernate.cfg.annotations.EntityBinder.bindEntity()	167	30	106	7	0
org.hibernate.spatial.dialect.hana.HANASpatialDialect.supports(SpatialFunction function)	org.hibernate.cfg.annotations.EntityBinder.bindEntity()	441	30	522	2	0
query.procedure.internal.ProcedureParameterImpl.prepare(CallableStatement statement, int startIndex)	org.hibernate.cfg.annotations.EntityBinder.bindEntity()	61	29	0	1	1
1 NaturalIdDataAccess naturalIdRegionAccessStrategy, final PersisterCreationContext creationContext)	org.hibernate.cfg.annotations.EntityBinder.bindEntity()	318	28	56	5	2
1 NaturalIdDataAccess naturalIdRegionAccessStrategy, final PersisterCreationContext creationContext)	org.hibernate.cfg.annotations.EntityBinder.bindEntity()	318	28	182	4	4
xt, Ejb3Column[] mapKeyColumns, Ejb3JoinColumn[] mapKeyManyToManyColumns, String targetPropertyName)	org.hibernate.cfg.annotations.EntityBinder.bindEntity()	371	27	209	8	4
pplyCaching(XClass clazzToProcess, SharedCacheMode sharedCacheMode, MetadataBuildingContext context)	org.hibernate.cfg.annotations.EntityBinder.bindEntity()	215	27	85	4	9
org.hibernate.tool.hbm2ddl.SchemaExport\$CommandLineArgs.parseCommandLineArgs(String[] args)	org.hibernate.cfg.annotations.EntityBinder.bindEntity()	124	27	30	4	3
e.internal.StatefulPersistenceContext.deserialize(ObjectInputStream ois, SessionImplementor session)	org.hibernate.cfg.annotations.EntityBinder.bindEntity()	96	27	37	3	1
ession, final PreLoadEvent preLoadEvent, final Iterable<PreLoadEventListener> preLoadEventListeners)	org.hibernate.cfg.annotations.EntityBinder.bindEntity()	124	26	60	5	2
ledFilters, boolean includeAllSubclassJoins, boolean renderSubclassJoins, String withClauseFragment)	org.hibernate.cfg.annotations.EntityBinder.bindEntity()	188	26	82	4	6
ollectionMetadata(MappingDocument mappingDocument, PluralAttributeSource source, Collection binding)	org.hibernate.cfg.annotations.EntityBinder.bindEntity()	173	26	71	4	4
tadata, ExecutionOptions options, Dialect dialect, Formatter formatter, GenerationTarget... targets)	org.hibernate.cfg.annotations.EntityBinder.bindEntity()	150	26	118	4	3
jb3JoinColumn[] columns, SimpleValue value, boolean unique, MetadataBuildingContext buildingContext)	org.hibernate.cfg.annotations.EntityBinder.bindEntity()	123	26	51	4	5
g.hibernate.hql.internal.ast.tree.SelectClause.initializeExplicitSelectClause(FromClause fromClause)	org.hibernate.cfg.annotations.EntityBinder.bindEntity()	174	25	74	7	6
ctionProviderInitiator.initiateService(Map configurationValues, ServiceRegistryImplementor registry)	org.hibernate.cfg.annotations.EntityBinder.bindEntity()	148	25	59	6	1
dLocalSessionContext\$TransactionProtectionWrapper.invoke(Object proxy, Method method, Object[] args)	org.hibernate.cfg.annotations.EntityBinder.bindEntity()	132	25	33	4	2
org.hibernate.engine.jdbc.internal.BasicFormatterImpl\$FormatProcess.perform()	org.hibernate.cfg.annotations.EntityBinder.bindEntity()	70	25	41	4	3
org.hibernate.engine.jdbc.ClobProxy.invoke(Object proxy, Method method, Object[] args)	org.hibernate.cfg.annotations.EntityBinder.bindEntity()	97	25	45	3	0

Processing time: 40 seconds

C:\Program Files\cmderr

Uso

C:\Program Files\cmder
λ drtools-metric D:\JavaApps\Doutorado\Pathfinder\softwarepathfinder\src\ -d --console --top 2

Type: com.softwarepathfinder.visualization.prefuse.AggregateDemo SLOC: 300 Number of Dependencies: 40

DEPENDENCIES:

```
com.softwarepathfinder.model.Invocation
com.softwarepathfinder.model.Method
com.softwarepathfinder.model.Path
com.softwarepathfinder.model.Project
com.softwarepathfinder.model.Type
java.awt.Cursor
java.awt.event.MouseEvent
java.awt.geom.Point2D
java.awt.geom.Rectangle2D
java.util.HashMap
java.util.Iterator
java.util.List
javax.swing.JFrame
javax.swing.SwingUtilities
prefuse.Constants
prefuse.Display
prefuse.Visualization
prefuse.action.ActionList
prefuse.action.RepaintAction
prefuse.action.assignment.ColorAction
prefuse.action.assignment.DataColorAction
prefuse.action.layout.CircleLayout
prefuse.action.layout.Layout
prefuse.action.layout.graph.NodeLinkTreeLayout
prefuse.activity.Activity
prefuse.controls.ControlAdapter
prefuse.controls.PanControl
prefuse.controls.ZoomControl
prefuse.data.Graph
prefuse.data.Node
prefuse.render.DefaultRendererFactory
prefuse.render.LabelRenderer
prefuse.render.PolygonRenderer
prefuse.render.Renderer
prefuse.util.ColorLib
prefuse.util.GraphicsLib
prefuse.visual.AggregateItem
prefuse.visual.AggregateTable
prefuse.visual.VisualGraph
prefuse.visual.VisualItem
```



λ drtools-metric D:\JavaApps\Doutorado\Pathfinder\softwarepathfinder\src\ -id --console --top 5

Type: com.softwarepathfinder.visualization.prefuse.AggregateDemo SLOC: 300 Number of Internal Dependencies: 5

INTERNAL DEPENDENCIES:

- com.softwarepathfinder.model.Invocation
- com.softwarepathfinder.model.Method
- com.softwarepathfinder.model.Path
- com.softwarepathfinder.model.Project
- com.softwarepathfinder.model.Type

Type: com.softwarepathfinder.model.Type SLOC: 246 Number of Internal Dependencies: 2

INTERNAL DEPENDENCIES:

- com.softwarepathfinder.persistence.jpa.PersistenceManager
- com.softwarepathfinder.utils.Log

Type: com.softwarepathfinder.parsing.java.InvocationVisitor SLOC: 220 Number of Internal Dependencies: 5

INTERNAL DEPENDENCIES:

- com.softwarepathfinder.model.Field
- com.softwarepathfinder.model.Method
- com.softwarepathfinder.model.Project
- com.softwarepathfinder.model.Type
- com.softwarepathfinder.utils.Log

Type: com.softwarepathfinder.visualization.yEd.TypeGraphML SLOC: 199 Number of Internal Dependencies: 6

INTERNAL DEPENDENCIES:

- com.softwarepathfinder.model.Field
- com.softwarepathfinder.model.Invocation
- com.softwarepathfinder.model.Locus
- com.softwarepathfinder.model.Method
- com.softwarepathfinder.model.Type
- com.softwarepathfinder.utils.exceptions.ConfException

Type: com.softwarepathfinder.parsing.php.InvocationVisitor SLOC: 181 Number of Internal Dependencies: 3

INTERNAL DEPENDENCIES:

- com.softwarepathfinder.model.Method
- com.softwarepathfinder.model.Project
- com.softwarepathfinder.model.Type

Processing time: 708 milliseconds

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D:\programs\drtools-metric
λ drtools-metric \JavaApps\Doutorado\repos\hibernate-orm-master\ -tc --console --top 35

TYPES	DEP	I-DEP	FAN-IN	FAN-OUT
org.hibernate.persister.entity.AbstractEntityPersister	138	110	17	134
org.hibernate.test.legacy.FooBarTest	79	44	0	54
org.hibernate.boot.model.source.internal.hbm.ModelBinder	144	125	2	142
org.hibernate.test.hql.ASTParserLoadingTest	82	50	0	67
org.hibernate.cfg.AnnotationBinder	160	37	11	43
org.hibernate.internal.SessionImpl	170	121	18	156
ate.cfg.annotations.reflection.JPAOverriddenAnnotationReader	124	7	3	21
nate.test.querycache.AbstractQueryCacheResultTransformerTest	35	21	2	34
org.hibernate.loader.Loader	86	69	15	79
org.hibernate.userguide.hql.HQLTest	46	17	0	18
org.hibernate.boot.internal.InFlightMetadataCollectorImpl	99	79	2	93
g.hibernate.persister.collection.AbstractCollectionPersister	90	78	8	88
org.hibernate.test.criteria.CriteriaQueryTest	54	29	0	33
org.hibernate.engine.internal.StatefulPersistenceContext	64	42	5	51
org.hibernate.cfg.annotations.CollectionBinder	105	41	6	46
org.hibernate.test.readonly.ReadOnlyProxyTest	19	9	0	12
org.hibernate.internal.CoreMessageLogger	41	15	284	16
hibernate.internal.util.collections.BoundedConcurrentHashMap	20	0	3	30
org.hibernate.query.internal.AbstractProducedQuery	94	40	6	53
org.hibernate.jpa.test.query.QueryTest	39	13	0	18
org.hibernate.test.immutable.ImmutableTest	23	13	0	17
org.hibernate.dialect.AbstractHANADialect	98	65	59	81
org.hibernate.test.hql.BulkManipulationTest	34	14	0	22
org.hibernate.test.hql.HQLTest	62	40	0	45
org.hibernate.test.readonly.ReadOnlySessionLazyNonLazyTest	18	5	0	7
org.hibernate.internal.SessionFactoryImpl	126	94	11	112
org.hibernate.dialect.Dialect	111	85	312	92
hancement.lazy.proxy.DeepInheritanceWithNonEntitiesProxyTest	24	9	0	17
org.hibernate.test.readonly.ReadOnlyCriteriaQueryTest	25	16	0	18
org.hibernate.cfg.annotations.EntityBinder	87	31	12	40
org.hibernate.test.legacy.ParentChildTest	43	20	0	24
org.hibernate.hql.internal.ast.HqlSqlWalker	88	66	39	79
org.hibernate.boot.internal.SessionFactoryOptionsBuilder	122	37	2	43
org.hibernate.test.readonly.ReadOnlySessionTest	17	6	0	8
org.hibernate.query.criteria.internal.CriteriaBuilderImpl	75	45	69	54

Processing time: 37 seconds

D:\programs\drtools-metric

λ |

Uso

```
C:\Program Files\cmder
λ drtools-metric D:\JavaApps\Doutorado\repos\hibernate-orm-master\ -s --console
```

```
SUMMARY OF METRICS
```

```
Total of Namespaces: 1371
Total of Types: 9954 - 7,26 (number of types/namespaces)
Total of SLOC: 738683 - 74,21 (number of SLOC/types)
Total of Methods: 75730 - 7,61 (number of methods/types)
Total of CYCLO: 106331 - 10,68 (number of CYCLO/types)
```

```
Processing time: 38 seconds
```

```
C:\Program Files\cmder
λ drtools-metric D:\JavaApps\Doutorado\repos\hibernate-orm-master\ -mv --save
Generating files to drtools-metric-visualization tool
Please, wait...
```

```
Summary info (CSV).....[DONE]
Namespaces info (CSV).....[DONE]
Types info (CSV).....[DONE]
Methods info (CSV).....[DONE]
Namespace coupling info (CSV).....[DONE]
Internal dependencies info (JSON)....[DONE]
Cyclic dependencies info (CSV).....[DONE]
Metric thresholds info (CSV).....[DONE]
Type coupling info (CSV).....[DONE]
```

To use the data with drtools-metric visualization, you need:

- 1 - create a folder of your project within the datasets folder
- 2 - copy the generated files (CSV and JSON) to the created folder
- 3 - do the setup on dr-tools-properties.js and you're done!

```
C:\Program Files\cmder
λ |
```



**metric
visualization**
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Metric Visualization

A tool quality suite to help the developers to maintain health and code evolution

PROJECT SUMMARY

Software Pathfinder

[View Thresholds](#)

13

Namespaces

65

Number of Types

4665

SLOC

402

Number of Methods



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Thermometer

Summary Visualization



Namespaces

Using NOC and NAC



Types

Using NOM, SLOC, and WMC



Methods

Using CYCLO, MLOC, and CALLS



Internal Dependencies

Internal dependencies of types



Namespace Coupling

Using CA and CE



Type Coupling

Coupling between types (input/output)



Instability/Abstractness/Distance

Using I, A, and D



Instability and Abstractness

Using I and A



Type Coupling

Using DEP, I-DEP, FAN-IN, and FAN-OUT



Cyclic Dependencies

Cyclic dependencies between types



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Metric Thresholds Information

Project: Software Pathfinder

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PROJECT

Acronym	Name	Description
SMALL	Small Project	small project with < 50 KLOC or 200 < classes
MEDIUM	Medium Project	medium project with (50 KLOC <= project <= 250 KLOC) or (200 <= classes <= 1000)
LARGE	Large Project	large project with > 250 KLOC or > 1000 classes

NAMESPACE

Acronym	Name	Description
NOC	Number of Types/Classes	Good: <= 1; Regular: between 11 and 28; Bad: > 28
NAC	Number of Abstract Types/Classes	without references

TYPE

Acronym	Name	Description
SLOC	Type/Class Line of Code	Bad: > 500



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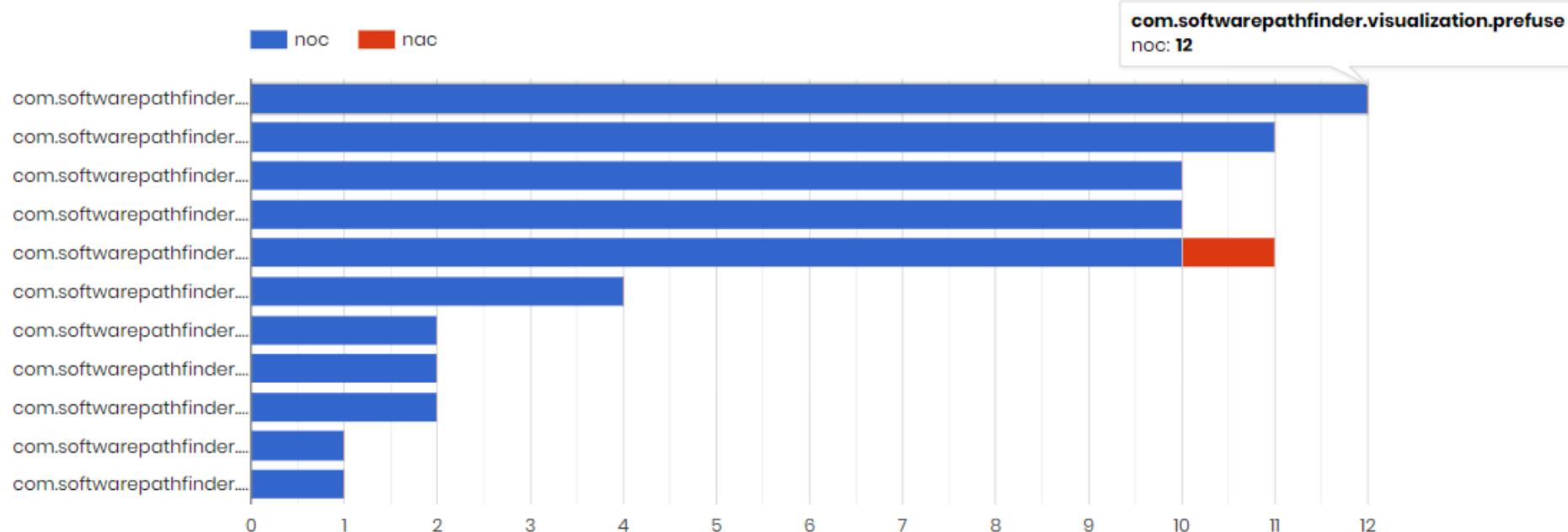
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Namespace Visualization

NOC (Number of Classes/Types) and NAC (Number of Abstract Classes/Types)

Project: Software Pathfinder

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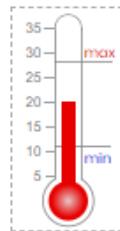
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Thermometer Visualization

Project: Findbugs 3.0.1

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Types (types/namespaces)



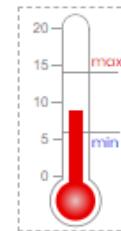
Total of Namespaces: 58

Total of Types: 1161

Types/namespaces: 20

Total of SLOC: 130364

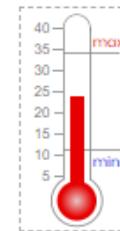
Methods (methods/types)



Total of Methods: 10753

Methods/Types: 9

Complexity (WMC/types)



Total of Complexity: 28447

Complexity/Types: 24



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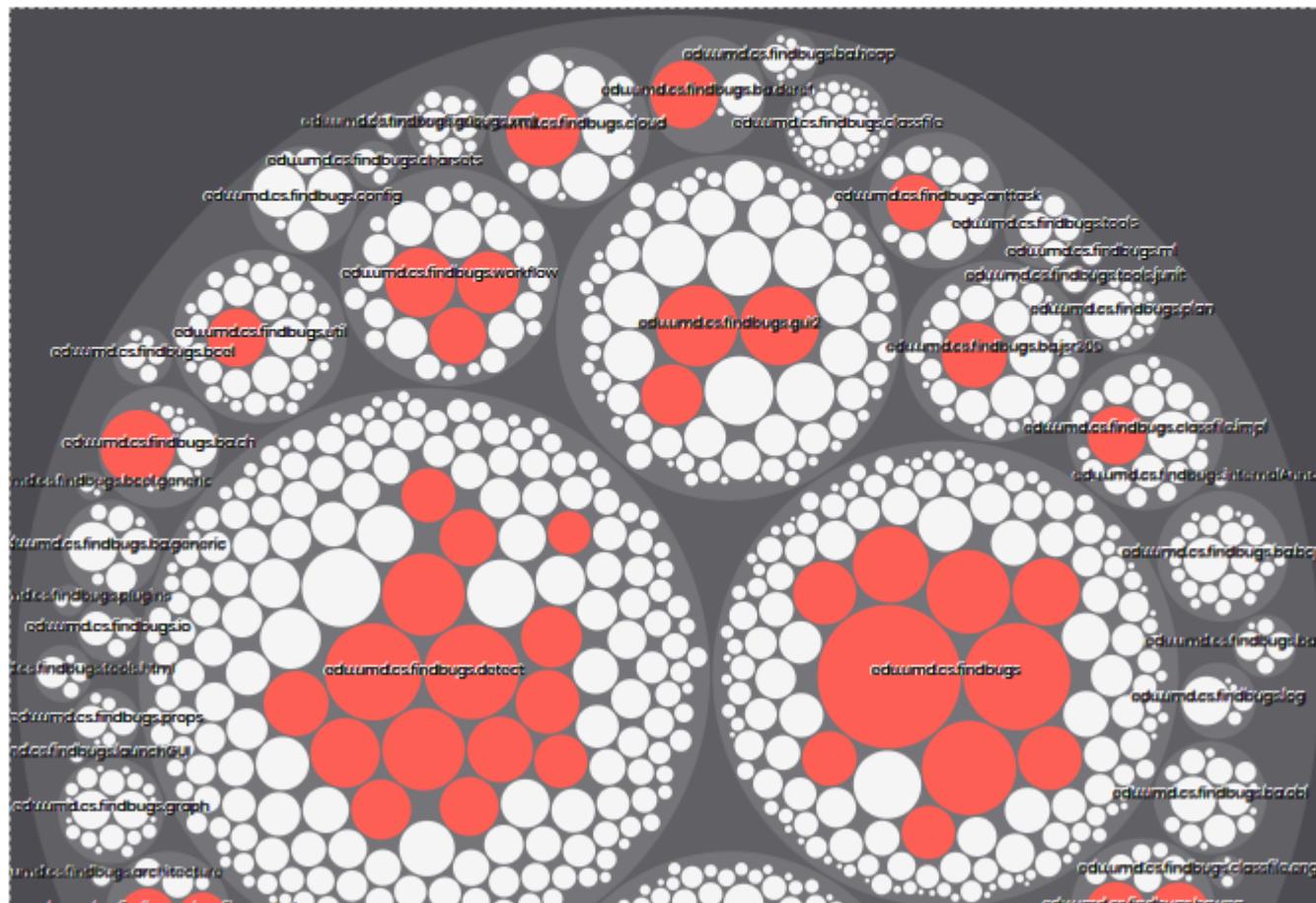
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Code Resonance

Bubble Size (SLOC - Lines of Code) and Bubble Color (The most complex classes are red bubbles, with high WMC)

Project Findbugs 3.0.1

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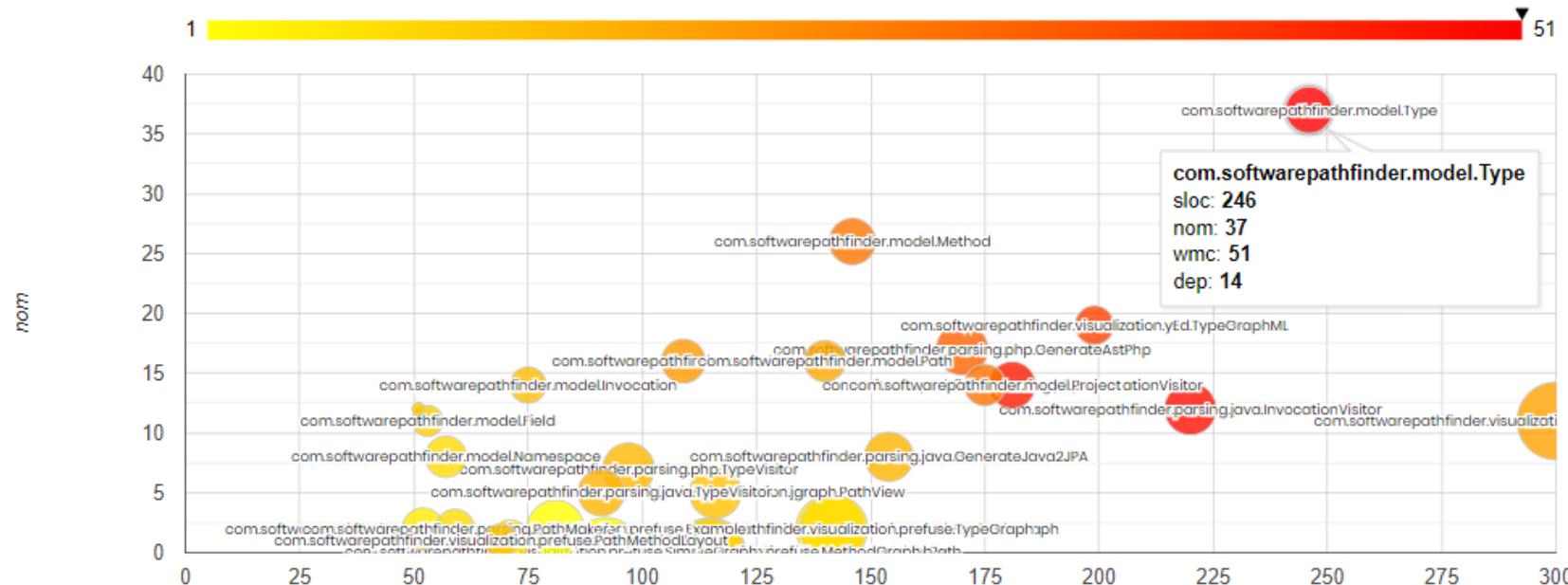
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Type Visualization

Types with Number of Methods/Functions (NOM - y axis), Lines of Code (SLOC - x axis), Complexity (WMC - bubble color), and Dependencies (DEP - bubble size)

Project: Software Pathfinder

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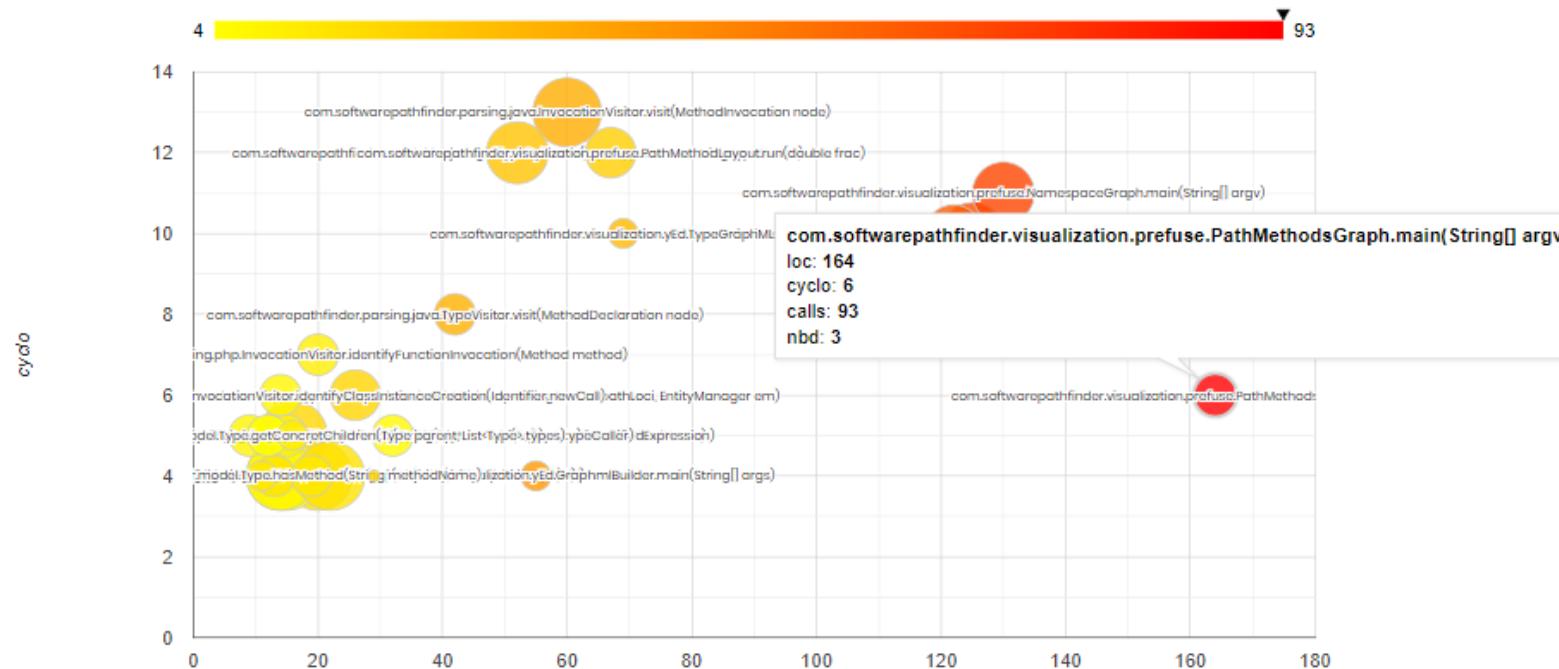
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Method Visualization

Methods with Complexity (CYCLO - y axis), Lines of Code (MLOC - x axis), Number of Invocations (CALLS - bubble color), and Nested Block Depth (NBD - bubble size)

Project: Software Pathfinder

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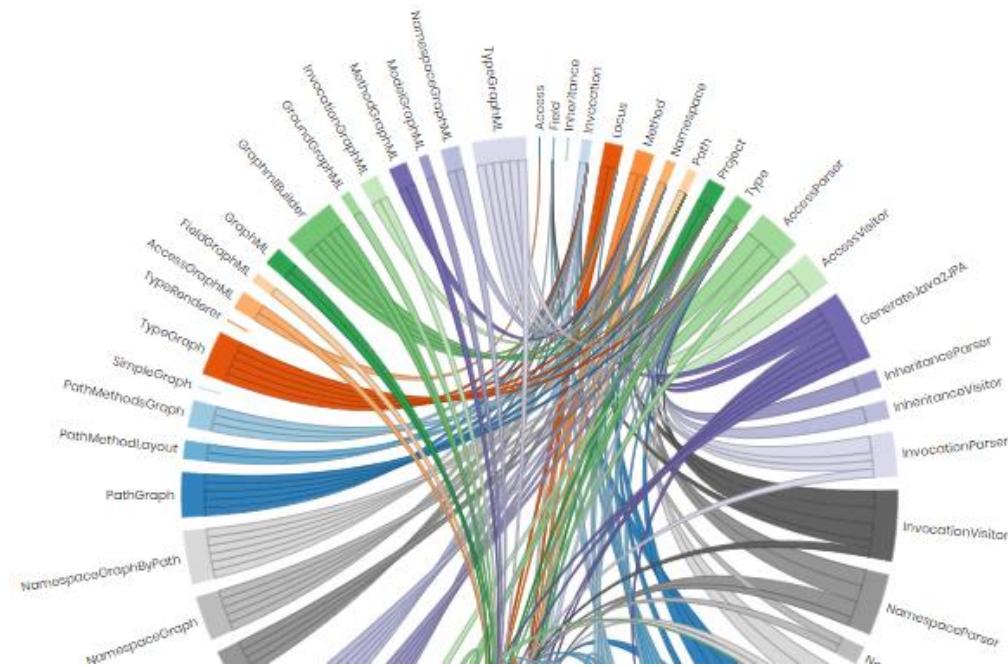
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Internal Dependencies Visualization

Internal dependencies between type/classes

Project Software Pathfinder

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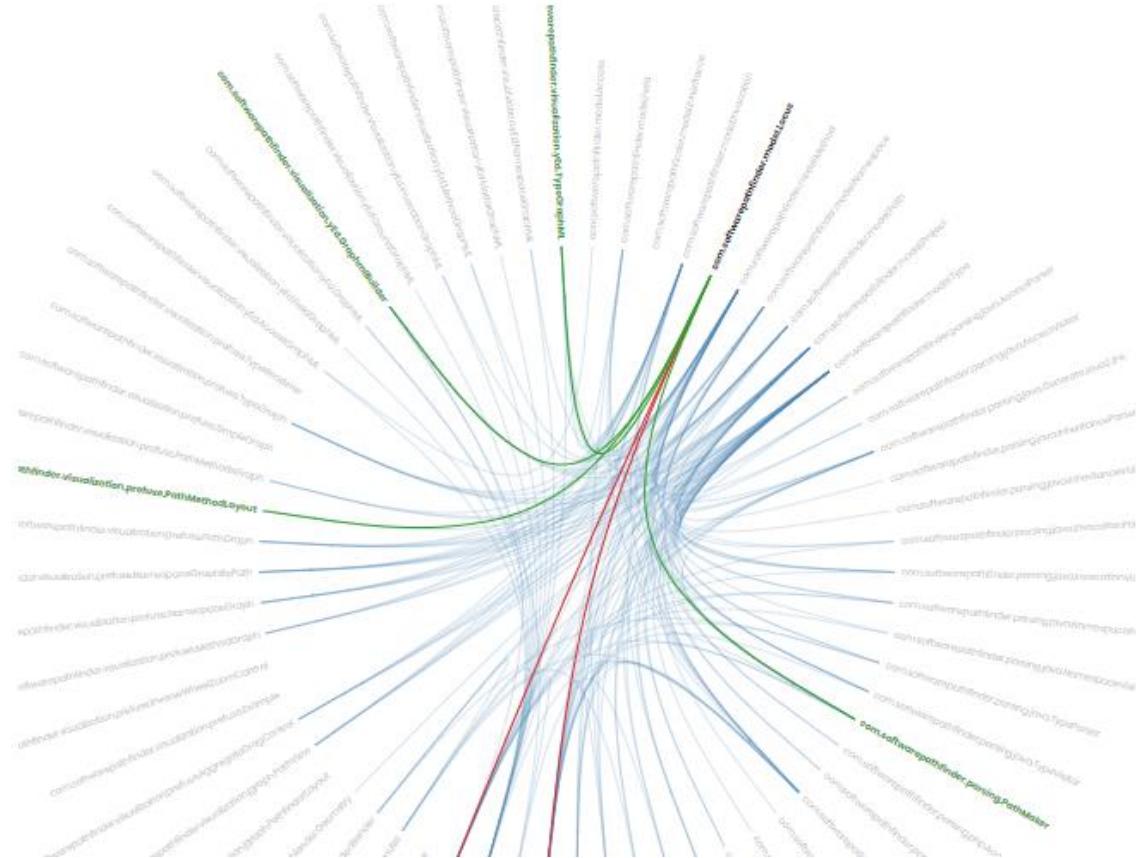
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Coupling (Input and Output) Visualization

Red lines (output coupling) and green lines (input coupling)

Project: Software Pathfinder

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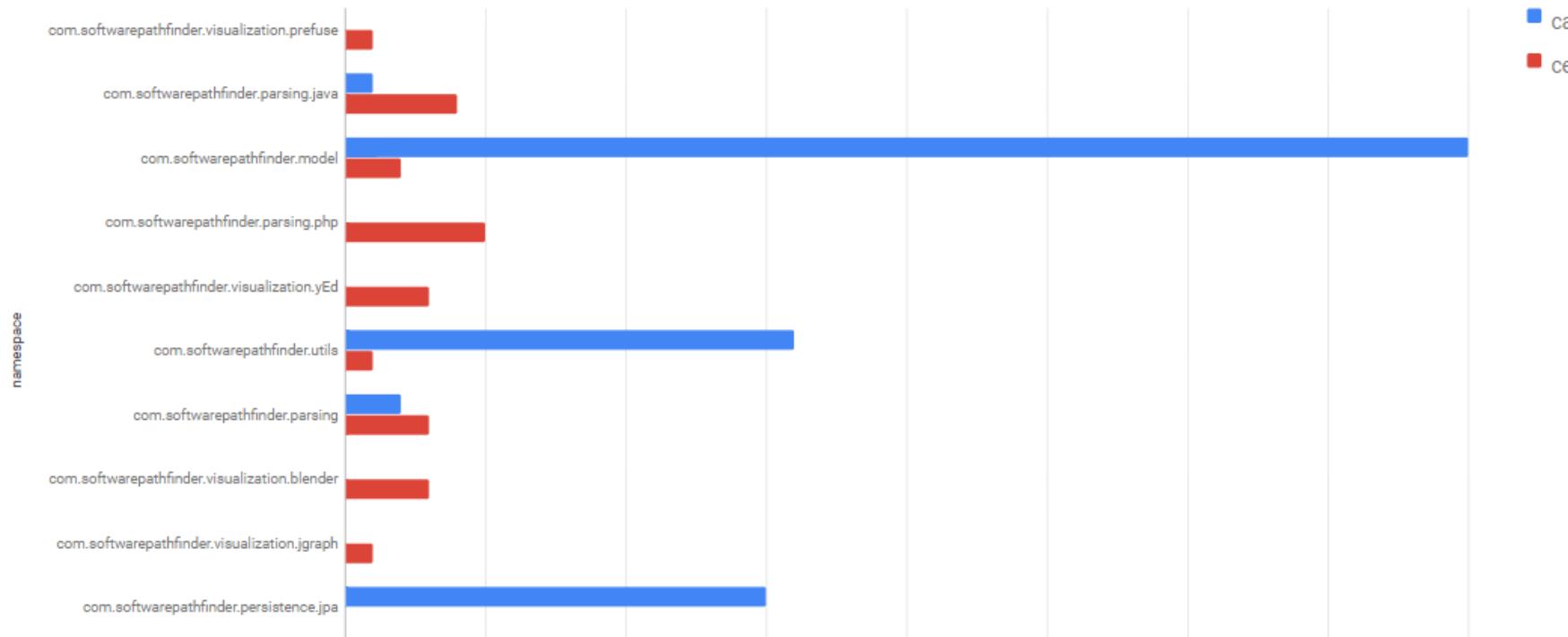


Namespace Coupling Visualization

CA (Afferent Coupling) and CE (Efferent Coupling)

Project: Software Pathfinder

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Instability/Abstractness/Distance Visualization

I (Instability), A (Abstractness Degree), and D (Normalized Distance)

Project: Software Pathfinder

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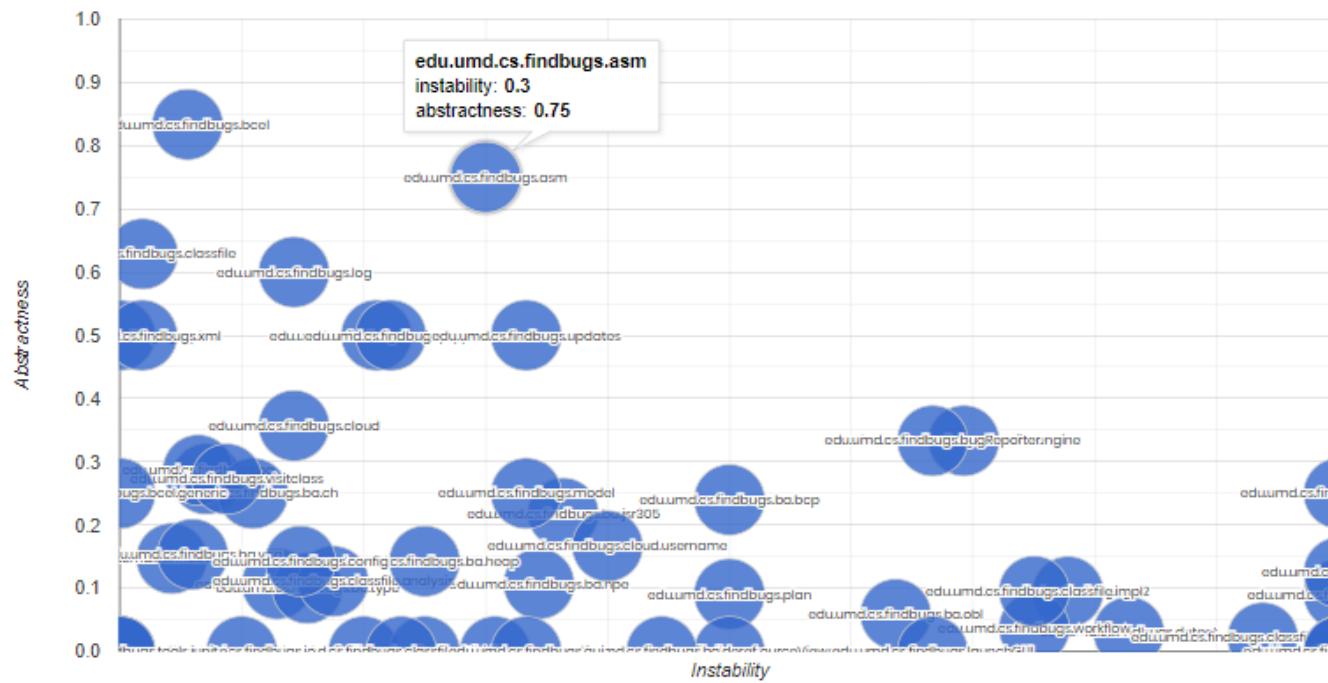
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Instability and Abstractness Visualization

Abstractness degree (y axis) and Instability (x axis)

Project Findbugs 3.0.1

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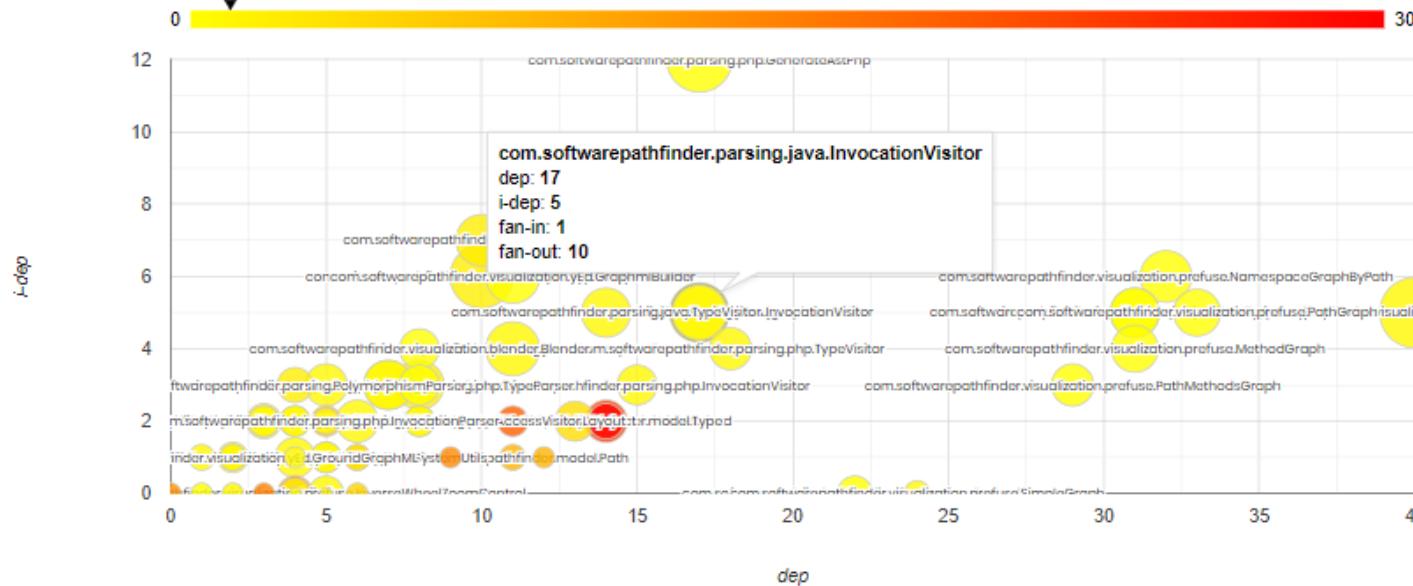
Uso

Type Coupling Visualization

Types with I-DEP (y axis), DEP (x axis), FAN-IN (bubble color), and FAN-OUT (bubble size)

Project: Findbugs 3.0.1

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Cyclic Dependencies Visualization

Cyclic Dependencies Visualization

Project: Findbugs 3.0.1

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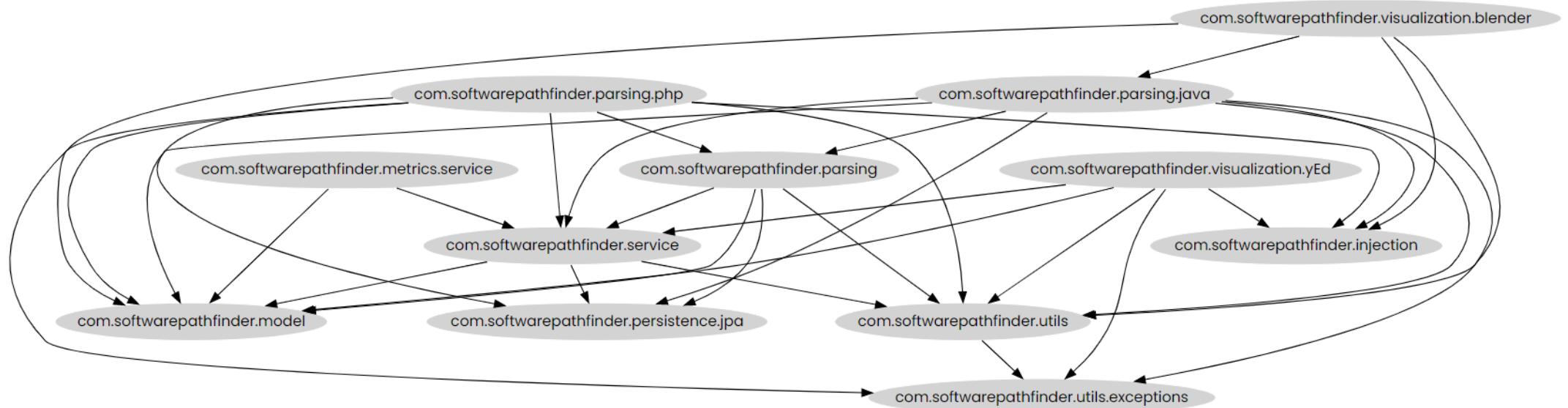
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Namespace Dependencies I

Hierarchical dependencies between namespaces

Project: Software Pathfinder

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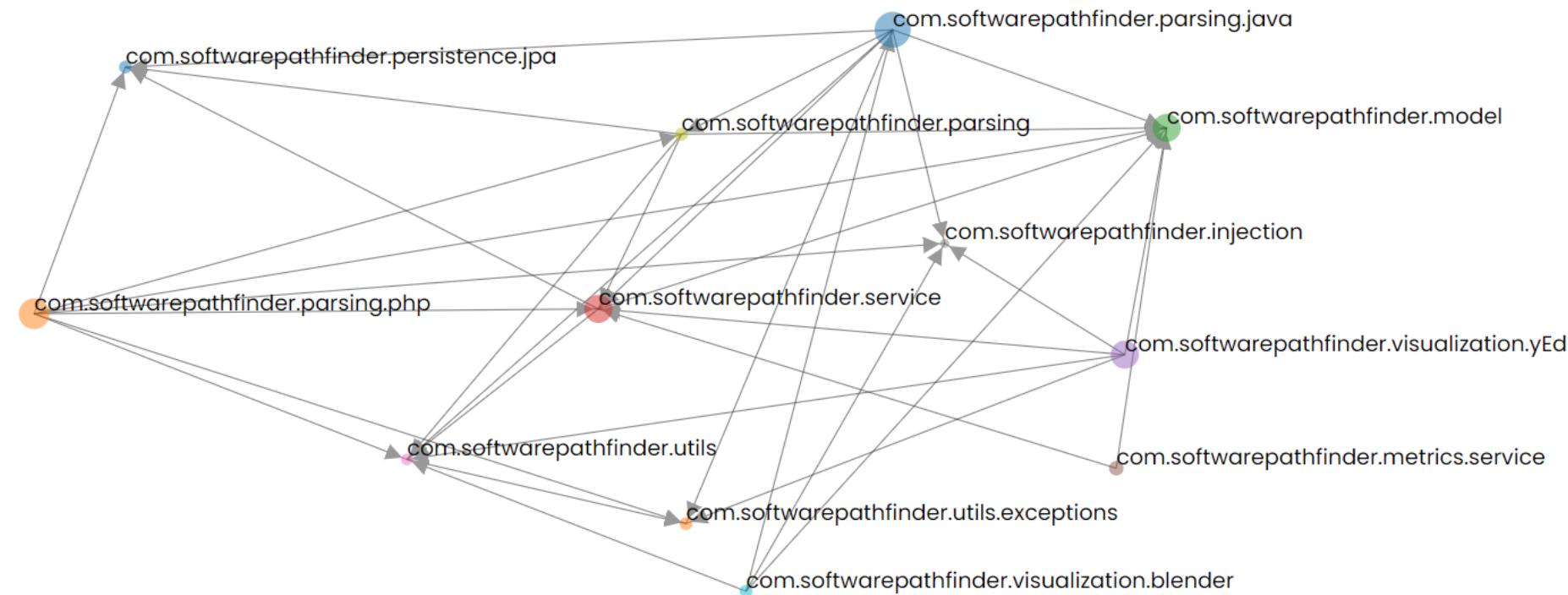
Namespace Dependencies II

Bubble Size (NOC - Number of Classes/Types)

Project: Software Pathfinder

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Disable name of namespaces



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32 Heurísticas de Análise

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Heurísticas - Summary

1. Contexto que fornece informações gerais sobre dimensões do Projeto

Indicativo de filtrar melhor as informações usando a opção '--top X' para ajudar no entendimento (Classificação: SMALL, MEDIUM e LARGE)

2. Considere o número médio de classes por namespace

Indicativo de que as classes não estão distribuídas uniformemente

3. Avalie o número médio de SLOC por classes

Indicativo de classes muito grandes

4. Observe a distribuição média de métodos por classes

Indicativo de muitos comportamentos por classe

5. Considere a complexidade média por classes

Indicativo de como está a complexidade das classes em geral



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Heurísticas - Namespaces

6. Observe a distribuição de classes por namespace

Se um namespace tem muitas classes (NOC alto), pode ser um indicativo de 'promiscuous package'

7. Avalie a distribuição de tipos abstratos (classes abstratas, interfaces) por namespaces

Indicativos para extensão e reuso

8. Avalie a relação das métricas NOC e NAC do namespace

Uma diferença muito grande entre eles pode indicar uma má distribuição entre tipos abstratos e tipos concretos



Heurísticas – Types (1)

9. Avalie as métricas além do SLOC

WMC, DEPS (DEP e I-DEP) e NOM/NPM são bons indicativos de como está a classe

10. Classe com NOA alto, mas baixo WMC e NOM alto

Pode ser um indicativo de POJO (Plain Old Java Object)

11. SLOC alto, mas sem muitos métodos (NOM/NPM baixo)

Pode ser um indicativo de 'long methods'

12. SLOC e WMC alto, mas sem muitos métodos (NOM/NPM baixo)

Pode ser um indicativo de 'complex class'

13. NOM/NPM alto pode ser indicativo de classe com muitas responsabilidades

Indica baixa coesão e possivelmente 'god class'



Heurísticas – Types (2)

14. **NOM/NPM alto e NOA baixo pode ser indicativo de classe com muitas responsabilidades**
Pode ser um indicativo de uma classe 'controller'
15. **NOM alto e NPM baixo pode indicar que o comportamento foi dividido**
Indicativo de métodos private/protected/default
16. **NOA alto pode ser indicativo de classe com muitas responsabilidades**
Pode ser um indicativo de baixa coesão, dificultando a manutenção
17. **DEP alto e I-DEP baixo pode indicar uma classe com muitas dependências externas**
Dependências de APIs externas (frameworks, libs)
18. **I-DEP alto (e por consequência DEP alto), pode indicar uma classe com muitas dependências de classe do projeto**
Incidência de alto acoplamento
19. **Alto LCOM3 pode indicar uma classe com baixa coesão**



Heurísticas – Methods

20. **PARAM alto pode ser indicativo de método com baixa coesão**
Possivelmente é um 'long method'
21. **CYCLO alto e MLOC baixo pode ser um 'complex method'**
Indicativo de problema de complexidade, legibilidade e entendimento
22. **NBD alto pode ser um 'complex/long method'**
Indicativo de problema de complexidade, legibilidade e entendimento
23. **CALLS alto pode indicar alto acoplamento**
Indicativo de problema de várias dependências
24. **MLOC alto, CYCLO alto, CALLS alto e NBD alto é forte indicativo de mais de um problema**
Pode ser um indicativo de um 'complex/long method'



Heurísticas – Coupling (1)

25. Evite dependência cíclicas

Tornam as mudanças complexas e gera a 'síndrome da compilação total'

26. CA alto pode indicar que o namespace é estável

Se ele mudar, vai fazer com que quem dependa dele seja alterado

27. CE alto pode indicar que o namespace é instável

A incidência de mudança em outros namespaces que ele depende vai fazer com que ele mude

28. I indica como está a instabilidade do namespace

I=0, namespace estável ao máximo; I=1, namespace instável ao máximo



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Heurísticas – Coupling (2)

- 29. Se $I=0$, indica que $CA > 0$ e $CE=0$, indica uma estabilidade total**

Ele é responsável e independente. Os dependentes tornam difícil alterá-lo e não tem dependência de outros que pode forçar a mudança

- 30. A indica como está o grau de abstração do namespace**

$A=0$, namespace não tem tipos abstratos; $A=1$, namespace somente possui tipos abstratos



Heurísticas – Coupling (3)

- 31. Considere namespaces que estão nas zonas de exclusão**

Zone of Pain (namespaces com I e A próximos a 0) e Zone of Uselessness (namespaces com I e A próximos a 1)

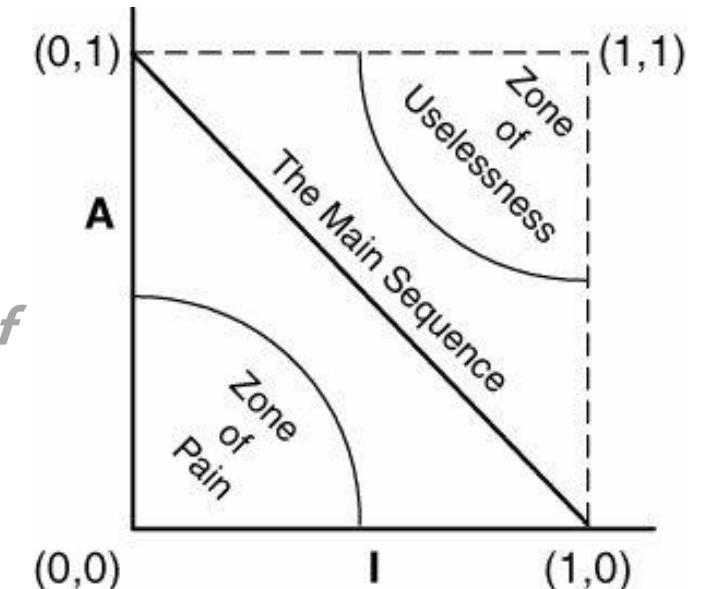
- 32. Namespace situado próximo a sequência principal indica que não é abstrato nem instável demais**

Valor de D (entre 0 e 1) que vai indicar a posição na sequência principal

- 33. D indica o quanto longe um namespace está da sequência principal**

D próximo a 0 indica proximidade da sequência principal; D próximo a 1, indica distância da sequência principal

Estes valores (mais próximo a 1) podem indicar quando um namespace está passível de manutenção e menos sensível a mudanças



Live demo!



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Questões??



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A tool quality suite to help the
developers to maintain health and code evolution

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