


ERIC UMUHOZA

Curriculum Vitae et Studiorum

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PERSONAL DATA

First Name	Eric
Last Name	Umuhoza
Date of Birth	March 27, 1985
Place of Birth	Rwanda
Nationality	Rwandese
Residence	Italy
Marital Status	Married
Work Address	Scholar-In-Residence Carnegie Mellon University–Africa Cell. +250 (0)783 851 854 E-mail: eumuhoza@andrew.cmu.edu, eric.umuhoza@gmail.com LinkedIn: https://www.linkedin.com/in/umuhoza-eric-723b4a42/ Skype: umuhozae Twitter: @EricUmuhoza Web: http://eric-umuhoza.com



EDUCATION

February 2017	Ph.D. in Information Technology and Engineering Department of Electronics, Information and Bioengineering Politecnico di Milano, Milan, Italy Thesis title: <i>“Domain-specific Modeling and Code Generation for Cross-platform Mobile and IoT-based Applications”</i> Advisor: Professor Marco Brambilla
October 2013	M.Sc. in Engineering of Computing Systems Politecnico di Milano, Milan, Italy Final grade: 108 over 110, overall GPA: 28.5 out of 30 Thesis title: <i>“Social Resource and Asset Sharing: A Case of Social Enterprise Optimization”</i> Course language: English Advisor: Professor Marco Brambilla
September 2010	B.Sc. in Computer Engineering Politecnico di Milano, Milan, Italy Thesis title: <i>“Servizi Web per l’Accesso a Dati in un Data Warehouse Bionfor- matico”</i> Course language: Italian Advisor: Professor Marco Masseroli

Domain-Specific Modeling and Code Generation for Cross-Platform Mobile Applications

[C.3, C.4, C.5, C.7, C.8, C.9, T.1]

Mobile devices constitute the most common computing device. This new computing model has brought intense competition among hardware and software providers who are continuously introducing increasingly powerful mobile devices and innovative OSs into the market. In consequence, cross-platform and multi-device development has become a priority for software companies that want to reach the widest possible audience. However, developing an application for several platforms implies high costs and technical complexity. This research proposes to face the challenge of the mobile revolution by exploiting *abstraction*, *modeling* and *code generation*, in the spirit of the modern paradigm of model-driven engineering. The rationale is to represent application designs in a platform-independent manner and then generate the code to deploy the application business logic and interaction logic onto any platform of choice. This simplify multi-device development, reducing substantially cost and development time, so as to increase the profit of solution providers and at the same time reduce the price and total cost of ownership for end-customers. The final goal is to enable the domain experts with no programming background to develop their own applications or a large part of thereof by delegating to software engineers only the technical issues when required.

- *Application Design: Mobile Applications Modeling* [C.9]

This research work has been conducted in collaboration with the *Ecole des Mines des Nantes, France* during my visit. The work addressed the modeling of mobile applications front-end. The research defined a platform independent modeling language for mobile applications named *Mobile Language*. The language has been defined as a mobile extension of a OMG standard called *Interaction Flow Modeling Language (IFML)*. The research included also the development of an Eclipse-based graphical mobile modeling tool using MDE frameworks and metamodels. The tools and technologies used include Eclipse, EMF, ECORE, MOF, UML, IFML, and Sirius. This research has been funded by the AutoMobile EU 7th FP SME Research project (<http://automobile.webratio.com>).

- *Implementation: Automatic Code Generation Strategies for Mobile Apps* [C.7]

This research line studied different approaches to generate the code for mobile apps from models describing those applications. I conducted a comparative study to identify the best trade-offs between different code generation strategies. The study showed that there is no approach better than others in absolute terms but provided useful guidelines that helped us, in particular, to identify the best strategy for the *WebRatio* company, an SME partner of the AutoMobile project. WebRatio was interested in producing a MDD tool for designing and developing cross-platform mobile apps. The approach we advised to WebRatio has been adopted and implemented in WebRatio Mobile Platform released in February 2015.

- *Application Monitoring: Model-driven User Behavior Analytics* [C.1, D.1]

While basic Web analytics tools are widespread and provide statistics about Web site navigation, no approaches exist for merging such statistics with information about the Web application structure, content and semantics. Current analytics tools only analyze the user interaction at page level in terms of page views, entry and landing page, page views per visit, and so on. This research line aims at combining user interaction models with user tracking information and details about the visualized content in the pages. We proposed a model-driven approach that combines user interaction modeling, full code generation of the designed application, user tracking at runtime through logging of runtime component execution and user activities, integration with page content details, generation of integrated schema-less data streams, and application of large-scale analytics and visualization tools for big data, by applying both traditional data visualization techniques and direct representation of statistics on visual models of the Web application.

Model-driven Development of User Interfaces for IoT Systems

[C.2, S.1]

Internet of Things technologies and applications are evolving and continuously gaining traction in all fields and environments, including homes, cities, services, industry and commercial enterprises. However, still many problems need to be addressed. For instance, the IoT vision is mainly focused on the technological and infrastructure aspect, and on the management and analysis of the huge amount of generated data, while so far the development of front-end and user interfaces for IoT has not played a relevant role in research. On the contrary, user interfaces in the IoT ecosystem they can play a key role in the acceptance of solutions by final adopters. This research proposes a model-driven approach to the design of IoT interfaces, by defining a specific visual design language and design patterns for IoT applications, and we show them at work. Our solution is based on extending the standard IFML language adopted by the OMG.

Modeling Languages Usability

[C.5]

The research on modeling language usability aims at understanding how the designed languages are actually used and how they fit the users' need. This investigation showed that available languages are either too complex (e.g: BPMN) with respect to user need or do not exactly fit the domain (e.g: UML). This happens because of the lack of right involvement of end-users in the language development process. We proposed a user-centered approach allowing the adaptation of existing modeling languages to the user needs through a language simplification process.

Effective Modeling Effort in Model-based Development Approaches

[C.10]

Even though several studies provided evidence that the adoption of model-based approaches can significantly enhance both developers' productivity and product quality, many software practitioners consider such approaches time-consuming, hence prefer to avoid using models which are believed as excessive, superfluous and unnecessary artifacts. As a result, software modeling is still not widely adopted in software development. We conducted a research with the aims of revealing whether it is actually modeling or designing that dominates the effort in the creative process of modeling software systems. Our experiments showed that more than 60% of the effort is spent in designing. For us, this means that the fault of supposedly unproductive processes should not be blamed on modeling, but to the (anyhow necessary) time devoted to thinking about the problem and identifying the solution.

Social Business Processes and Web Applications Modeling

[T.2]

This research aims at providing solutions to increase efficiency in organization by using ICT tools enabling a shared participation of all stakeholders in business process. The solutions proposed integrate BPM systems with the social tools in order to improve communication, the knowledge sharing and the transparency of the decisions. The research studied the case of enterprise resource management. The validation was done through a web application that integrates social sharing practices with other enterprise systems such as Enterprise Resource Planning. The application has been implemented in a model-driven-engineering (MDE) framework which allows to quickly develop, modify and integrate an application. The tools and technologies used include Social BPMN, WebML/IFML, CSS, HTML, JS, and WebRatio. This work is a part of the BPM4People project (<http://www.bpm4people.org>).

INTERNATIONAL COLLABORATION

Carnegie Mellon University–Africa
Scholar-in-Residence

[August 2018- Ongoing]

École des Mines de Nantes, France

[04/2014-12/2014]

Visiting scholar at Département Informatique

Affiliated with the AtlanMod Group, a research team specialized on Model-Driven Engineering

Head of the team: Professor Jordi Cabot

Chalmers University of Technology

Joint research on understanding the effective modeling effort and its impact on the adoption of model-driven development approaches.

Collaborators: Rodi Jolak, Ph.D. student; and Professor Michel Chaudron.

TEACHING ACTIVITIES AT CARNEGIE MELLON UNIVERSITY– AFRICA

Advanced Database Systems Fall Semester 2018

Master of Science in Electrical and Computer Engineering

Master of Science in Information Technology

TEACHING ACTIVITIES AT POLITECNICO DI MILANO

Software Engineering

[2014-2015, 2015-2016, 2016-2017] *B.Sc. in Computer Engineering*

Information Systems

[2014-2015, 2015-2016, 2016-2017] *B.Sc. in Computer Engineering*

Web Technologies

2015-2016, *B.Sc. in Computer Engineering*

OTHER PROFESSIONAL ACTIVITIES

June 2017 - August 2018

Senior Postdoctoral Researcher

Department of Information Engineering, Computer Science and Mathematics

University of L'Aquila (L'Aquila, Italy)

The main objective of this position was to design advanced techniques and tools supporting traceability between models. The designed approach has been applied to the case of user interactions design with the goal of maximizing user experience during the interaction with applications produced following model-driven development approach. It has also been applied to conflict management in the context of distributed software development.

February 2015 - May 2017

Research Fellow

Department of Electronics, Information and Bioengineering

Politecnico di Milano (Milan, Italy)

Previous and current researches within BEIB include: Model-driven development of Mobile, Web, and IoT applications; Big data; Software repository mining; and User behavior analysis.

April 2014 - December 2014

Research Engineer at ARMINES

Affiliated to the Ecole des Mines de Nantes (Nantes, France)

I contributed in the design of a domain-specific modeling language for mobile applications.

October 2013 - Mars 2014

Research Assistant at DEIB

Politecnico di Milano (Milan, Italy)

I investigated on the relevance, approaches, and the challenges of mobile applications development.

June 2012 - September 2012

Software Engineer

WebRatio s.r.l, a spin-off of the Politecnico di Milano

Address: www.webratio.com

Design and development of various data-driven Web applications, using *WebML* (web modeling language) and BPMN in WebRatio

December 2010 - October 2011

Software Engineer at Almaviva

Consultant at Banca Intesa San Paolo (Milan, Italy)

Address: www.intesasanpaolo.com

Affiliated to *Money Market Deal Capture Group*, I participated in the development of various software components.

2004 - 2006

Lecturer and Trainer of Foundations of ICT

Lycée Saint Alexandre Sauli de Muhura (Rwanda)

Digital Divide Rwanda project. In collaboration with *METID* center of Politecnico di Milano.

SOCIAL AND CULTURAL EXPERIENCE

Vice President of Rwandan Community Abroad (RCA Italy) *March 2017 - September 2018*

Commissioner of Education and Knowledge Transfer *February 2009 - November 2009*
at Rwandan Diaspora in Italy

OTHER SKILLS

Kinyarwanda	Mother tongue
English	Fluent
French	Fluent
Italian	Fluent

ACADEMIC REFERENCES

Marco Brambilla	Associate Professor Dipartimento di Elettronica, Informazione e Bioingegneria Politecnico di Milano, Italy Email: marco.brambilla@polimi.it
Alfonso Pierantonio	Professor of Software Engineering Department of Information Engineering, Computer Science and Mathematics Università degli Studi dell'Aquila, Italy Email: alfonso.pierantonio@univaq.it
Michel Chaudron	Professor of Software Engineering Department of Computer Science and Engineering. Chalmers University of Technology, Sweden Email: chaudron@chalmers.se; m.r.v.chaudron@gmail.com
Timothy X Brown	Director of Academic Affairs, CMU-Africa Professor of Engineering and Public Policy Carnegie Mellon University Email: timxb@andrew.cmu.edu

PUBLICATIONS AND VISIBILITY

ORCID ID: <https://orcid.org/0000-0002-2451-8897>.

Google Scholar is recording a production of 19 papers, starting from 2012, with H-index=5. [**Google Scholar Account**:<https://scholar.google.com/citations?user=rcGIhfMAAAAJ&hl=en>]. I have co-authored papers with 15 different researchers, as recorded by [**DBLP**: <http://dblp.uni-trier.de/pers/hd/u/Umuhoza:Eric>]. To view the impacts of my research, you can also refer to Research Gate: <https://www.researchgate.net/profile/Eric>. I have been a reviewer for *Science of Computer Programming* Journal, *IET Software Journal*, and I am PC member of *Symposium On Applied Computing* Conference.

Journals

- J.1. Brambilla, M., Umuhoza, E. and Acerbis, R., 2017. Model-driven development of user interfaces for IoT systems via domain-specific components and patterns. *Journal of Internet Services and Applications*, 8(1), p.14.

Papers in Proceedings of International Conferences

- C.1. Carlo Bernaschina, Marco Brambilla, Andrea Mauri, and Eric Umuhoza "A Big Data Analysis Framework for Model-Based Web User Behavior Analytics". ICWE 2017.
- C.2. Eric Umuhoza, Marco Brambilla. "Model-driven Development of User Interfaces for IoT Systems via Domain-specific Components and Patterns". ICEIS 2017.
- C.3. Eric Umuhoza, Marco Brambilla. "Model Driven Development Approaches for Mobile Applications: A Survey". MobiWIS 2014.
- C.4. Marco Brambilla, Andrea Mauri, Eric Umuhoza. "Model Driven Development of Social Media Environmental Monitoring Applications". AAAI 2016.
- C.5. Eric Umuhoza, Marco Brambilla, Davide Ripamonti, Jordi Cabot. "An Empirical Study on Simplification of Business Process Modeling Languages". SLE 2015.
- C.6. Eleonora Ciceri, Roman Fedorov, Eric Umuhoza, Marco Brambilla, Piero Fraternali "Assessing Online Media Content Trustworthiness, Relevance and Influence: an Introductory Survey". KDWEB 2015
- C.7. Eric Umuhoza, Hamza Ed-douibi, Marco Brambilla, Jordi Cabot, Aldo Bongio "Automatic Code Generation for Cross-platform, Multi-Device Mobile Apps: Some Reflections from an Industrial Experience". MobileDeli 2015.
- C.8. Eric Umuhoza. "Domain-Specific Modeling and Code Generation for Cross-Platform Multi-Device Mobile Apps." CEUR STAF 2015, Doctoral Symposium, L'Aquila, Italy, 2015.
- C.9. M. Brambilla, A. Mauri, Eric Umuhoza. Extending the Interaction Flow Modeling Language (IFML) for Model Driven Development of Mobile Applications Front End. MobiWIS 2014.
- C.10. R. Jolak, E. Umuhoza, M. Chaudron, and M. Brambilla "Dissecting Design Time and Modeling Time in UML Modeling". EASE 2017.
- C.11. M. Brambilla, R. Eramo, A. Pierantonio, G. Rosa and E. Umuhoza. "Enhancing Flexibility in User Interaction Modeling by Adding Design Uncertainty to IFML" FlexMDE 2017 - 3rd Flexible MDE Workshop. September 2017 - Austin (Texas)

Demo Papers

- D.1. C. Bernaschina, M. Brambilla, T. Koka, A. Mauri, E. Umuhoza. "Integrating Modeling Languages and Web Logs for Enhanced User Behavior Analytics". At WWW 2017.

Thesis

- T.1. Eric Umuhoza, "Domain-specific Modeling and Code Generation for Mobile and IoT-based Applications". Doctoral Dissertation, Politecnico di Milano, Italy, 2017.
- T.2. Eric Umuhoza, "Social Resource and Asset Sharing: A Case of Social Enterprise Optimization". M.Sc. Thesis, Politecnico di Milano, Italy, 2013.