Towards Multi-Class Socio-Technical Congruence: An Exploratory Case Study in DevSecOps

November 13, 2023

1   Online Appendix

Table 1: Selected Github repositories in our method

ID	Repo_name	Repo_URL
1	ros/rosdistro	https://github.com/ros/rosdistro
2	cloudfoundry/cloud_controller_ng	https://github.com/cloudfoundry/cloud_controller_ng
3	edx/configuration	https://github.com/edx/configuration
4	matplotlib/matplotlib	https://github.com/matplotlib/matplotlib
5	ansible/ansible-modules-extras	https://github.com/ansible/ansible-modules-extras
6	DataDog/dd-agent	https://github.com/DataDog/dd-agent
7	ansible/ansible-modules-core	https://github.com/ansible/ansible-modules-core
8	rg3/youtube-dl	https://github.com/rg3/youtube-dl
9	Theano/Theano	https://github.com/Theano/Theano
10	emberjs/guides	https://github.com/emberjs/guides
11	zulip/zulip	https://github.com/zulip/zulip
12	bbatsov/rubocop	https://github.com/bbatsov/rubocop
13	bundler/bundler	https://github.com/bundler/bundler
14	coreos/rkt	https://github.com/coreos/rkt
15	google/closure-compiler	https://github.com/google/closure-compiler
16	Kapeli/Dash-User-Contributions	https://github.com/Kapeli/Dash-User-Contributions
17	Katello/katello	https://github.com/Katello/katello
18	samtools/htsjdk	https://github.com/samtools/htsjdk
19	zendesk/samson	https://github.com/zendesk/samson
20	thoughtbot/suspenders	https://github.com/thoughtbot/suspenders
21	sferik/rails_admin	https://github.com/sferik/rails_admin
22	scikit-image/scikit-image	https://github.com/scikit-image/scikit-image
23	Flexget/Flexget	https://github.com/Flexget/Flexget
24	GeoNode/geonode	https://github.com/GeoNode/geonode
25	biolab/orange3	https://github.com/biolab/orange3
26	oppia/oppia	https://github.com/oppia/oppia
27	svenfuchs/rails-i18n	https://github.com/svenfuchs/rails-i18n
28	rubygems/rubygems	https://github.com/rubygems/rubygems
29	spotify/luigi	https://github.com/spotify/luigi
30	docker/machine	https://github.com/docker/machine
31	hylang/hy	https://github.com/hylang/hy
32	apache/libcloud	https://github.com/apache/libcloud
33	refinery/refinerycms	https://github.com/refinery/refinerycms
34	DSpace/DSpace	https://github.com/DSpace/DSpace
35	elastic/logstash	https://github.com/elastic/logstash
36	pyca/cryptography	https://github.com/pyca/cryptography
37	KeepSafe/aiohttp	https://github.com/KeepSafe/aiohttp
38	lisa-lab/pylearn2	https://github.com/lisa-lab/pylearn2
39	python/mypy	https://github.com/python/mypy
40	thoughtbot/shoulda-matchers	https://github.com/thoughtbot/shoulda-matchers
41	gratipay/gratipay.com	https://github.com/gratipay/gratipay.com
42	pypa/pip	https://github.com/pypa/pip
43	twisted/twisted	https://github.com/twisted/twisted
44	plataformatec/simple_form	https://github.com/plataformatec/simple_form
45	cloudfoundry/loggregator	https://github.com/cloudfoundry/loggregator
46	fastlane/fastlane	https://github.com/fastlane/fastlane
47	travis-ci/travis-build	https://github.com/travis-ci/travis-build
48	pfnet/chainer	https://github.com/pfnet/chainer
49	Yelp/paasta	https://github.com/Yelp/paasta
50	stephenmcd/mezzanine	https://github.com/stephenmcd/mezzanine

Table 1: Cont. Selected repositories cont.

ID	Repo_name	Repo_URL
51	cloudfoundry/uaa	https://github.com/cloudfoundry/uaa
52	GoogleCloudPlatform/PerfKitBenchmarker	https://github.com/GoogleCloudPlatform/PerfKitBenchmarker
53	intelsdi-x/snap	https://github.com/intelsdi-x/snap
54	xonsh/xonsh	https://github.com/xonsh/xonsh
55	berkshelf/berkshelf	https://github.com/berkshelf/berkshelf
56	ipfs/go-ipfs	https://github.com/ipfs/go-ipfs
57	docker/swarm	https://github.com/docker/swarm
58	rapidftr/RapidFTR	https://github.com/rapidftr/RapidFTR
59	Pylons/pyramid	https://github.com/Pylons/pyramid
60	rackerlabs/blueflood	https://github.com/rackerlabs/blueflood
61	SciTools/iris	https://github.com/SciTools/iris
62	sharetribe/sharetribe	https://github.com/sharetribe/sharetribe
63	boto/boto	https://github.com/boto/boto
64	puppetlabs/puppetlabs-mysql	https://github.com/puppetlabs/puppetlabs-mysql
65	caelum/vraptor4	https://github.com/caelum/vraptor4
66	openshift/geard	https://github.com/openshift/geard
67	pantsbuild/pants	https://github.com/pantsbuild/pants
68	ngageoint/geowave	https://github.com/ngageoint/geowave
69	kivy/kivy	https://github.com/kivy/kivy
70	shazow/urllib3	https://github.com/shazow/urllib3
71	networkx/networkx	https://github.com/networkx/networkx
72	travis-ci/travis-core	https://github.com/travis-ci/travis-core
73	mozilla/kitsune	https://github.com/mozilla/kitsune
74	capistrano/capistrano	https://github.com/capistrano/capistrano
75	mozilla/socorro	https://github.com/mozilla/socorro
76	thoughtbot/hound	https://github.com/thoughtbot/hound
77	checkstyle/checkstyle	https://github.com/checkstyle/checkstyle
78	nipy/dipy	https://github.com/nipy/dipy
79	CloudifySource/cloudify	https://github.com/CloudifySource/cloudify
80	biocore/scikit-bio	https://github.com/biocore/scikit-bio
81	activeadmin/activeadmin	https://github.com/activeadmin/activeadmin
82	weaveworks/weave	https://github.com/weaveworks/weave
83	docker/docker-py	https://github.com/docker/docker-py
84	pallets/werkzeug	https://github.com/pallets/werkzeug
85	python-pillow/Pillow	https://github.com/python-pillow/Pillow
86	pydanny/cookiecutter-django	https://github.com/pydanny/cookiecutter-django
87	travis-ci/travis-cookbooks	https://github.com/travis-ci/travis-cookbooks
88	MongoEngine/mongoengine	https://github.com/MongoEngine/mongoengine
89	ratpack/ratpack	https://github.com/ratpack/ratpack
90	mperham/sidekiq	https://github.com/mperham/sidekiq
91	ga4gh/server	https://github.com/ga4gh/server
92	convox/rack	https://github.com/convox/rack
93	sunpy/sunpy	https://github.com/sunpy/sunpy
94	translate/translate	https://github.com/translate/translate
95	pry/pry	https://github.com/pry/pry
96	vispy/vispy	https://github.com/vispy/vispy
97	apache/drill	https://github.com/apache/drill
98	fsouza/go-dockerclient	https://github.com/fsouza/go-dockerclient
99	ethereum/go-ethereum	https://github.com/ethereum/go-ethereum
100	letsencrypt/boulder	https://github.com/letsencrypt/boulder

Table 2: Results for STC and 2C-STC for four thresholds

ID	STC	2C-STC (0.1)	2C-STC (0.25)	2C-STC (0.5)	2C-STC (0.75)
1	0.3573	0.259	0.1415	0.1838	0.1838
2	0.2902	0.3036	0.2212	0.2051	0.1298
3	0.4051	0.4566	0.4279	0.3578	0.1332
4	0.1409	0.134	0.134	0.134	0
5	0.0454	0.0437	0.0302	0.0286	0.0292
6	0.1788	0.121	0.1336	0.0824	0.0772
7	0.0607	0.0704	0.0502	0.0424	0.0392
8	0.1146	0.0945	0.0835	0.0472	0.0381
9	0.2327	0.1867	0.1429	0.0862	0.0966
10	0.0608	0.0382	0.0382	0.0366	0.0295
11	0.2108	0.1722	0.1447	0.0954	0.0928
12	0.4763	0.5661	0.4307	0.4307	0.4153
13	0.1745	0.1399	0.1035	0.1049	0.0894
14	0.2593	0.3125	0.2854	0.2854	0.2854
15	0.1673	0.1363	0.085	0.0646	0.0646
16	0.0779	0	0	0	0
17	0.4116	0.4954	0.451	0.4375	0.4375
18	0.1795	0	0	0	0
19	0.3221	0.2774	0.2844	0.2832	0.068
20	0.4647	0.5953	0.1	0.1	0.1
21	0.1359	0.1766	0.181	0.1732	0.0907
22	0.1525	0.0896	0.0796	0.0719	0.0642
23	0.1266	0.1204	0.1262	0.1317	0.0512
24	0.3147	0.2727	0.2245	0.2245	0.1562
25	0.407	0.4141	0.1429	0.1429	0
26	0.2684	0.2641	0.2137	0.0494	0.0494
27	0.1115	0.0539	0.0539	0.0539	0.0539
28	0.1217	0.0921	0.0742	0.0745	0.0624
29	0.149	0.1444	0.1488	0.1488	0.0319
30	0.1403	0.1366	0.122	0.1148	0.051
31	0.4725	0.4208	0.375	0	0
32	0.2304	0.1952	0.1581	0.1575	0.1373
33	0.1215	0.087	0.0568	0.0382	0.0193
34	0.422	0.3964	0.3036	0.3093	0.2429
35	0.1291	0.1426	0.1121	0.1189	0.0604
36	0.1646	0.1731	0.1593	0.1374	0.1308
37	0.2585	0.4043	0.3629	0.2947	0.2482
38	0.345	0	0	0	0
39	0.1965	0.2124	0.1324	0.0419	0
40	0.1796	0.208	0.1971	0.1971	0.2411
41	0.3365	0.2961	0.1796	0.096	0.025
42	0.1332	0.1097	0.0957	0.0929	0.1018
43	0.3278	0.3611	0.3364	0.1761	0.1949
44	0.2378	0.1736	0.1736	0.1736	0.1736
45	0.477	0.4444	0	0	0
46	0.0533	0.0575	0.0388	0.0359	0.0339
47	0.1883	0.1351	0.1278	0.1278	0
48	0.3823	0.3482	0.2698	0	0
49	0.5558	0.6081	0.5293	0.4342	0.4418
50	0.1475	0.211	0.1279	0.057	0.04

Table 2: Cont.: Results for STC and 2C-STC for four thresholds

ID	STC	2C-STC (0.1)	2C-STC (0.25)	2C-STC (0.5)	2C-STC (0.75)
51	0.3382	0.3885	0.3017	0.3585	0.2792
52	0.4677	0.4731	0.3278	0.4643	0
53	0.3686	0.4595	0.4595	0.3694	0.3694
54	0.3094	0.1016	0.1016	0.1016	0.1492
55	0.2685	0.1952	0.1952	0.0781	0.0781
56	0.224	0.1485	0.0767	0.1189	0.1189
57	0.2605	0.1176	0.1176	0.1176	0.1176
58	0.5378	0.4911	0.4201	0.3001	0.3247
59	0.2798	0.3936	0.2945	0.261	0.3646
60	0.6395	0.2065	0.2065	0.1667	0.1667
61	0.5351	0	0	0	0
62	0.5288	0	0	0	0
63	0.1276	0.1251	0.1266	0.1245	0.084
64	0.2739	0.2963	0.2859	0.2752	0.2933
65	0.3021	0.1231	0	0	0
66	0.4784	0.6765	0	0	0
67	0.2361	0.2678	0.2287	0.2218	0
68	0.3652	0.4045	0.0753	0.0753	0
69	0.1711	0.2793	0.1925	0.1925	0.1925
70	0.3171	0.2977	0.2664	0.2558	0.2459
71	0.0853	0.1471	0.1471	0.1471	0.1471
72	0.3194	0.2211	0.2593	0.2206	0.2319
73	0.2556	0.1453	0.1412	0.0333	0
74	0.2451	0.2623	0.2308	0.133	0.1278
75	0.317	0.3011	0.3082	0	0
76	0.3489	0.2882	0.1556	0.045	0
77	0.2599	0.2414	0.2414	0.094	0.1286
78	0.3662	0	0	0	0
79	0.5411	0.595	0	0	0
80	0.5948	0	0	0	0
81	0.0844	0.0801	0.0926	0.1014	0.1241
82	0.3447	0.1907	0.1907	0.2119	0.161
83	0.1831	0.2265	0.1655	0.1436	0.1225
84	0.1407	0.1765	0.1389	0.1345	0.1417
85	0.1284	0.1004	0.1004	0.0736	0.0736
86	0.2277	0.1999	0.2027	0.1166	0.0931
87	0.1582	0.1032	0.0633	0.0633	0.0633
88	0.2774	0.1972	0.1374	0.1108	0.1108
89	0.2818	0.3491	0.3485	0.1154	0.1154
90	0.1056	0.0565	0.0662	0.0743	0.0488
91	0.517	0	0	0	0
92	0.3157	0.2612	0.2401	0.2277	0.282
93	0.2885	0.2559	0	0	0
94	0.2434	0.0818	0.0818	0.027	0.027
95	0.1809	0.2528	0.0871	0.0871	0.108
96	0.2113	0	0	0	0
97	0.3542	0.4822	0.3939	0.4924	0.2809
98	0.333	0.3863	0.3657	0.3585	0.3942
99	0.1024	0.0705	0.0632	0.0651	0.0597
100	0.3784	0.4506	0.3136	0.22	0.1918

Table 3: Vulnerability counts and VS for the selected projects

ID	C	H	M	L	VS
1	0	12	13	4	7.3138
2	0	0	85	1	6.8651
3	1	28	240	290	5.4494
4	0	1	18	8	6.0852
5	0	0	16	0	6.9
6	5	9	12	2	7.8821
7	0	1	26	0	6.9741
8	0	9	121	4	6.9448
9	0	7	15	8	6.5667
10	2	25	11	1	8.2641
11	0	7	64	46	5.8402
12	0	0	1	0	6.9
13	0	0	1	0	6.9
14	0	12	23	6	7.0463
15	0	1	0	0	8.9
16	0	4	1	1	7.7333
17	2	75	71	31	7.2531
18	0	13	12	4	7.3828
19	1	14	21	67	5.2505
20	0	0	1	0	6.9
21	0	4	2	0	8.2333
22	0	3	6	0	7.5667
23	0	8	40	20	6.2529
24	7	95	109	714	4.8132
25	0	0	10	0	6.9
26	0	7	32	100	4.8424
27	22	77	93	214	5.866
28	0	0	3	4	5.1857
29	0	0	25	26	5.3706
30	34	93	57	204	6.0737
31	6	8	45	225	4.6451
32	0	47	44	39	6.7231
33	0	0	1	0	6.9
34	24	94	91	462	5.2255
35	2	30	16	147	4.9779
36	0	6	6	184	4.1449
37	0	5	9	16	5.6333
38	0	0	47	3	6.72
39	0	6	33	43	5.4732
40	0	1	5	0	7.2333
41	1	11	179	143	5.6907
42	0	0	15	4	6.2684
43	0	1	26	42	5.1029
44	0	0	1	2	4.9
45	0	15	1	7	7.2913
46	0	5	54	0	7.0695
47	14	24	15	66	6.0042
48	0	2	38	58	5.1653
49	1	16	77	26	6.5425
50	0	3	16	0	7.2158
51	0	35	57	388	4.6208
52	6	23	122	427	4.7955
53	2	2	3	112	4.1622

ID	C	H	M	L	VS
54	0	0	12	0	6.9
55	0	0	1	0	6.9
56	0	23	19	2	7.8091
57	1	3	13	3	6.905
58	4	41	149	6	7.282
59	0	2	16	12	5.8333
60	8	450	237	115	7.6158
61	0	0	2	1	5.9
62	22	122	168	220	6.2462
63	5	36	99	126	5.8079
64	0	0	23	0	6.9
65	8	65	54	6	7.9286
66	0	4	3	3	6.8
67	6	20	58	228	4.8955
68	423	1700	3900	2100	6.7044
69	0	0	18	3	6.4714
70	0	0	1	1	5.4
71	0	1	5	4	5.9
72	0	0	48	4	6.6692
73	0	3	40	452	4.1727
74	0	13	22	4	7.259
75	1	9	35	6	6.9608
76	4	55	72	6	7.662
77	0	2	1	41	4.1955
78	0	0	20	0	6.9
79	33	137	181	36	7.5933
80	0	0	1	0	6.9
81	1	26	63	7	7.2515
82	30	126	243	341	5.9838
83	12	16	72	450	4.5713
84	0	1	10	2	6.5923
85	0	0	10	0	6.9
86	0	0	1	188	3.9159
87	2	2	4	0	8.175
88	0	0	3	9	4.65
89	0	0	4	1	6.3
90	0	1	1	0	7.9
91	8	18	40	20	6.9093
92	25	91	274	718	5.1902
93	0	0	4	2	5.9
94	0	3	16	2	6.9
95	0	1	10	9	5.65
96	0	2	6	0	7.4
97	79	168	488	337	6.4988
98	0	45	73	36	6.7831
99	0	46	40	1	7.923
100	2	54	206	274	5.5795