Metrics	Description
Structure Dimension	
Class distribution (6)	The percentages of all classes appeared in the trace that are defined in UserCode, 3rdLib, and the SDK, respectively, counting unique class signatures only, and the same three percentages but counting all instances of each class signature.
Method distribution (6)	The same six percentages as for class distribution but counting method sigatures.
Inter-layer interaction (9)	The percentage of calls appeared in the trace that are between any two of the three layers (UserCode, 3rdLib, SDK), counting all instances of calls.
Component distribution (8)	The percentage of all executed components that are of each of the four component types (Activity, Service, BroadcastReceiver, ContentProvider), respectively, counting unique component signatures only, and the same four percentages but counting all instances of each component signature.
Callback invocation (4)	The percentages of all exercised call targets that are lifecycle methods and event handlers, respectively, counting unique method signatures only, and the same two percentages but counting all instances of each method signature.
Callback categorization (30)	The percentage of all invoked lifecycle methods that are in each of the five categorizes we defined, the percentage of all invoked event handlers that are in each of the ten categorizes we defined, all counting unique method signatures only; and the same 15 percentages but counting all instances of each method signature.
ICC Dimension	
Connection type (4)	The percentage of all exercised ICCs that are in each of the four possible categories, counting all instances of ICC Intents.
Data payload (3)	The percentages of all exercised ICCs that carry URI data only, bundle data only, and both forms of data, respectively, counting all instances of ICC Intents.
Security Dimension	
Source/sink invocation (4)	The percentages of all exercised call targets that are sources and sinks, respectively, counting unique method signatures only, and the same two percentages but counting all instances of each method signature.
Risky source/sink invocation (4)	The percentages of all invoked sources and sinks that are risky, respectively, counting unique method signatures only, and the same two percentages but counting all instances of each method signature.
Source/sink categorization (22)	The percentage of all invoked sources that are in each of the five categorizes we used, the percentage of all invoked sinks that are in each of the six categorizes we used, all counting unique method signatures only; and the same 11 percentages but counting all instances of each method signature.

Risky source/sink categorization (22)	The percentage of all invoked risky sources that are in each of the five categorizes we used, the percentage of all invoked risky sinks that are in each of the six categorizes we used, all counting unique method signatures only; and the same 11 percentages but counting all instances of each method signature.

The *D** set consists of metrics with respect to which the mean of benign benchmark apps and that of malicious benchmark apps differ by at least 2% (i.e., *noticeably different*)
The *D* set consists of metrics with respect to which the mean of benign benchmark apps and that of malicious benchmark apps differ by at least 5% (i.e., *disparately different*)

Dimension	Id	Name	Description	in *D** Set	in *D* Set
	1	SDK->SDK	Percentage of calls from SDK to SDK	✔	✔
	2	SDK->3rdLib	Percentage of calls from SDK to third-party library		
	3	SDK->UserCode	Percentage of calls from SDK to user code		
	4	3rdLib->SDK	Percentage of calls from third-party library to SDK	✔	✔
	5	3rdLib->3rdLib	Percentage of calls from third-party library to third-party library		
	6	3rdLib->UserCode	Percentage of calls from third-party library to user code		
	7	UserCode->SDK	Percentage of calls from user code to SDK	✔	✔
	8	UserCode->3rdLib	Percentage of calls from user code to third-party library		
	9	UserCode->UserCode	Percentage of calls from user code to user code		
	10	userCode-cls	Percentage out of all executed classes that are defined in user code, counting unique class signatures only	✔	✔
	11	3rdLib-cls	Percentage out of all executed classes that are defined in third-party libraries, counting unique class signatures only	✔	
	12	sdk-cls	Percentage out of all executed classes that are defined in SDK, counting unique class signatures only	✔	
	13	userCode-me	Percentage out of all executed methods that are defined in user code, counting unique method signatures only	✔	✔
	14	3rdlib-me	Percentage out of all executed methods that are defined in third-party libraries, counting unique method signatures only	✔	
	15	sdk-me	Percentage out of all executed methods that are defined in SDK, counting unique method signatures only	✔	
	16	userCode-clsIns	Percentage out of all executed classes that are defined in user code, counting all class signature instances	✔	✔
	17	3rdLib-clsIns	Percentage out of all executed classes that are defined in third-party libraries, counting all class signature instances		
	18	sdk-clsIns	Percentage out of all executed classes that are defined in SDK, counting all class signature instances		
	19	userCode-meIns	Percentage out of all executed methods that are defined in user code, counting all method signature instances	✔	✔
	20	3rdlib-meIns	Percentage out of all executed methods that are defined in third-party libraries, counting all method signature instances		
	21	sdk-meIns	Percentage out of all executed methods that are defined in SDK, counting all method signature instances		
	22	activity	Percentage out of all executed components that are Activity components, counting unique class signatures	✔	
	23	service	Percentage out of all executed components that are Service components, counting unique class signatures	✔	
	24	receiver	Percentage out of all executed components that are BroadcastReceiver components, counting unique class signatures	✔	
	25	provider	Percentage out of all executed components that are ContentProvider components, counting unique class signatures		
	26	activityIns	Percentage out of all executed components that are Activity components, counting all class signature instances		
	27	serviceIns	Percentage out of all executed components that are Service components, counting all class signature instances		
	28	receiverIns	Percentage out of all executed components that are BroadcastReceiver components, counting all class signature instances	✔	
	29	providerIns	Percentage out of all executed components that are ContentProvider components, counting all class signature instances		
	30	lc	Percentage out of all executed methods that are lifecycle (callback) methods, counting unique method signatures		
	31	eh	Percentage out of all executed methods that are event handlers (callback) methods, counting unique method signatures		
	32	lc-ins	Percentage out of all executed methods that are lifecycle (callback) methods, counting all method signature instances		
	33	eh-ins	Percentage out of all executed methods that are event handlers (callback) methods, counting all method signature instances		

General					
General	34	Activity	Percentage out of all executed lifecycle methods that are callbacks defined in Activity components, counting unique method signatures	✔	✔
	35	Activity-Ins	Percentage out of all executed lifecycle methods that are callbacks defined in Activity components, counting all method signature instances	✔	✔
	36	Application	Percentage out of all executed lifecycle methods that are callbacks defined in Application classes/subclasses, counting unique method signatures	✔	✔
	37	Application-Ins	Percentage out of all executed lifecycle methods that are callbacks defined in Application classes/subclasses, counting all method signature instances	✔	✔
	38	BroadcastReceiver	Percentage out of all executed lifecycle methods that are callbacks defined in BroadcastReceiver components, counting unique method signatures		
	39	BroadcastReceiver-Ins	Percentage out of all executed lifecycle methods that are callbacks defined in BroadcastReceiver components, counting all method signature instances		
	40	ContentProvider	Percentage out of all executed lifecycle methods that are callbacks defined in ContentProvider components, counting unique method signatures	✔	
	41	ContentProvider-Ins	Percentage out of all executed lifecycle methods that are callbacks defined in ContentProvider components, counting all method signature instances	✔	
	42	Service	Percentage out of all executed lifecycle methods that are callbacks defined in Service components, counting unique method signatures	✔	
	43	Service-Ins	Percentage out of all executed lifecycle methods that are callbacks defined in Service components, counting all method signature instances	✔	
	44	APPLICATION_MANAGEMENT	Percentage out of all executed event handlers that are callbacks handling system events for application management, counting unique method signatures	✔	
	45	APPLICATION_MANAGEMENT-Ins	Percentage out of all executed event handlers that are callbacks handling system events for application management, counting all method signature instances	✔	
	46	SYSTEM_STATUS	Percentage out of all executed event handlers that are callbacks handling system events related to system status access and management, counting unique method signatures	✔	✔
	47	SYSTEM_STATUS-Ins	Percentage out of all executed event handlers that are callbacks handling system events related to system status access and management, counting all method signature instances	✔	✔
	48	LOCATION_STATUS	Percentage out of all executed event handlers that are callbacks handling system events related to location info access and management, counting unique method signatures	✔	
	49	LOCATION_STATUS-Ins	Percentage out of all executed event handlers that are callbacks handling system events related to location info access and management, counting all method signature instances	✔	
	50	HARDWARE_MANAGEMENT	Percentage out of all executed event handlers that are callbacks handling system events relevant to hardware management, counting unique method signatures		
	51	HARDWARE_MANAGEMENT-Ins	Percentage out of all executed event handlers that are callbacks handling system events relevant to hardware management, counting all method signature instances		
	52	NETWORK_MANAGEMENT	Percentage out of all executed event handlers that are callbacks handling system events relevant to network management, counting unique method signatures		
	53	NETWORK_MANAGEMENT-Ins	Percentage out of all executed event handlers that are callbacks handling system events relevant to network management, counting all method signature instances		
	54	APP_BAR	Percentage out of all executed event handlers that are callbacks handling UI events relevant to application bars, counting unique method signatures		

	#	Name	Description		
	55	APP_BAR-Ins	Percentage out of all executed event handlers that are callbacks handling events UI relevant to application bars, counting all method signature instances		
	56	MEDIA_CONTROL	Percentage out of all executed event handlers that are callbacks handling UI events relevant to media controls, counting unique method signatures		
	57	MEDIA_CONTROL-Ins	Percentage out of all executed event handlers that are callbacks handling UI events relevant to media controls, counting all method signature instances		
	58	VIEW	Percentage out of all executed event handlers that are callbacks handling UI events relevant to Views, counting unique method signatures	✓	✓
	59	VIEW-Ins	Percentage out of all executed event handlers that are callbacks handling UI events relevant to Views, counting all method signature instances	✓	✓
	60	WIDGET	Percentage out of all executed event handlers that are callbacks handling UI events relevant to widgets, counting unique method signatures		
	61	WIDGET-Ins	Percentage out of all executed event handlers that are callbacks handling UI events relevant to widgets, counting all method signature instances		
	62	DIALOG	Percentage out of all executed event handlers that are callbacks handling UI events relevant to dialogs, counting unique method signatures		
	63	DIALOG-Ins	Percentage out of all executed event handlers that are callbacks handling UI events relevant to dialogs, counting all method signature instances		
ICC	64	int_ex	Percentage out of all exercised ICCs that are internal explicit ICCs (those that are between components within the same app and have target specified explicitly)	✓	
	65	int_im	Percentage out of all exercised ICCs that are internal implicit ICCs (those that are between components within the same app and do NOT have target specified explicitly)		
	66	ext_ex	Percentage out of all exercised ICCs that are external explicit ICCs (those that are between components across two different apps and have target specified explicitly)	✓	
	67	ext_im	Percentage of all exercised ICCs that are internal implicit ICCs (those that are between components across two different apps and do NOT have target specified explicitly)		
	68	data_only	Percentage out of all exercised ICCs that carry URI data only in the associated Intents (i.e., the 'data' field of Intent objects are non-void)	✓	
	69	extras_only	Percentage out of all exercised ICCs that carry extras data only in the associated Intents (i.e., the 'extras' field of Intent objects are non-void)	✓	
	70	data_both	Percentage out of all exercised ICCs that carry both URI and extras data only in the associated Intents (i.e., the 'data' and 'extras' fields of Intent objects are non-void)	✓	
	71	src	Percentage out of all call targets that are source APIs, counting unique method signatures	✓	✓
	72	sink	Percentage out of all call targets that are sink APIs, counting unique method signatures	✓	
	73	srcIns	Percentage out of all call targets that are source APIs, counting all method signature instances	✓	✓
	74	sinkIns	Percentage out of all call targets that are sink APIs, counting all method signature instances	✓	
	75	riskSrc	Percentage out of all exercised source APIs that reach (via method-level control flows) at least one sink API call, counting unique method signatures	✓	✓
	76	riskSink	Percentage out of all exercised sink APIs that are reachable (via method-level control flows) from at least one source API call, counting unique method signatures	✓	
	77	riskSrcIns	Percentage out of all exercised source APIs that reach (via method-level control flows) at least one sink API call, counting all method signature instances	✓	
	78	riskSinkIns	Percentage out of all exercised sink APIs that are reachable (via method-level control flows) from at least one source API call, counting all method signature instances	✓	

	#	Metric	Description		
Security	79	ACCOUNT_INFORMATION	Percentage out of all exercised source APIs that access account information, counting unique method signatures		
	80	ACCOUNT_INFORMATION-Ins	Percentage out of all exercised source APIs that access account information, counting all method signature instances		
	81	ACCOUNT_INFORMATION-escape	Out of the exercised source APIs that reach (via method-level control flows) at least one sink API call, percentage that access account information, counting unique method signatures		
	82	ACCOUNT_INFORMATION-escape-Ins	Out of the exercised source APIs that reach (via method-level control flows) at least one sink API call, percentage that access account information, counting all method signature instances		
	83	CALENDAR_INFORMATION	Percentage out of all exercised source APIs that access calendar information, counting unique method signatures		
	84	CALENDAR_INFORMATION-Ins	Percentage out of all exercised source APIs that access calendar information, counting all method signature instances		
	85	CALENDAR_INFORMATION-escape	Out of the exercised source APIs that reach (via method-level control flows) at least one sink API call, percentage that access calendar information, counting unique method signatures		
	86	CALENDAR_INFORMATION-escape-Ins	Out of the exercised source APIs that reach (via method-level control flows) at least one sink API call, percentage that access calendar information, counting all method signature instances		
	87	LOCATION_INFORMATION	Percentage out of all exercised source APIs that access location information, counting unique method signatures	✓	✓
	88	LOCATION_INFORMATION-Ins	Percentage out of all exercised source APIs that access location information, counting all method signature instances	✓	
	89	LOCATION_INFORMATION-escape	Out of the exercised source APIs that reach (via method-level control flows) at least one sink API call, percentage that access location information, counting unique method signatures	✓	✓
	90	LOCATION_INFORMATION-escape-Ins	Out of the exercised source APIs that reach (via method-level control flows) at least one sink API call, percentage that access location information, counting all method signature instances	✓	
	91	NETWORK_INFORMATION	Percentage out of all exercised source APIs that access network information, counting unique method signatures	✓	✓
	92	NETWORK_INFORMATION-Ins	Percentage out of all exercised source APIs that access network information, counting all method signature instances	✓	✓
	93	NETWORK_INFORMATION-escape	Out of the exercised source APIs that reach (via method-level control flows) at least one sink API call, percentage that access network information, counting unique method signatures	✓	✓
	94	NETWORK_INFORMATION-escape-Ins	Out of the exercised source APIs that reach (via method-level control flows) at least one sink API call, percentage that access network information, counting all method signature instances	✓	✓
	95	SYSTEM_SETTINGS	Percentage out of all exercised source APIs that access system settings, counting unique method signatures	✓	✓
	96	SYSTEM_SETTINGS-Ins	Percentage out of all exercised source APIs that access system settings, counting all method signature instances	✓	
	97	SYSTEM_SETTINGS-escape	Out of the exercised source APIs that reach (via method-level control flows) at least one sink API call, percentage that access system settings, counting unique method signatures	✓	✓
	98	SYSTEM_SETTINGS-escape-Ins	Out of the exercised source APIs that reach (via method-level control flows) at least one sink API call, percentage that access system settings, counting all method signature instances	✓	
	99	ACCOUNT_SETTINGS	Percentage out of all exercised sink APIs that aims at operations on account settings, counting unique method signatures	✓	
	100	ACCOUNT_SETTINGS-Ins	Percentage out of all exercised sink APIs that aims at operations on account settings, counting all method signature instances		
	101	ACCOUNT_SETTINGS-reach	Out of the exercised sink APIs that are reachable (via method-level control flows) from at least one source API call, percentage that aims at operations on account settings, counting unique method signatures	✓	

#	Name	Description		
102	ACCOUNT_SETTINGS-reach-Ins	Out of the exercised sink APIs that are reachable (via method-level control flows) from at least one source API call, percentage that aims at operations on account settings, counting all method signature instances		
103	FILE	Percentage out of all exercised sink APIs that aims at file operations, counting unique method signatures		
104	FILE-Ins	Percentage out of all exercised sink APIs that aims at file operations, counting all method signature instances		
105	FILE-reach	Out of the exercised sink APIs that are reachable (via method-level control flows) from at least one source API call, percentage that aims at file operations, counting unique method signatures		
106	FILE-reach-Ins	Out of the exercised sink APIs that are reachable (via method-level control flows) from at least one source API call, percentage that aims at file operations, counting all method signature instances		
107	LOG	Percentage out of all exercised sink APIs that aims at logging operations, counting unique method signatures	✓	✔
108	LOG-Ins	Percentage out of all exercised sink APIs that aims at logging operations, counting all method signature instances	✓	✔
109	LOG-reach	Out of the exercised sink APIs that are reachable (via method-level control flows) from at least one source API call, percentage that aims at logging operations, counting unique method signatures	✓	✔
110	LOG-reach-Ins	Out of the exercised sink APIs that are reachable (via method-level control flows) from at least one source API call, percentage that aims at logging operations, counting all method signature instances	✓	✔
111	NETWORK	Percentage out of all exercised sink APIs that aims at networking operations, counting unique method signatures		
112	NETWORK-Ins	Percentage out of all exercised sink APIs that aims at networking operations, counting all method signature instances	✓	✔
113	NETWORK-reach	Out of the exercised sink APIs that are reachable (via method-level control flows) from at least one source API call, percentage that aims at networking operations, counting unique method signatures		
114	NETWORK-reach-Ins	Out of the exercised sink APIs that are reachable (via method-level control flows) from at least one source API call, percentage that aims at networking operations, counting all method signature instances	✓	✔
115	SMS_MMS	Percentage out of all exercised sink APIs that aims at messaging operations, counting unique method signatures	✓	✔
116	SMS_MMS-Ins	Percentage out of all exercised sink APIs that aims at messaging operations, counting all method signature instances	✓	✔
117	SMS_MMS-reach	Out of the exercised sink APIs that are reachable (via method-level control flows) from at least one source API call, percentage that aims at messaging operations, counting unique method signatures	✓	✔
118	SMS_MMS-reach-Ins	Out of the exercised sink APIs that are reachable (via method-level control flows) from at least one source API call, percentage that aims at messaging operations, counting all method signature instances	✓	✔
119	SYSTEM_SETTINGS	Percentage out of all exercised sink APIs that aims at operations on system settings, counting unique method signatures		
120	SYSTEM_SETTINGS-Ins	Percentage out of all exercised sink APIs that aims at operations on system settings, counting all method signature instances	✓	
121	SYSTEM_SETTINGS-reach	Out of the exercised sink APIs that are reachable (via method-level control flows) from at least one source API call, percentage that aims at operations on system settings, counting unique method signatures		
122	SYSTEM_SETTINGS-reach-Ins	Out of the exercised sink APIs that are reachable (via method-level control flows) from at least one source API call, percentage that aims at operations on system settings, counting all method signature instances	✓	