

International Journal of Software Engineering & Applications (IJSEA)

ISSN : 0975 - 9018 (Online); 0976-2221 (Print)

<http://www.airccse.org/journal/ijsea/ijsea.html>

New Issue: September 2020, Volume 11, Number 5 --- Table of Contents

<http://www.airccse.org/journal/ijsea/vol11.html>



SECURE DESCARTES: A SECURITY EXTENSION TO DESCARTES SPECIFICATION LANGUAGE

Venkata N Inukollu¹ and Joseph E Urban²

¹Department of Computer Science and, Purdue University, Fort Wayne, USA

² Department of Computer Science, Arizona State University, USA

ABSTRACT

With increase in demand for the security aspects of software, every phase of the Software Development Life Cycle (SDLC) is experiencing major changes with respect to security. Security designers, developers, and testers are keen on improving various security aspects of a system. Specification of security requirements propagates to different phases of an SDLC and there exist different techniques and methodologies to specify security requirements. Business level security requirements are specified using policy specification languages. The current literature has specification languages that are domain based, web based, network based, syntax based, semantics based, predicate based, and protocol based. In this research effort, a generic secure policy prototype and components of the generic secure policy were defined using formal methods. The Descartes specification language, a formal executable specification language, has been developed to specify software systems. The development of a secure policy framework along with extended constructs of the Descartes specification language for specifying secure policies are some of the deliverables of this research effort. Concepts of secure policies were adopted from the SPromela, Ponder, and REI methodologies for secure policy specification, analysis, and design.

KEYWORDS

Policy language, Secure policy language, Formal methods, Descartes specification language, & SDLC

For More Details: <https://aircconline.com/ijsea/V11N5/11520ijsea01.pdf>

Volume Link: <http://www.airccse.org/journal/ijsea/vol11.html>

REFERENCES

- [1] García, F. J., Martínez, G., Botía, J. A., and Skarmeta, A. G., "Representing Security Policies in Web Information Systems," Proceedings of the 14th International World Wide Web Conference, 2005.
- [2] Damianou, N., Naranker, D, Emil, L., and Morris, S., "The Ponder Policy Specification Language," Proceedings of the International Workshop on Policies for Distributed Systems and Networks, 2001, pp. 18-38.
- [3] Kagal, L., Finin, T., and Joshua, A., "A Policy Language for Pervasive Computing Environment," Proceedings of the International Workshop on Policies for Distributed Systems and Networks, 2003, pp. 63-74.
- [4] Kagal, L., Rei: A Policy Language for the Me-Centric Project, HP Labs Technical Report, 2002.
- [5] Godik, S., Anderson, A., Parducci, B., Humenn, P., and Vajjhala, S., OASIS eXtensible Access Control 2 Markup Language (XACML) 3, Technical Report, 2002.
- [6] Abbassi, R. and El Fatmi, S.G., "S-promela: An Executable Specification Security Policies Language," Proceedings of the First International Conference on Communications and Networking, 2009, pp. 1 - 8.
- [7] Koch, M., and Parisi-Presicce, F., "Describing Policies with Graph Constraints and Rules," Proceedings of the First International Conference on Graph Transformation, 2002, pp. 223-238.
- [8] Riberio, C., and Guedes, P., "An Access Control Language for Security Policies with Complex Constraints," Proceedings of Network and Distributed System Security Symposium, 2001.
- [9] Herzberg, A., Mass, Y., Mihaeli, J., Naor, D., and Ravid, Y., "Access Control meets Public Key Infrastructure, or: Assigning Roles to Strangers," Proceedings of IEEE Symposium on Security and Privacy, 2000, pp. 2-14.
- [10] ANSI/IEEE, IEEE std. 830-1998 Recommended Practice for Software Requirements Specification, (ANSI/IEEE), 1998.
- [11] Urban, J. E., A Specification Language and Its Processor, Ph.D. Dissertation, University of Louisiana at Lafayette, 1977.
- [12] van Lamsweerde, A., "Goal-oriented requirements engineering: A guided tour," Proceedings of Fifth IEEE International Symposium on Requirements Engineering, 2001, pp. 249-262.
- [13] Glinz, M., "On Nonfunctional Requirements," Proceedings of 15th IEEE International Conference on Requirements Engineering, 2007, pp. 15-19.
- [14] IEEE, Standard Glossary of Software Engineering Terminology. IEEE Standard 610.12-1990.
- [15] Jacobson, I., Rumbaugh, J., and Booch, G., The Unified Software Development Process. Reading: Addison Wesley, 1999.
- [16] Firesmith, D., "Specifying Reusable Security Requirements," Journal of Object Technology, 2004, pp. 61-75.
- [17] Hall, A., "Seven Myths of Formal Methods," Software, IEEE , 2002, pp.11-19.
- [18] Clarke, Edmund M., and Jeannette M. Wing. "Formal Methods: State of the Art and Future Directions." Journal of ACM Computing Surveys, 1996, pp. 626-643.

- [19] SANS Critical Security Controls. Critical Security Controls for Effective Cyber Defense: <http://www.sans.org/critical-security-controls> accessed June 12, 2015.
- [20] Sung, K. Y. and Urban, J. E., "Real-time Descartes: a Real-Time Specification Language," Proceedings of the Third Workshop on Future Trends in Distributed Computing Systems, 1992, pp. 79-85.
- [21] Wu, Y., A Methodology for Deriving a Booch Object Oriented Design from Extensions to the Descartes Specification Language, MS Thesis, Arizona State University, Dec, 1994.
- [22] Horne, B., Subburaj, V. H., and Urban, J. E., "Extensions to the Descartes Specification Language for the Development of Real-time Object Oriented Systems," Proceedings of the International Conference on Computing, Networking and Digital Technologies, 2012, pp. 225-236.
- [23] Medina, M.A. and Urban, J.E., "An Approach to Deriving Reactive Agent Designs from Extensions to the Descartes Specification Language," Proceedings of the Eighth International Symposium on Autonomous Decentralized Systems, 2007, pp. 363-367.
- [24] Urban, J. E., Subburaj, V. H., and Ramamoorthy, L., "Extending the Descartes Specification Language Towards Process Modeling," Proceedings of the Federated Conference on Computer Science and Information Systems, 2011, pp. 337-340.
- [25] Kanada, Y., "Taxonomy and description of policy combination methods," Proceedings of a Conference on Policies in Distributed Systems and Networks, 2001, pp. 171-184
- [26] Wei, Q. and Adams, C., "Exploring User-to-Role Delegation in Role-Based Access Control," Proceedings of the Eighth World Congress on Management of eBusiness, 2007, pp. 21-31.
- [27] Bai, Q. and Zheng, Y., "Study on the Access Control Model," Proceedings of the Cross Strait Quad-Regional Conference on Radio Science and Wireless Technology, 2011, pp. 830 – 834.
- [28] Arsi, S., Inukollu, V. N., & Urban, J. E. Issues and Challenges of Secure Policy Specification Languages.
- [29] Sakhnini, N., Inukollu, V. N., & Urban, J. E. (2016, April). Automatic parallel programming using the descartes specification language. Proceedings of the 7th IEEE..International Conference on Information and Communication Systems ,pp. 298-303, 2016.
- [30] Inukollu, V. N., Arsi, S., & Ravuri, S. R. (2014). Security issues associated with big data in cloud computing. International Journal of Network Security & Its Applications, 6(3), 45.

ITERATIVE AND INCREMENTAL DEVELOPMENT ANALYSIS STUDY OF VOCATIONAL CAREER INFORMATION SYSTEMS

Isyaku Maigari Ibrahim¹, Ogwueleka Francisca Nonyelum² and Isah Rambo Saidu³

^{1&2}Department of Computer Science, Nigerian Defense Academy, Kaduna,

Nigerian Defense Academy, Kaduna, Nigeria

³Department of Cybersecurity and Interdisciplinary studies,

Nigerian Defense Academy, Kaduna, Nigeria

ABSTRACT

Software development process presents various types of models with their corresponding phases required to be accordingly followed in delivery of quality products and projects. Despite the various expertise and skills of systems analysts, designers, and programmers, systems failure is inevitable when a suitable development process model is not followed. This paper focuses on the Iterative and Incremental Development (IID) model and justified its role in the analysis and design software systems. The paper adopted the qualitative research approach that justified and harnessed the relevance of IID in the context of systems analysis and design using the Vocational Career Information System (VCIS) as a case study. The paper viewed the IID as a change-driven software development process model. The results showed some system specification, functional specification of system and design specifications that can be used in implementing the VCIS using the IID model. Thus, the paper concluded that in systems analysis and design, it is imperative to consider a suitable development process that reflects the engineering mind-set, with heavy emphasis on good analysis and design for quality assurance.

KEYWORDS

Iterative, incremental development, vocational carrier, system development process

For More Details: <https://aircconline.com/ijsea/V11N5/11520ijsea02.pdf>

Volume Link: <http://www.airccse.org/journal/ijsea/vol11.html>

REFERENCES

- [1] Abrahamsson, P., Salo, O., Ronkainen, J., and Warsta, J. (2017). Agile software development methods: Review and analysis. arXiv preprint arXiv:1709.08439, pp. 72 - 79
- [2] Bakir, A., Turhan, B., and Bener, A. (2011). A comparative study for estimating software development effort intervals. *Software Quality Journal*, 19(3), 537-552.
- [3] Balaji, S., and Murugaiyan, M. S. (2012). Waterfall vs. V-Model vs. Agile: A comparative study on SDLC. *International Journal of Information Technology and Business Management*, 2(1), 26-30.
- [4] Bender RBT Inc. (2003). *Systems Development Lifecycle: Objectives and Requirements*. Bender RBT Inc, Queensbury, New York, pp, 22 - 53
- [5] Benediktsson, O., Dalcher, D., Reed, K., and Woodman, M. (2003). COCOMO-based effort estimation for iterative and incremental software development. *Software Quality Journal*, 11(4), 265-281.
- [6] Boehm, B. W. (1988). A spiral model of software development and enhancement. *Computer*, 21(5), 61-72.
- [7] Colby, C. L., Mithas, S., Orlando, T., and Norman, E. (2015). "What Drives Successful Product Development and Innovation in the Software Development Process? The Product Development Success Index (PDSI) "Frontiers in Service Conference, San Jose, CA [online]. Available at: <https://www.slideshare.net/ccolby/frontiers-2015-by-3-pillar-csrockbridge-50735368> and <http://productdevelopmentsuccess.com/about> [Accessed 28 Apr. 2018].
- [8] Daria, K. (2018). *New Product Development Process in Finnish Software Start-Ups and University Spin-Outs*. Master's Thesis, LUT School of Business and Management, Lappeenranta University of Technology, Finland pp.1-95.
- [9] Feiler, P. and Humphrey, W. (1993) "Software process development and enactment: Concepts and definitions," in *Software Process, 1993. Continuous Software Process Improvement*, Second International Conference on the. IEEE, pp. 28-40.
- [10] Fuggeffa, A. (2000). *Software Process: A Roadmap*. In *Proceedings of the Conference on the Future of Software Engineering* ACM pp. 25-34.
- [11] Greer, D., and Ruhe, G. (2004). Software release planning: an evolutionary and iterative approach, *Information and Software Technology*, 46 (2004) 243–253.
- [12] Iqbal, S. Z., and Idrees, M. (2017). Z-SDLC Model: A New Model For Software Development Life Cycle (SDLC). *International Journal of Engineering and Advanced Research Technology (IJEART)*, 3(2), pp. 1-8.
- [13] ISO/IEC, Amendment to ISO/IEC 12207-2008 - Systems and software engineering Software life cycle processes. pp 34 - 35
- [14] Jakeman, A. J., Letcher, R. A., and Norton, J. P. (2006). Ten iterative steps in development and evaluation of environmental models. *Environmental Modelling & Software*, 21(5), 602-614.
- [15] Janzen, D., and Saiedian, H. (2005). Test-driven development concepts, taxonomy, and future direction. *Computer*, 38(9), 43-50.
- [16] Jonathan, A. (2018). *A comparative analysis on small-group task-based learning between software engineering and dance studies at the University of Auckland*. Master Thesis, University of Auckland, 1-94.

- [17] Kern, A., Kuhlmann, M., Schaad, A., and Moffett, J. (2002, June). Observations on the role life-cycle in the context of enterprise security management. In Proceedings of the seventh ACM symposium on Access control models and technologies ACM, pp. 43-51.
- [18] Lamassoure, E., Wall, S., and Easter, R. (2004, September). Model-based engineering design for trade space exploration throughout the design cycle. In Space 2004 Conference and Exhibit (p. 5855).
- [19] Larman, C., and Basili, V. R. (2003). Iterative and incremental developments. a brief history. Computer, 36(6), 47-56.
- [20] Magana, A. J., Seah, Y. Y., and Thomas, P. (2018). Fostering Cooperative Learning with Scrum in a Semi-Capstone Systems Analysis and Design Course. Journal of Information Systems Education, 29(2), 75-91.
- [21] Mitchell, S. M., and Seaman, C. B. (2009). A comparison of software cost, duration, and quality for waterfall vs. iterative and incremental development: A systematic review. In Proceedings of the 2009 3rd International Symposium on Empirical Software Engineering and Measurement IEEE Computer Society, pp. 511-515.
- [22] O'Connor, R. V. (2008) "Human aspects of information technology development," International Journal of Technology, Policy and Management, Vol. 8, No. 1, pp.633-648
- [23] Pinto, G., Wiese, I., and Dias, L. F. (2018). How do scientists develop scientific software? An external replication. In 2018 IEEE 25th International Conference on Software Analysis, Evolution and Reengineering (SANER)IEEE pp. 582-591
- [24] Pressman, R. S. (2005) "Software Engineering: A practitioners approach." Fifth Edition. MacGraw-Hill, pp 429 -430
- [25] Salo, O. (2006). Enabling Software Process Improvement in Agile Software Development Teams and Organisations. VTT Publications, pp. 153.
- [26] Selic, B. (2003). The pragmatics of model-driven development. IEEE software, 20(5), 19-25.
- [27] Soriyan H. A. (2004) A conceptual Framework for Information System Development Methodology for Educational and Industrial Sectors in Nigeria. PhD Thesis. Obafemi Awolowo University, Ile-Ife Nigeria, pp. 53 -54
- [28] Trott, P. (2005). Innovation Management and New Product Development. Pearson, England. Pp 23.
- [29] Völter, M., Stahl, T., Bettin, J., Haase, A., and Helsen, S. (2013). Model-driven software development: technology, engineering, management. John Wiley & Sons, pp 262 - 263
- [30] Wastell, D. (1999) "The Human Dimension of the Software Process," Software Process: Principles, Methodology, and Technology, pp. 165-199.
- [31] Zhou, M., and Mockus, A. (2011). Does the initial environment impact the future of developers?. In Proceedings of the 33rd International Conference on Software Engineering ACM pp. 271-280

MASRML - A DOMAIN-SPECIFIC MODELING LANGUAGE FOR MULTI-AGENT SYSTEMS REQUIREMENTS

Gilleanes Thorwald Araujo Guedes¹ Iderli Pereira de Souza Filho¹ Lukas Filipe Gaedicke¹ Giovane D'Ávila Mendonça¹ Rosa Maria Vicari² and Carlos Brusius²

¹Curso de Engenharia de Software, Pampa Federal University, Alegrete, RS, Brazil

gilleanesguedes@unipampa.edu.br, lukasgaedicke@unipampa.edu.br,
iderlisouza@gmail.com, giovanedavila@gmail.com

²Departamento de Informatica, Federal University of Rio Grande do Sul,

Porto Alegre, RS, Brazil

rosa@inf.ufrgs.br, cbrusius@uol.com.br

ABSTRACT

MASRML – Multi-Agent Systems Requirements Modeling Language – is a UML-based Domain-Specific Modeling Language conceived for the requirements modeling in multi-agent system projects. Along this work the extended metamodel developed to support the language is described and the applicability of this DSML in the requirements identification of a multi-agent system is demonstrated using the new mechanisms produced to model specific functional requirements for this kind of system. This work also includes how the DSML was validated and the impressions collected during the validations.

KEYWORDS

UML, Metamodels, Stereotypes, Requirements Engineering, Multi-Agent Systems, Agent Roles, AgentRoleActors, InternalUseCases

For More Details: <https://aircconline.com/ijsea/V11N5/11520ijsea03.pdf>

Volume Link: <http://www.airccse.org/journal/ijsea/vol11.html>

REFERENCES

- [1] Boes, Jérémy & Migeon, Frédéric. (2017) “Self-organizing multi-agent systems for the control of complex systems.” *Journal of Systems and Software*, 134, pp12–28.
- [2] Dam, H. Khanh & Winikoff, Michael, (2013) “Towards a Next-Generation AOSE Methodology”, *Science of Computer Programming*, 78(6), pp684-694.
- [3] Depke, Ralph, Heckel, Reiko & Küster, Jochen, (2002) “Formal agent-oriented modeling with uml and graph transformation”, *Science of Computer Programming*, 44(2), pp229–252.
- [4] Dorri, Ali. Kanhere, Salil & Jurdak, Raja, (2018) “Multi-Agent Systems: A Survey”, *IEEE Access*, 6, pp28573–28593.
- [5] Ganzha, Maria. Omelczuk, Adam. Paprzycki, Marcin. Wypysiak, Mateusz, (2012) “Information resource management in an agent-based virtual organization-initial implementation”, *Computer Science and Information Systems*, 9(3), pp1307–1330.
- [6] Hamidane, Fathi. Mokhati, Farid & Belleili-Souici, Habiba, (2010) “Towards formalizing multi-agent systems functional requirements in maude”, *International Journal of Advanced Research in Computer Science*, 1(2).
- [7] Nakagawa, Hiroyuki. Yoshioka, Nobukazu. Ohsuga, Akihiko & Honiden, Shinichi, (2012) “A Framework for Validating Task Assignment in Multiagent Systems Using Requirements Importance” *Lecture Notes in Computer Science*, pp443–458.
- [8] Pereplechikov, Mikhail & Padgham, Lin, (2005) “Use case and actor driven requirements engineering: An evaluation of modifications to Prometheus” *Multi-Agent Systems and Applications IV*, Pechoucek, M. Petta, P. Varga, L. eds., Berlin, Heidelberg, pp203–212.
- [9] Saleh, Kasem & El-Morr, Christo, (2004) “M-UML: An extension to UML for the modeling of mobile agent-based software systems” *Information and Software Technology*, 46(4), pp219–227.
- [10] Trencansky, Ivan & Cervenka Radovan, (2005) “Agent Modeling Language (AML): A Comprehensive Approach to Modeling MAS” *Informatica*. Vol. 29, No 4, pp391-400.
- [11] Vicari, Rosa & Gluz, João, (2007) “An Intelligent Tutoring System (ITS) View on AOSE” *International Journal of Agent-Oriented Software Engineering*, vol. 1, 1746-1383, pp295-333.
- [12] Berenbach, Brian. Paulish, Daniel. Kazmeier, Juergen & Rudorfer, Arnold (2009) *Software & Systems Requirements Engineering In Practice*. McGraw-Hill.
- [13] Bratman, Michael (1999) *Intention, Plans, and Practical Reason*. CSLI Publications.
- [14] Julian, Vicente & Botti, Vicente, (2019) “Multi-Agent Systems”, *Applied Sciences*, 9, 1402, DOI:10.3390/app9071402.
- [15] Regnell, Bjorn, (1999) *Requirements Engineering with Use Cases – A Basis for Software Development*. Lund University, Sweden.
- [16] Sommerville, Ian (2011) *Software Engineering - 9th. Edition*, Addison Wesley.
- [17] Bonjean, N. Meftteh, W. Gleizes, M & Maurel, C, (2014) “ADELFE 2.0”. *Handbook on Agent-Oriented Design Processes*. Springer-Verlag, pp19-64.
- [18] Cao, Longbing, (2015) “OSOAD Methodology”, *Metasynthetic Computing and Engineering of Complex Systems*. Springer, London, pp111-129.

- [19] Cossentino, Massimo & Seidita, Valeria, (2014) "PASSI: Process for agent societies specification and implementation". Handbook on Agent-Oriented Design Processes. Springer- Verlag, pp287-329.
- [20] Cossentino, Massimo. Hilaire, Vincent. Gaud, Nicholas. Galland, Stephane & Koukam, Abederrafia, (2014) "The ASPECS process". Handbook on Agent-Oriented Design Processes. Springer-Verlag, pp65-114.
- [21] Lind, Jurgen, (2001) "The MASSIVE Method". Iterative Software Engineering for Multiagent Systems. Springer-Verlag, ISBN 978-3-540-45162-4, DOI 10.1007/3-540-45162-5,
- [22] Morandini, Mirko. Dalpiaz, Fabiano. Nguyen, Cu & Siena. Alberto, (2014) "The Tropos Software Engineering Methodology". Handbook on Agent-Oriented Design Processes. Springer- Verlag, pp463-490.
- [23] Rodriguez, Lorena. Insfran, Emilio & Cernuzzi, Luca, (2011) "Requirements Modeling for MultiAgent Systems", Multi-Agent Systems - Modeling, Control, Programming, Simulations and Applications, Intech web.org, pp3-22.
- [24] Collier, Rem. O'Hare, Gregory & Rooney, Colm, (2004) "A uml-based software engineering methodology for agent factory", 16th International Conference on Software Engineering and Knowledge Engineering, Banff, CA.
- [25] Flake, Stephan. Geiger Christian & Küster Jochen, (2001) "Towards UML-based Analysis and Design of Multi-Agent Systems", Proceedings of ENAIS'2001, Dubai.
- [26] Frank, Ulrich, (2011) "Some guidelines for the conception of domain-specific modelling languages" 4th International Workshop on Enterprise Modelling and Information Systems Architectures, Gesellschaft für Informatik, Bonn, pp93-106.
- [27] Galafassi, Fabiane, Galafassi, Cristiano. Vicari, Rosa & Gluz, Joao, (2019) "Heráclito: Intelligent Tutoring System for Logic", Advances in Practical Applications of Survivable Agents and Multi-Agent Systems: The PAAMS Collection, PAAMS 2019, Lecture Notes in Computer Science, vol.11523, pp251-254.
- [28] Guedes, Gilleanes & Vicari, Rosa, (2010) "A UML Profile Oriented to the Requirements Collecting and Analyzing for the MultiAgent Systems Project", 22nd International Conference on Software Engineering and Knowledge Engineering - SEKE2010, Redwood, California, USA.
- [29] Guedes, Gilleanes & Vicari, Rosa (2011) "Applying a UML Metamodel to the Requirements Modeling in Multi-Agents Systems Projects - The APA Case Study", XV Portuguese Conference on Artificial Intelligence, Vol. 1, pp609-623.
- [30] Heinze, Clinto. Papasimeon, Michael & Goss, Simon, (2000) "Specifying agent behaviour with use cases", Pacific Rim International Workshop on Multi-Agents, Springer, pp128-142.
- [31] Iglesias, Carlos. Garijo, Mercedes. Gonzalez, Jose & Velasco, Juan, (1997) "Analysis and Design of Multi-Agent Systems using MAS-Commonkads" International Workshop on Agent Theories, Architectures, and Languages, Springer. pp313-327.
- [32] Laouadi, Mohamed. Mokhati, Farid & Seridi-Bouchelaghem, Hassina, (2010) "A novel formal specification approach for real time multi-agent system functional requirements", German Conference on Multiagent System Technologies, Springer, pp15-27.
- [33] Laouadi, Mohamed. Mokhati, Farid. Seridi-Bouchelaghem, Hassina, (2013) "Towards an organizational model for real time multi-agent system specification", Science and Information Conference, IEEE, pp577-584.

- [34] Papasimeon, Michael & Heinze, Clinton, (2003) "Specifying Requirements in a Multi-Agent System with Use Cases", Defence Science and Technology Organization, Technical Report.
- [35] Slhoub, Khaled. Carvalho, Marco & Bond, Walter, (2018) "Recommended practices for the specification of multi-agent systems requirements", IEEE 8th Annual Ubiquitous Computing, Electronics and Mobile Communication Conference, UEMCON 2017, pp179–185.
- [36] Spanoudakis, Nikolaos. Moraitis, Pavlos, (2008) "The Agent Modeling Language (AMOLA)", 13th International Conference on Artificial Intelligence: Methodology, Systems, and Application, Springer-Verlag, Berlin, pp32–44.
- [37] Werneck, Vera. Kano, A. & Cysneiros, Luiz (2007) "Evaluating ADELFE Methodology in the Requirements Identification", 10th Workshop on Requirements Engineering, Canada, pp3-24.
- [38] OMG – Object Management Group, (2011), "OMG Unified Modeling Language - Version 2.4.1", <http://www.omg.org>.
- [39] OMG – Object Management Group. (2017), "OMG Unified Modeling Language - Version 2.5.1", <http://www.omg.org>.