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(54) Title: METHODS AND SYSTEMS OF DYNAMICALLY GENERATING AND USING DEVICE-SPECIFIC AND DEVICE-STATE-SPECIFIC CLASSIFIER MODELS FOR THE EFFICIENT CLASSIFICATION OF MOBILE DEVICE BEHAVIORS

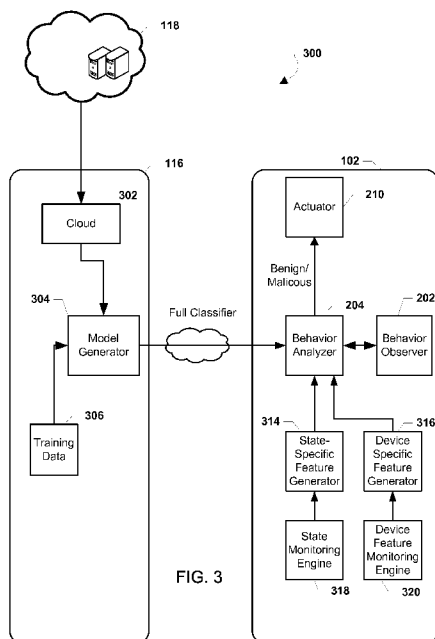
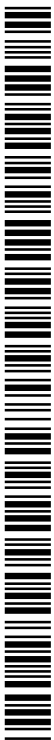


FIG. 3

(57) Abstract: The various aspects provide a mobile device and methods implemented on the mobile device for modifying behavior models to account for device-specific or device-state-specific features. In the various aspects, a behavior analyzer module may leverage a full feature set of behavior models (i.e. a large classifier model) received from a network server to create lean classifier models for use in monitoring for malicious behavior on the mobile device, and the behavior analyzer module may dynamically modify these lean classifier models to include features specific to the mobile device and/or the mobile device's current configuration. Thus, the various aspects may enhance overall security for a particular mobile device by taking the mobile device and its current configuration into account and may improve overall performance by monitoring only features that are relevant to the mobile device.





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B. FIELDS SEARCHED
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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	K. SALLER, S. OSTER, A. SCHUERR, J. SCHROETER, M. LOCHAU: "Reducing feature models to improve runtime adaptivity on resource limited devices", PROCEEDINGS OF THE 16TH INTERNATIONAL SOFTWARE PRODUCT LINE CONFERENCE (SPLC'12), vol. II, 2 September 2012 (2012-09-02), pages 135-142, XP058009814, DOI: 10.1145/2364412.2364435 section 5 ----- -/--	1-30

Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	C. DE STEFANO, G. FOLINO, F. FONTANELLA, A. SCOTTO DI FRECA: "Pruning GP-based classifier ensembles by Bayesian networks", LECTURE NOTES IN COMPUTER SCIENCE, vol. 7491, 1 September 2012 (2012-09-01), pages 236-245, XP047016355, DOI: 10.1007/978-3-642-32937-1_24 sections 1 and 2	1-30
X	----- G. FOLINO, C. PIZZUTI, G. SPEZZANO: "An ensemble-based evolutionary framework for coping with distributed intrusion detection", GENETIC PROGRAMMING AND EVOLVABLE MACHINES, vol. 11, no. 2, 7 February 2010 (2010-02-07), pages 131-146, XP019789345, DOI: 10.1007/s10710-010-9101-6 sections 3 and 4	1-30
X	----- J. GAO, W. HU, X. ZHANG, X. LI: "Adaptive distributed intrusion detection using parametric model", PROCEEDINGS OF THE 2009 IEEE/WIC/ACM INTERNATIONAL JOINT CONFERENCES ON WEB INTELLIGENCE AND INTELLIGENT AGENT TECHNOLOGIES (WI-IAT'09), vol. 1, 15 September 2009 (2009-09-15), pages 675-678, XP055107983, DOI: 10.1109/WI-IAT.2009.113 section 2	1-30
X	----- A.-D. SCHMIDT, R. BYE, H.-G. SCHMIDT, J. CLAUSEN, O. KIRAZ, K. A. YÜKSEL, S. A. CAMTEPE, S. ALBAYRAK: "Static analysis of executables for collaborative malware detection on android", PROCEEDINGS OF THE 2009 IEEE INTERNATIONAL CONFERENCE ON COMMUNICATIONS (ICC'09), 14 June 2009 (2009-06-14), XP031506460, DOI: 10.1109/ICC.2009.5199486 section IV	1-30
X	----- S. Abu-Nimeh: "Phishing detection using distributed Bayesian additive regression trees", 13 December 2008 (2008-12-13), Southern Methodist University, XP055107295, ISBN: 978-0-549-90863-0 chapters 2, 4, 6 and 8	1-30
