Advanced System and Software Architecture Modeling and Assessment SYS750-LTA

School of Systems and Enterprises
Spring 2023

Instructor: William D. Miller
Course Web Address: https://sit.instructure.com/courses/64458
Course Schedule:
Weekly Lectures from week of Wednesday, January 18, 2023 through Thursday, May 4, 2023 (Spring break is Sunday, March 12 through Sunday, March 19)
Review/Project Work Period Friday, May 5 through Tuesday, May 16, 2023
Grades posted no later than Friday, May 19, 2023
Contact Info: Canvas Mail (alternate wmiller@stevens.edu), Mobile/Text 1.908.759.7110
Virtual Office Hours: TBD and other times by appointment
Class Hours: TBD
Virtual session URL: Instructor will send out virtual session Zoom invitation to students via Canvas Mail
Prerequisite: SYS650 System Architecture and Design
Cross-listed with: N/A

COURSE DESCRIPTION

This course presents fundamentals of modeling complex systems architectures. It introduces object-oriented decomposition and model-based systems engineering using SysML. Emphasis is on modeling mission objectives to define system level architecture. Broader systems architecting topics are examined like system of systems, agile systems engineering, reference architectures and patterns, and architecture assessment. The course concludes with a system of systems level architecture modeling practicum based on a real-world system of systems.

The following topics are covered:

1. Introduction to System/SoS Modeling, and SysML
2. Modeling Behavior
3. Modeling Structure
4. End to end Architecture Modeling Examples
5. Non-Functional Requirements and Parametrics
6. Intro to Executable SysML Modeling

7. SysML supporting tools
8. Implementing MBSE and Advanced MBSE Research
9. Reference Architectures and Patterns
10. System of Systems Architecting
11. Architecture Frameworks
12. Considering Agile System Engineering
13. Architecture Management and Assessment
14. Advanced Topics in Systems Architecting.

STUDENT LEARNING OUTCOMES

After successful completion of this course, students will be able to…

- Document requirements, generate use cases, capture activity diagrams, and document logical and physical architecture using SysML
- Understand the value of modeling to architects when reasoning about the system and its constituent parts
- Apply a process for modeling system and system of systems using SysML
- Apply the experience gained through the use of a systems engineering based tool that supports systems engineering requirements, architecture, and modeling processes
- Develop an architecture applying the methods learned in the course.

COURSE FORMAT AND STRUCTURE

The course uses lectures, augmented by systems engineering readings from both academia and industry, to describe the concepts of system architecting and model-based systems engineering. The course is designed to leverage the experiences of professionals in the program and culminates in an individual assignment that relies on both professional engineering experience and classroom learning.

This course is fully online with live weekly class via Zoom. The lectures are recorded and available for playback ahead of the live Zoom sessions. Students are encouraged to view the recorded lectures ahead of the Zoom sessions. To access the course, please visit stevens.edu/canvas . For more information about course access or support, contact the Technology Resource and Assistance Center (TRAC) by calling 201-216-5500.

Course Logistics

- Our weeks will run from Wednesdays to Tuesdays, with Zoom sessions scheduled for Wednesday evenings US Eastern time. I will post information (online activities, discussion starters, etc.) for the upcoming week by the previous Sunday evenings.
- Assignment due dates and times are posted in the weekly schedule.
- Deadlines are an unavoidable part of being a professional and this course is no exception. Course requirements must be completed and posted or submitted on or before specified due date and delivery time deadline. Due dates and delivery time deadlines are defined as Eastern Time (as used in Hoboken, NJ). Please note, students living in distance time zones or overseas must comply with this course time and time and due date deadline policy. Avoid any inclination to procrastinate. An assignment file should be appended by your username or team name, such as "assignment1_kim53.doc" or "assignment2_team3.doc". This will make it easier for me to manage assignment files you download to your computer.

Instructor's Online Hours

I will be available via Canvas Mail and will respond as soon as I am available (generally within 24-48) hours. Furthermore, there is a specific discussion forum that you can use to ensure that you have my attention – to ask questions or to call my attention to a particular discussion you are engaged in that you would like me to take a look at. If you feel you are being neglected in any way, please contact me. When emailing me, please place in the subject line the course number/section and the topic of the email (i.e., SYS750-LTA-Assignment 2 Question). This will help me tremendously in locating your emails quicker.

Virtual Office Hours

Virtual Office Hours are to discuss questions related to weekly readings and/or assignments. Office hours will be held TBD. To connect to the weekly office hours session, use the link to the weekly office hours invitation via Canvas Mail. Please make requests by Canvas Mail for special appointments.

Online Etiquette Guidelines

Your instructor and fellow students wish to foster a safe online learning environment. All opinions and experiences, no matter how different or controversial they may be perceived, must be respected in the tolerant spirit of academic discourse. You are encouraged to comment, question, or critique an idea but you are not to attack an individual. Our differences, some of which are outlined in the University's inclusion statement below, will add richness to this learning experience. Please consider that sarcasm and humor can be misconstrued in online interactions and generate unintended disruptions. Working as a community of learners, we can build a polite and respectful course ambience. Please read the Netiquette rules for this course:

- Do not dominate any discussion. Give other students the opportunity to join in the discussion.
- Do not use offensive language. Present ideas appropriately.
- Be cautious in using Internet language. For example, do not capitalize all letters since this suggests shouting.
- Avoid using vernacular and/or slang language. This could possibly lead to misinterpretation.
- Keep an "open-mind" and be willing to express even your minority opinion.
- Think and edit before you push the "Send" button.
- Do not hesitate to ask for feedback.

TENTATIVE COURSE SCHEDULE

Changes to the course schedule will be posted as revisions to the syllabus in Canvas.

Tentative Course Schedule

Week/ Module & Class Date	Topic(s)	Readings	Assignments (via Canvas) & Due Dates
01 (1/18)	Introduction to System/ SoS Modeling, and SysML	Delligatti Chapters 2, 5; Zen and the Art of User Requirements	Key Takeaways/Issues 1/24 by 12:00 p.m. Eastern Time

02 (1/25)	Revisit CONOPS, Elaborating Use Cases, Modeling Requirements, Practicum Introduction	Delligatti Chapters 6, 11	Key Takeaways/Issues 1/31 by 12:00 p.m. Eastern Time
03 (2/1)	Intro to OO Concepts, Modeling with Blocks, Model Organization	Delligatti Chapters 3, 4, 10	Key Takeaways/Issues 2/7 by 12:00 p.m. Eastern Time
04 (2/8)	End-to-End Architecture Modeling – The Dishwasher	Friedenthal, Part III – Modeling Examples; Practical Approach for Modelling Submarine Subsystem Architecture in SysML; Model Base Systems Engineering used in developing a Telescope Manager	Key Takeaways/Issues 2/14 by 12:00 p.m. Eastern Time
05 (2/15)	Architecting the System – Bringing DSM and SysML Together	Design Structure Matrix Extensions and Innovations	Key Takeaways/Issues 2/21 by 12:00 p.m. Eastern Time
06 (2/22)	Non-Functional Requirements and Parametrics	Delligatti Chapters 9, 12	Key Takeaways/Issues 2/28 by 12:00 p.m. Eastern Time
07 (3/1)	Reference Architectures and Patterns, System Entropy	Applying the Concept of Patterns to Systems Architecture; The Design of Future Cars in a New Age of Architectural Competition	Key Takeaways/Issues 3/7 1st Practicum Checkpoint 3/7 by 12:00 p.m. Eastern Time
08 (3/8)	SoS and Systems Collaboration	An Implementer's View of the Evolutionary Systems Engineering for Autonomous Unmanned Systems	Key Takeaways/Issues 3/21 by 12:00 p.m. Eastern Time
Spring Break	March 12-19, 2023		
09 (3/22)	Architect Like DaVinci and Architecture Assessment	Architecture Innovation: The Reconfiguration of Existing Product Technologies and the Failure of Established Firms Architecture Decisions: Demystifying Architecture	Key Takeaways/Issues 3/28 by 12:00 p.m. Eastern Time
10 (3/29)	Service Oriented Architecture for SE, Architecture Frameworks	SOA Challenges in a Hard Real-Time Combat System Environment	Key Takeaways/Issues 4/4 by 12:00 p.m. Eastern Time

11 (4/5)	Considering Agile System Engineering	Fifty Shades of Agile: an Analysis of Different Perspectives of Agile SE	Key Takeaways/Issues 4/11 by 12:00 p.m. Eastern Time
12 (4/12)	Architecture Management, TRIZ for Systems Engineering		Key Takeaways/Issues 4/18 2nd Practicum Checkpoint 4/18 by 12:00 p.m. Eastern Time
13 (4/19)	SysML 2 Preview	To be provided	Key Takeaways/Issues 4/25 by 12:00 p.m. Eastern Time
14 (4/26)	SysML 2 API Preview	To be provided	Key Takeaways/Issues 5/2 by 12:00 p.m. Eastern Time
15 (5/3)	Course Review		Key Takeaways/Issues 5/9 by 12:00 p.m. Eastern Time
Paper & Practicum (5/4-16)	Reflection Paper Practicum Model/Report		Reflection Paper Due 5/2 Practicum Due 5/16 by 11:59 p.m. Eastern Time

COURSE MATERIALS

Textbooks:
1. A Practical Guide to SysML: The Systems Modeling Language 3rd Edition; by S. Friedenthal. A. Moore, R. Steiner; Publisher: OMG; ISBN: 978-0128002025
2. SysML Distilled: A Brief Guide to the Systems Modeling Language; by: Lenny Delligatti; Pub: Addison Wesley; ISBN: 978- 0321927866

Other Readings: Posted in Canvas

Materials: Recorded materials posted in Canvas

SysML tool information to be provided

Design Structure Matrix (DSM) Macros in Microsoft Excel
https://dsmweb.org/excel-macros-for-partitioning-und-simulation/

TECHNOLOGY REQUIREMENTS

Baseline technical skills necessary for online courses

- Basic computer and web-browsing skills
- Navigating Canvas

Technology skills necessary for this specific course

- Live web conferencing using Zoom
- Recording a slide presentation with audio narration

Required Equipment

- Computer: current Mac (OS X) or PC (Windows 7+) with high-speed internet connection
- Microphone: built-in laptop or tablet mic or external microphone

- Optional: Webcam: built-in or external webcam, fully installed

Required Software

- Microsoft Word
- Microsoft Excel
- Microsoft PowerPoint
- Design Structure Matrix Macros in Excel
- SysML software to be specified

GRADING PROCEDURES

Grades will be based on:

Class Participation / Discussion Board Submissions: Weekly Key Takeaways and Issues	15%
Complete the SoS Modeling Practicum	60%
Write a Reflection Paper	25%

Late Policy

Occasionally, things happen in life that cause you to be late submitting course assignments. As this is a graduate level course, I will accept late assignments.

Academic Integrity

Graduate Student Code of Academic Integrity

All Stevens graduate students promise to be fully truthful and avoid dishonesty, fraud, misrepresentation, and deceit of any type in relation to their academic work. A student's submission of work for academic credit indicates that the work is the student's own. All outside assistance must be acknowledged. Any student who violates this code or who knowingly assists another student in violating this code shall be subject to discipline.

All graduate students are bound to the Graduate Student Code of Academic Integrity by enrollment in graduate coursework at Stevens. It is the responsibility of each graduate student to understand and adhere to the Graduate Student Code of Academic Integrity. More information including types of violations, the process for handling perceived violations, and types of sanctions can be found at www.stevens.edu/provost/graduate-academics.

LEARNING ACCOMODATIONS

Stevens Institute of Technology is dedicated to providing appropriate accommodations to students with documented disabilities. The Office of Disability Services (ODS) works with undergraduate and graduate students with learning disabilities, attention deficit-hyperactivity disorders, physical disabilities, sensory impairments, psychiatric disorders, and other such disabilities in order to help students achieve their academic and personal potential. They facilitate equal access to the educational programs and opportunities offered at Stevens and coordinate reasonable accommodations for eligible students. These services are designed to

encourage independence and self-advocacy with support from the ODS staff. The ODS staff will facilitate the provision of accommodations on a case-by-case basis.

For more information about Disability Services and the process to receive accommodations, visit https://www.stevens.edu/office-disability-services. If you have any questions please contact: Phillip Gehman, the Director of Disability Services Coordinator at Stevens Institute of Technology at pgehman@stevens.edu or by phone 201-216-3748.

Disability Services Confidentiality Policy

Student Disability Files are kept separate from academic files and are stored in a secure location within the Office of Disability Services. The Family Educational Rights Privacy Act (FERPA, 20 U.S.C. 1232g; 34CFR, Part 99) regulates disclosure of disability documentation and records maintained by Stevens Disability Services. According to this act, prior written consent by the student is required before our Disability Services office may release disability documentation or records to anyone. An exception is made in unusual circumstances, such as the case of health and safety emergencies.

INCLUSIVITY

Name and Pronoun Usage

As this course includes group work and class discussion, it is vitally important for us to create an educational environment of inclusion and mutual respect. This includes the ability for all students to have their chosen gender pronoun(s) and chosen name affirmed. If the class roster does not align with your name and/or pronouns, please inform the instructor of the necessary changes.

Inclusion Statement

Stevens Institute of Technology believes that diversity and inclusiveness are essential to excellence in academic discourse and innovation. In this class, the perspective of people of all races, ethnicities, gender expressions and gender identities, religions, sexual orientations, disabilities, socioeconomic backgrounds, and nationalities will be respected and viewed as a resource and benefit throughout the semester. Suggestions to further diversify class materials and assignments are encouraged. If any course meetings conflict with your religious events, please do not hesitate to reach out to your instructor to make alternative arrangements.

You are expected to treat your instructor and all other participants in the course with courtesy and respect. Disrespectful conduct and harassing statements will not be tolerated and may result in disciplinary actions.

MENTAL HEALTH RESOURCES

Part of being successful in the classroom involves a focus on your whole self, including your mental health. While you are at Stevens, there are many resources to promote and support mental health. The Office of Counseling and Psychological Services (CAPS) offers free and confidential services to all enrolled students who are struggling to cope with personal issues (e.g., difficulty adjusting to college or trouble managing stress) or psychological difficulties (e.g., anxiety and depression) and who can visit the office in person. CAPS is open from 9:00 am – 5:00 pm Mondays, Wednesdays, Thursdays and Fridays and from 9:00 am – 7:00 pm on Tuesdays during the Fall and Spring semesters; appointments are highly encouraged. For those students who cannot visit the Stevens campus for an in-person appointment, you can

contact a local mental health care provider for an in-person appointment, or if you are enrolled in the Stevens Student Health Insurance, you may call Care Connect for 24/7 mental health support at 1-888-857-5462.

EMERGENCY INFORMATION

In the event of an urgent or emergent concern about the safety of yourself or someone else in the Stevens community, please immediately call the Stevens Campus Police at 201-216-5105 or on their emergency line at 201-216-3911. These phone lines are staffed 24/7, year round. For students who do not reside near the campus and require emergency support, please contact your local emergency response providers at 911 or via your local police precinct. Other 24/7 national resources for students dealing with mental health crises include the National Suicide Prevention Lifeline (1-800-273-8255) and the Crisis Text Line (text "Home" to 741-741). If you are concerned about the wellbeing of another Stevens student, and the matter is *not* urgent or time sensitive, please email the CARE Team at care@stevens.edu. A member of the CARE Team will respond to your concern as soon as possible.