

Khaldoon Al-Zoubi, PhD

PROFILE

Before joining the faculty of Computer Information Technology (Software Engineering) at JUST, I worked for 20 years as a Senior Software Engineer, Researcher and inventor in leading hi-tech companies in Canada and USA. During my hi-tech industry experience, I had full hands on involvement in generating patents, researching, architecting, designing and developing software solutions throughout my career. I incorporate a wide range of industry experience mainly in Data Center (DC) networking and protocols solutions, Software Defined Networks (SDN), large-scale Cloud Computing, embedded software, Real-Time Systems, Graphical User Interface (GUI), Device Drivers, Client/Server communication, QNX/Linux, Explosives/Narcotics detections, and air-traffic communication systems.

I received both Ph.D. (2011) in Electrical and Computer Engineering (minor in Networking), and M.C.S (2006) from Carleton University (Ottawa, Ontario, Canada). I also received BS (1995) in Electrical and Computer Engineering from the University of Louisiana at Lafayette (Lafayette, Louisiana, USA).

My research focuses on Software as a service (SaaS) based systems, Software Interoperability for heterogeneous systems, Software virtualization and abstraction, Cloud Computing, Simulation & Modeling, Distributed Simulation, Networking, Data Center (DC), Software Defined Networks (SDN), Web-services, Object-Oriented and Agile Modeling, and Software Engineering.

Multiple patents (*Please see the patents list at <https://patents.justia.com/inventor/khaldoon-al-zoubi>*) and publications have been generated based on such research.

INVENTIONS (PATENTS)

Please see the patents list at <https://patents.justia.com/inventor/khaldoon-al-zoubi>

EDUCATION

PhD in Electrical and Computer Engineering, Carleton University (Ottawa, Ontario, Canada) 2007-2011

Thesis Title: *Enhanced Distributed Simulation Interoperability and Algorithms Using Web Services* (ISBN: 9780494815427)

Master of Computer Science in Software Engineering, Carleton University (Ottawa, Ontario, Canada) 2006

Thesis Title: *Hierarchical Scheduling in Grid Systems* (ISBN: 9780494164808)

Bachelor of Science in Electrical and Computer Engineering, University of Louisiana at Lafayette (Lafayette, Louisiana, USA) 1995

Department: Electrical and Computer Engineering (<http://ee.louisiana.edu/>)

PROFESSIONAL EXPERIENCE

Assistant Professor

Faculty of Computer Information Technology (Software Engineering)

Jordan University of Science and Technology (JUST)

February 2016 – Present

Courses: Software Design, Software Modelling, Software fundamentals

Senior Software Researcher

Huawei Technologies

Ottawa, Ontario, Canada

June 2014 – January 2016

Projects: Researching and architecting next generation products related to the Data Centers (DC) and Clouds. These products are specifically related to the Software Defined Networks (SDN), Software fabric abstraction, logical Networks, Virtualization methods, OpenStack, Openflow Virtual Switches (OVS) and Network Topology.

Responsibilities:

- Participated in generating a number of patents.
- Contributed with many software patches to the open-source opendaylight (<https://www.opendaylight.org/>) project on behalf of Huawei Technologies.
- Architected and Designed Service Profile architectures and mapping them to Logical Networks.
- Architected and Designed Logical Networks and mapping them to Fabric abstractions.
- Architected and Designed User Models and RESTful APIs.
- Developing the core parts of above defined architectures and designs.
- Tutor other developers in R&D to carry out some parts of products development.

Technical Environment: Technical Leading, Software Design and Architecting, Open-source Software, Networking, Data Centers (DC), Cloud Computing, Java, RESTful Web-services, Linux, Unit/Integration testing, Databases (Cassandra), Eclipse IDE, XML, JSON, etc.

Senior Software Designer

BlackBerry

Ottawa, Ontario, Canada

2012 – April 2014

Project: Olympia (Large scale Cloud Computing system), which consists of a complex of servers that are responsible for managing more than 150 million blackberry devices and users activities such as publishing files/images on blackberry channels, storing and backing up files/images, image processing like resizing and cropping, and Web-based devices tracking.

Responsibilities:

- Developing new features, fixing software problems, Unit/Integration testing, and documentation.
- Was the prime developer of developing the servers that responsible for queuing, aggregating files as they arrive into zip files so that they can be pushed into Net-Storage. These servers also calculate the published files URLs, allowing them to be downloaded at a later time by different BlackBerry applications and devices around the world.
- Was the prime developer of implementing the image transformation process, which includes image resizing into different resolution, image cropping, banned image filtration, and returning their download URLs as XML documents to BlackBerry devices and apps.
- Was the prime developer of several features such as the implementations of converting the user servers to operate in herds, allowing 0 down time in situations like upgrading servers to new software releases.
- Performed unit testing within Eclipse environment to all of implementations and code changes.
- Performed integration testing usually using rackspace environment and java bean shell scripts.
- Provided full support to functional and performance testers and production operators mainly to the features that I implemented.
- Alongside a team of 5 people, we were able to release a number of successful software solutions.

Technical Environment: Cloud Computing, Java, Java bean shell, Agile organized environment, RESTful Web-services, Networking, Linux, Unit/Integration testing, Databases (Mysql & Cassandra), Eclipse IDE, XML, etc.

Senior Software Engineer/Architect

Scintrex Trace Corporation
Ottawa, Ontario, Canada
2006 – 2012

Projects: worked on a range of the state-of-art Real-time Desktop and Embedded systems used for Explosive and Narcotics detections and X-Ray imaging process. They are mainly used by military and police around the world in areas similar to airports and border crossings.

Responsibilities:

- Fully in charge of architecting, planning, designing, implementing, and testing the required software according to military and security agencies requirements.
- Worked independently to design and implement the E5000 new generation system according to different governments requirements. E5000 is a Dual Mode (Explosive and Narcotic) Trace Detector. Product overview can be found at <http://www.scintrextrace.com/brochures/current/E5000.pdf>
- Implemented the E5000 (more than 100,000 lines of C/C++ code) as 16 Linux processes. Those processes provide different functions such as AtoD hardware control, data acquisition from hardware, GUI and data analysis and detections.
- Implemented the GUI as a Linux process using Qt. This GUI provides full fledged engineering analysis tools, which allows users to configure and control the system. It further provides users of 2D plots, enhancing user analysis of different situations.
- Implemented E5000 inter-processes communications on top of Linux IPC, allowing both asynchronies and synchronies communications.
- Provided independently a full support of the previous E5000 generation, which was based QNX. This support included developing new features and fix issues as they appear.
- Successfully delivered many software builds and releases successfully on time; able to migrate the system software design and implementations from the QNX platform and Photon GUI programming to the Linux platform and Qt GUI Programming.
- Worked closely with the hardware engineers, chemists and technicians.

Technical Environment: C, C++, Qt GUI Programming, Photon microGUI Programming, Device Driver Programming, TCP/IP, Client/server, embedded programming, real-time software development, ARM7, Linux, QNX 4.25, and worked with the entire software cycle and organizing many employees/customers training sessions.

Senior Software Engineer
Xwave solutions (worked at NAV Canada site)
Ottawa, Ontario, Canada
2003 – 2006

Project: SAATS (Shanwick Automated Air Traffic System) is a system that is responsible for managing all air traffic heading from Europe to North America over the Atlantic Ocean.

Responsibilities:

- Developed the software Functional Specifications of the coordination messaging protocol with systems.
- Further designed and implemented the software of all of the Data communication links protocols, which achieve the air traffic coordination with other air-traffic systems and aircrafts.
- Implemented the client/server required messaging dialog protocol, which allows clients (i.e. air traffic operators) to communicate with the back-end servers.

Technical Environment: Worked with the entire software cycle from developing specification and requirements until product release, Computer communication protocols, real-time software development & testing, TCP/IP, C, C++, Pascal VMS, UNIX operating system, OpenVMS operating system, and XML.

Senior Software Engineer/Team Leader
SigPro Wireless
Ottawa, Ontario, Canada
2000 – 2003

Project: FLEXIUM™ System-on-Chip (SoC) with accompanying software is a universal air-interface engine that enables the next generation of wireless personal communication devices (PCDs) to communicate with high-speed wireless networks around the world.

Responsibilities:

- Fully in charge of the software team to develop & test the specifications according to standards, as well as perform the software design, testing and implementation of those specifications.
- Lead a team of eight developers to implement the CDMA2000 Upper Layer (Layer 3) messages including Layer 2 interface.
- Worked with the System team to define the physical layer interfaces with CDMA2000 Layer 2.

Technical Environment: Rational Rose Real Time, UML, C, C++, ARM9 Processor, TCP/IP, x-kernel, Tornado & VxWorks, ADS (ARM Development suite), and CDMA2000 standards.

Software Engineer

Xwave solutions (worked at NAV Canada site)

Ottawa, Ontario, Canada

1998 – 2000

Project: GAATS (Gander Automated Air Traffic System) system, owned by NAV Canada, controls the air traffic heading from North America to Europe.

Responsibilities:

- Fully designed and implemented the required software for all of client-server communication between the GAATS server and workstations.
- Was the prime integration developer (out of twelve developers) to ensure a new software gold candidate build has met customer (NAV Canada) acceptance. This usually requires debugging and fixing new problems, delivering and installing new build at customer (NAV Canada) site, and may require working with developers from other companies to figure out the system side that needs to fix a problem.

Examples of Skills Used: Client/Server programming, TCP/IP, C, C++, Pascal VMS, UNIX operating system, OpenVMS operating system, and worked with the entire software cycle.

Software Engineer

Texas Instrument

Dallas, TX, USA

1996 – 1997

Project: V-series is a Texas Instrument (TI) system used for testing all types of TI-based VLSI chips.

Responsibilities:

- Designed and coded the system level diagnostic and calibration programs for the V-series Test System.

Technical Environment: C, Pascal, ITP (i.e. TI-based device programming language), and UNIX operating system.

PUBLICATIONS

Journal Papers:

- "Distributed Simulation of DEVS and Cell-DEVS Models Using the RISE Middleware". K. Al-Zoubi, Gabriel Wainer. Simulation Modelling Practice and Theory. , Elsevier. Vol. 55. June 2015, Pages 27–45.
- RISE: A general simulation interoperability middleware container". K. Al-Zoubi, Gabriel Wainer. Journal of Parallel and Distributed Computing, Elsevier. Vol. 73. Issue 5. May 2013. Pages 580–594.
- "Distributed simulation of DEVS and Cell-DEVS models in CD++ using Web-Services". G. Wainer, R. Madhoun, K. Al-Zoubi. Simulation Modelling Practice and Theory, Elsevier, Maryland Heights, MO, USA. Volume 16, Number 9, Pages: 1266--1292 - October 2008.
- "Hierarchical Scheduling in Heterogeneous Grid Systems". K. Al-Zoubi. International Journal of Information Technology and Web Engineering, IGI Global, Hershey, PA, USA. Volume 2, Number 1, Pages: 1-16 pages. 2007.

Book Chapters:

- “Distributed Simulation Using RESTful Interoperability Simulation Environment (RISE) Middleware”. Khaldoon Al-Zoubi, Gabriel A. Wainer. Chapter 6 in “Handbook on Intelligence-based Systems Engineering”. Andreas Tolk and Lakhmi Jain Editors. Springer-Verlag, 2011.
- "An Introduction to Distributed Simulation". Khaldoon Al-Zoubi, Gabriel A. Wainer. Chapter 11, Modeling and Simulation Fundamentals: Theoretical Underpinnings and Practical Domains. Catherine Banks, John Sokolowski, Editors. Wiley. New Jersey, USA, 2010.
- “DEVS Standardization: Foundations and Trends”. G. Wainer, K. Al-Zoubi, et al. Chapter 15, “Discrete-Event Modeling and Simulation: Theory and Applications.” G. Wainer, P. Mosterman (Editors). CRC Press. Taylor and Francis. December 2010.
- “An Introduction to DEVS Standardization”. G. Wainer, K. Al-Zoubi, et al. Chapter 16, “Discrete-Event Modeling and Simulation: Theory and Applications.” G. Wainer, P. Mosterman (Editors). CRC Press. Taylor and Francis. December 2010.
- “Standardizing DEVS Model Representation”. G. Wainer, K. Al-Zoubi, et al. Chapter 17, “Discrete-Event Modeling and Simulation: Theory and Applications.” G. Wainer, P. Mosterman (Editors). CRC Press. Taylor and Francis. December 2010.
- “Standardizing DEVS Simulation Middleware”. G. Wainer, K. Al-Zoubi, et al. Chapter 18, “Discrete-Event Modeling and Simulation: Theory and Applications.” G. Wainer, P. Mosterman (Editors). CRC Press. Taylor and Francis. December 2010.
- “Hierarchical Scheduling in Heterogeneous Grid Systems”. Khaldoon Al-Zoubi. Chapter X, Integrated Approaches in Information Technology and Web Engineering: Advancing Organizational Knowledge Sharing. Ghazi Alkhatib, David Rine, Editors. IGI Global, Hershey, PA, USA, 2009.

Conference Papers:

- “Simulation in the Cloud Using Handheld Devices”. E. Mancini, G. Wainer, K. Al-Zoubi, and O. Dalle. Proceedings of the 12th IEEE/ACM International Symposium on Cluster, Cloud and Grid Computing. Ottawa, Canada. 2012.
- “Managing Simulation Workflow Patterns using Dynamic Service-Oriented”. K. Al-Zoubi, G. Wainer. Proceedings of the Winter Simulation Conference (WSC 2010). Baltimore, Maryland, USA. 2010.
- “RISE: REST-ing Heterogeneous Simulation Interoperability”. K. Al-Zoubi, G. Wainer. Proceedings of the Winter Simulation Conference (WSC 2010). Baltimore, Maryland, USA. 2010.
- “Performing Distributed Simulation with RESTful Web-Services Approach”. K. Al-Zoubi, G. Wainer. Proceedings of the Winter Simulation Conference (WSC 2009). Austin, TX – 2009.
- “Using REST Web-Services Architecture for Distributed Simulation”. K. Al-Zoubi, G. Wainer. Proceedings of the 23rd of the IEEE Principles of Advanced and Distributed Simulation (PADS 2009), pp. 114-121. Lake Placid, NY – 2009.
- "Interfacing and Coordination for a DEVS Simulation Protocol Standard". K. Al-Zoubi, G. Wainer. Proceedings of the 12th IEEE/ACM International Symposium on Distributed Simulation and Real-Time Applications (DS-RT 2008), pp. 300-307. Vancouver, BC – 2008.
- "Hierarchical scheduling in Grid Systems". K. Al-Zoubi, S. Dandamudi. Proceedings of the 4th International Multiconference on Computer Science and Information Technology, CSIT 2006, Volume 1, pp. 289 – 299. Amman, Jordan.

PHD AND MASTER THESIS ABSTRACTS

PhD Thesis Abstract:

With the expansion of the Internet, the desire toward global cooperation in the distributed simulation technology has also been on the rise. As a result, much research has been devoted to develop middleware interoperability methods on the Web, particularly using purely SOAP-based WS or HLA with SOAP extension. However, such frameworks still have constraints in the structural rules that are placed on the middleware design methods. In particular, the way they exchange, structure, and use information is tied to programming, making it difficult to decouple systems implementations and design. In this work, these issues are addressed, enhancing the distributed simulation methods on the Internet using SOAP WS and RESTful WS. In particular, the main objective of the methods presented is to decouple systems design and implementations while allowing composition scalability and dynamicity. To do so, the proposed SOAP-based methods wrap each system in a single WS port while algorithms synchronize simulation via exchanging XML messages. However, the thesis shows how the objective can better achieved by the RESTful Interoperability Simulation Environment (RISE) middleware, which is the first existing RESTful simulation environment. RISE is a general middleware that serves as a container to hold different simulation environments without being specific to a certain environment. In RISE, all functionalities are hidden in resources (URIs) that connected to each other via constant uniform virtual channels where all synchronization messages are described in XML. To prove the concept of the general middleware container, we started by RISE-enabling a simulator called CD++, so that it can perform distributed simulation on the Web. This system performance tests have shown promising results comparing to the SOAP-enabled version. Additional methods have also

been defined such as algorithms that could be used as a basis for DEVS standardization, and workflow methods to enhance simulation experimentation automation and reusability via the Web.

Master Thesis Abstract:

This research is mainly focused on the first two stages of the Grid scheduling, namely: Resource discovery and resource selection stages. We propose a self-discovery method for the resource discovery stage. In addition, we propose an adaptive child scheduling method for the resource selection stage. We also propose three rescheduling algorithms in the resource selection stage: (1) the Butterfly algorithm in order to reschedule jobs when better resources become available, (2) the Fallback algorithm in order to reschedule jobs that had their resources taken away from the Grid before the actual resource allocation and (3) the Load-Balance algorithm in order to balance load among resources. With the purpose of increasing system scalability and flexibility, the proposed hierarchal scheduling approach is combined with the Peer-to-Peer (P2P) systems approach in one hybrid system. A Grid model (consisting of 2400 nodes) is built to test the proposed ideas through simulation over a number of different workloads and scenarios. We compare the performance of the proposed hierarchal systems against the P2P systems approach according to three metrics: (1) the total response time, (2) the average waiting time, and (3) the average execution time.