Beyond Code: An Introduction to Model-Driven Software Development (CISC 836, Fall 2021)

Schedule & Reading List

Tentative course schedule

Notes:

- The list of course readings shown below is still tentative. Changes are possible.
- Free access to papers only from Queen's domain (i.e., use the Queen's proxy site for off-campus access)
- The course has a page in OnQ containing discussion forums for each of the three assignments. You need your Queen's "NetID" to log in.

Week	Date	Topic	Slides	Lead reviewers
1	Sept 7, 9	**Course info: Intro, motivation, admin** *Content:* What is a model? Models in software development. *Readings:* None	part1_4up, part2_4up	
2	Sept 14, 16	**Expressing software models: UML** *Content:* Class diagrams, object diagrams, state machines, sequence diagrams. *Readings:* None	4-up	
3	Sept 21, 23	**MDSD with UML-RT and IBM RSARTE I** *Content:* UML-RT: Basic concepts (capsules, protocols, ports, basic state machines) [Moh21a,Moh21b]. RSARTE: Installation, basic use, examples. *Readings:* None *Assignments:* Assignment 1 *RSARTE download and installation instructions:* See Assignment 1 *UML-RT web interface:* Go here *Video tutorial:* Informal system description, how to define structure, how to define the behaviour *Sample models:* Go to here. Instructions on how to import these models into RSARTE can be found on the Assignment 1 page. *In class exercise:* What is a restaurant?	Parts 1 to 3, 4-up	
4	Sept 28,	**MDSD with UML-RT and IBM RSARTE I**		

	30	Content: UML-RT: Basic concepts (capsules, protocols, ports, basic state machines) [Moh21a,Moh21b]. RSARTE: Installation, basic use, examples. Readings R1 (Complexity): [Boo18], [Sub18] Readings R2 (Abstraction): [Kra07], [Spo02] Assignments: Assignment 2		R1: Paul-Mark R2: Youssef
5	Oct 5, 7	**MDSD with UML-RT and IBM RSARTE II** Content: UML-RT: More on ports and state machines [Moh21a,Moh21b] Readings R3 (Actors): [Akka17], [KCM16] Readings R4 (State machines): [Sam09, pages 1-1 to 1-8 and 3-1 to 3-6], [RG21] Assignments: Assignment 2 Sample models: Go to UML-RT sample models In class exercise (on Thursday): Can you get there from here?	Part 4, 4-up	R3: Christina R4: Aaron
	Oct 12, 14	**Fall break, no class**		
6	Oct 19,21	**MDSD with UML-RT and IBM RSARTE III** Content: UML-RT: Design guidelines, advanced features [Moh21a,Moh21b] Readings: None Assignments: Assignment 3	Part 5, 4-up, Part 6, 4-up	
7	Oct 26,28	**Domain Specific Languages I** Content: Meta modeling, Eclipse Modeling Framework (EMF) Readings: None In class exercise (on Thursday): Take it Apart		
8	Nov 2,4	**Domain Specific Languages II** Content: Eclipse Modeling Framework (EMF), DSL examples, pros and cons, definition, metamodeling Readings R5 (Modeling applications: data analytics): [ROH+19] Readings R6 (Modeling applications: security: [TSS+20] Assignments: Assignment 4	DSLs, 4-up EMF, 4-up	R5: Bara' R6: Mohammad
9	Nov 9,11	**Domain Specific Languages III** Content: Abstract syntax, concrete syntax, semantics, tooling, Xtext, debugging models Readings R7 (Modeling applications: robotics, adaptive systems): [CCF+20] Readings R8 (DSLs: Examples): [Tom17, sections on 'what?' and 'why?'], [Voe21] Sample EMF projects: Go to Samples of EMF projects		R7: Jeffrey R8: Ibrahim
10	Nov 16,18	**Domain Specific Languages IV** Content: Abstract syntax, concrete syntax, semantics, tooling, Xtext, debugging models Readings R9 (DSLs: Examples: autonomous vehicles)		R9: Sudhandar R10: Manar

		[SBO+20] *Readings R10 (DSLs: Evaluation):* [HSS14] *Sample DSLs:* Go to Examples of DSLs in Xtext		
11	Nov 23,25	**MDE** *Content:* MDE: strengths and weaknesses *Readings R11 (Statistical models):* [RVY14] *Readings R12 (MDE: obstacles to adoption):* [Sel12]		R11: Tindur R12: Zhimin
12	Nov 30, Dec2	**Slack, work on projects**		

Readings (tentative)

- **Complexity and abstraction**
  - **R1:** [Boo18] G. Booch. The History of Software Engineering. IEEE Software. Volume 35, Issue 5. Sept/Oct 2018.
  - **R1:** [Sub18] V. Subramaniam. Don't Walk Away from Complexity, Run. Presentation at GOTO 2018.
  - **R2:** [Kra07] J. Kramer. Is abstraction the key to computing? Communications of the ACM, Volume 50, Issue 4, Pages 36-42. April 2007. 7 pages.
  - **R2:** [Spo02] J. Spolsky. The Law of Leaky Abstractions. Joel on Software Blog. 2002. 6 pages.
- **Actors and state machines**
  - **R3:** [Akka17] Akka Documentation. 2017.
    - Why modern systems need a new programming model (here)
    - How the Actor Model Meets the Needs of Modern, Distributed Systems (here)
    - Actor Systems (here)
    - What is an Actor? (here)
  - **R3:** [KCM16] Joeri De Koster, Tom Van Cutsem, Wolfgang De Meuter. 43 Years of Actors: A Taxonomy of Actor Models and Their Key Properties. 6th International Workshop on Programming Based on Actors, Agents, and Decentralized Control (AGERE'16). October 30, 2016.
  - **R4:** [Sam09] M. Samek. A Crash Course in UML State Machines. Article based on Chapter 2 of the book "Practical UML Statecharts in C/C++ Second Edition". March 2009.
  - **R4:** [RG21] Refactoring Guru Website. Design Patters: State. 2021.
- **Applications of modeling: analytics, security, robotics**
  - **R5:** [ROH+19] G.K. Rajbahadur, G.A. Oliva, A.E. Hassan, and J. Dingel. Pitfalls Analyzer: Quality Control for Model-Driven Data Science Pipelines. 22rd ACM/IEEE International Conference on Model Driven Engineering Languages and Systems (MODELS '19). 2019. Presentation at KNIME Spring Summit 2020.
  - **R6:** [TSS+20] K. Tuma, L. Sion, R. Scandariato, and K. Yskout. Automating the Early Detection of Security Design Flaws. 23rd ACM/IEEE International Conference on Model Driven Engineering Languages and Systems (MODELS '20). 2020.
  - **R7:** [CCF+20] B.H.C. Cheng, R.J. Clark, J.E. Fleck, M.A. Langford, and P.K. McKinley. AC-ROS: Assurance Case Driven Adaptation for the Robot Operating System. 23rd ACM/IEEE International Conference on Model Driven Engineering Languages and Systems (MODELS '20). 2020.
- **DSLs**
  - **R8:** [Tom17] F. Tomassetti. The complete guide to Domain Specific Languages. Blog post at https://tomassetti.me/domain-specific-languages. 2017.
  - **R8:** [Voe21] M. Voelter. Is a DSL suitable for you? 2021.
  - **R9:** [SBO+20] SceML: a graphical modeling framework for scenario-based testing of autonomous vehicles. 23rd ACM/IEEE International Conference on Model Driven Engineering Languages and Systems (MODELS '20). 2020.

- **R10:** [HSS14] Comparing Three Notations for Defining Scenario-Based Model Tests: A Controlled Experiment. B. Hoisl, S. Sobernig, and M. Strembeck. 9th International Conference on the Quality of Information and Communications Technology. 2014.
- **Future of software development and MDE**
    - **R11:** [RVY14] V. Raychev, M. Vechev, E. Yahav. Code completion with statistical language models. ACM SIGPLAN Notices 49(6):419-428. June 2014.
    - **R12:** [Sel12] B. Selic. What will it take? A view on adoption of model-based methods in practice. Software & Systems Modeling (SoSyM). Volume 11, Issue 4, Pages 513-526. 2012.

Supporting material

- **MDE**
    - Marco Brambilla, Jordi Cabot, Manuel Wimmer. Model-Driven Software Engineering in Practice. 2nd Edition. Morgan and Claypool. 2017. Available as ebook (search Queen's University Library for book title)
    - [Lud03] J. Ludewig. Models in Software Engineering - An Introduction. Software & Systems Modeling, 2(1): 5-14. March 2003.
    - [Sch06] D.C. Schmidt. Model-Driven Engineering. IEEE Computer, Volume 39, Issue 2. Feb. 2006. Page(s):25 - 31.
- **UML**
    - M. Fowler. UML Distilled: A Brief Guide to the Standard Object Modeling Language (3rd Edition). Addison Wesley. 2004. Available as ebook (search Queen's University Library for book title)
    - G. Booch, J. Rumbaugh, I. Jacobson. UML User Guide. 2nd Edition. Addison Wesley. 2005. Available as ebook (search Queen's University Library for book title)
    - [SSH+16] Supporting material for 'UML @ Classroom' book by Seidl, Scholz, Huemer, and Kappel.
    - [IBM16] Online UML Class Diagram tutorial by IBM.
    - [AM16a] Online UML State Machine tutorial by Agile Modeling.
    - [AM16b] Online UML Sequence Diagram tutorial by Agile Modeling.
    - [OMG17] Object Management Group. UML 2.5.1 Specification. Dec 2017.
    - [Sel12] B. Selic. The Less Well Known UML. Formal Methods for Model-Driven Engineering. Lecture Notes in Computer Science Volume 7320, 2012, pp 1-20.
- **UML-RT**
    - [Moh21a] M. Mohlin. Modeling Real-Time Applications in RSARTE.
    - [Moh21b] M. Mohlin. UML-RT States and Transitions.
    - [Moh21c] M. Mohlin. UML-RT Choice vs Junction Points.
    - [Sel98] B. Selic and J. Rumbaugh. Using UML for modeling complex real-time systems. Languages, Compilers, and Tools for Embedded Systems (LCTES'98). Montreal, Canada. 1998.
    - [PD14] E. Posse, J. Dingel. An executable formal semantics for UML-RT. Software & Systems Modeling 15 (1), 179-217. 2016.
- **IBM RSARTE**
    - [HCL21a] HCL Technologies. RSARTE User's Guide.
    - [Moh21d] M. Mohlin. Building C++ Applications with RTist.
    - [Moh21e] RSARTE C++ RT Services Library.
    - [Moh21f] M. Mohlin. Debugging RTist Models.
    - [HCL21b] HCL Technologies. Model Debugger Introduction. Video.
    - [HCL21c] HCL Wiki. Look for 'RTist'
- **EMF**
    - [Vog16] Online EMF tutorial by Lars Vogel.
    - [ES16] Online EMF tutorial by EclipseSource.
    - [IBM16] Eclipse EMF Homepage.
    - [Ecl16] EMF Documentation.
- **DSLs**

- [Voe13] M Voelter. DSL Engineering: Designing, Implementing and Using Domain-Specific Languages. CreateSpace Independent Publishing Platform. 2013.
- [Tom17] F. Tomassetti. The complete guide to (external) Domain Specific Languages. Blog post at https://tomassetti.me/domain-specific-languages. February 20, 2017.
- [Fow21] M. Fowler. Domain-Specific Languages Guide. 2021.
- [Bar21] M. Barash. Introductory course on domain-specific languages with Xtext and MPS. 2021.

Last modified: Mon Mar 15 2021 14:49:12