CSSE 490 Model-Based Software Engineering: Introduction

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What is a Model?

- An abstraction, perspective, or simulation?
  Mix of these or something else?

- A description of a system, theory, or phenomenon that accounts for its known or inferred properties and may be used for understanding its characteristics
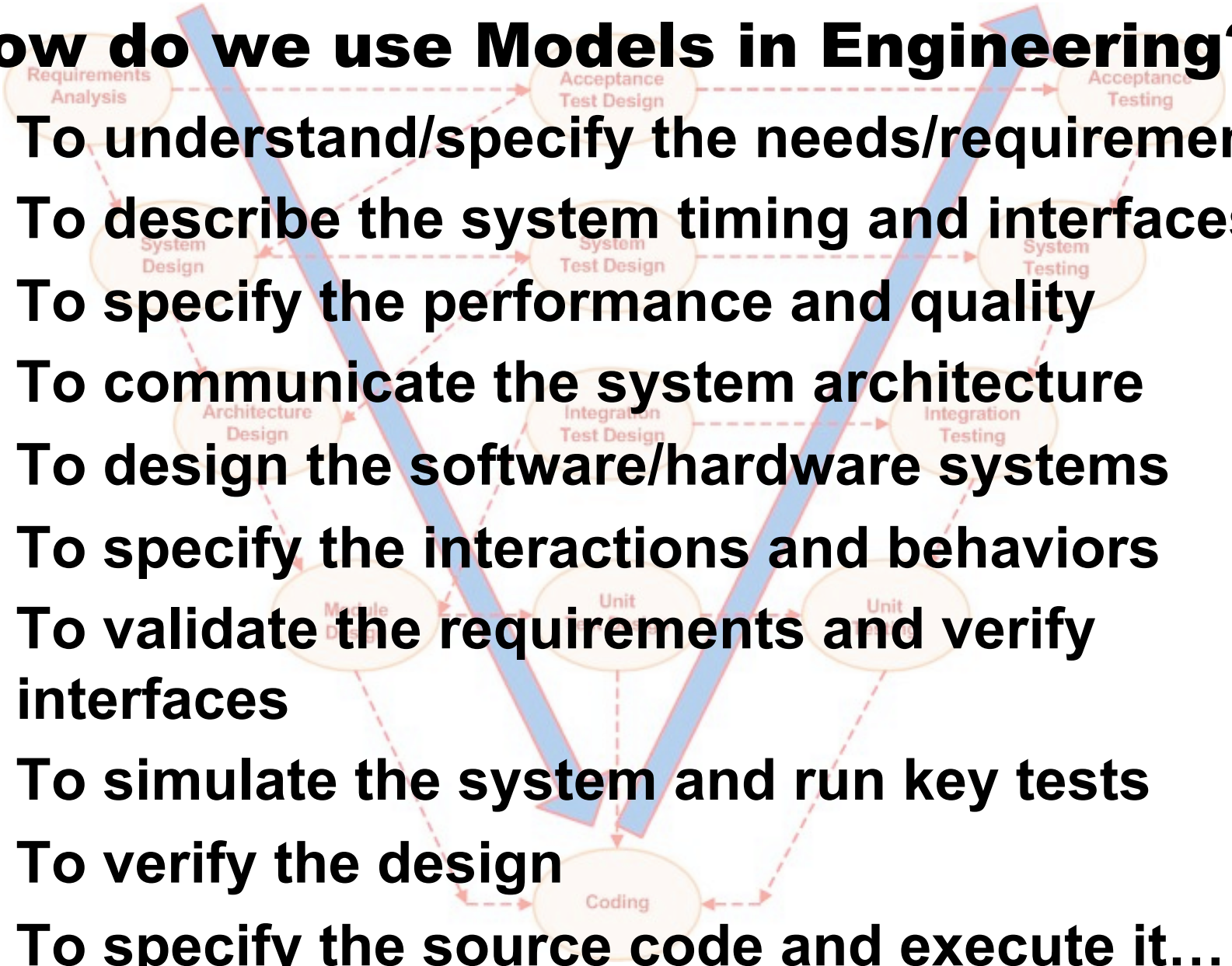
- Models answer questions!

What is Engineering?

- **It's what an engineer does…
  and it's a department in a firm…**
- **But, what else can you think of**

- **Think for 15 seconds…**
- **Turn to a neighbor
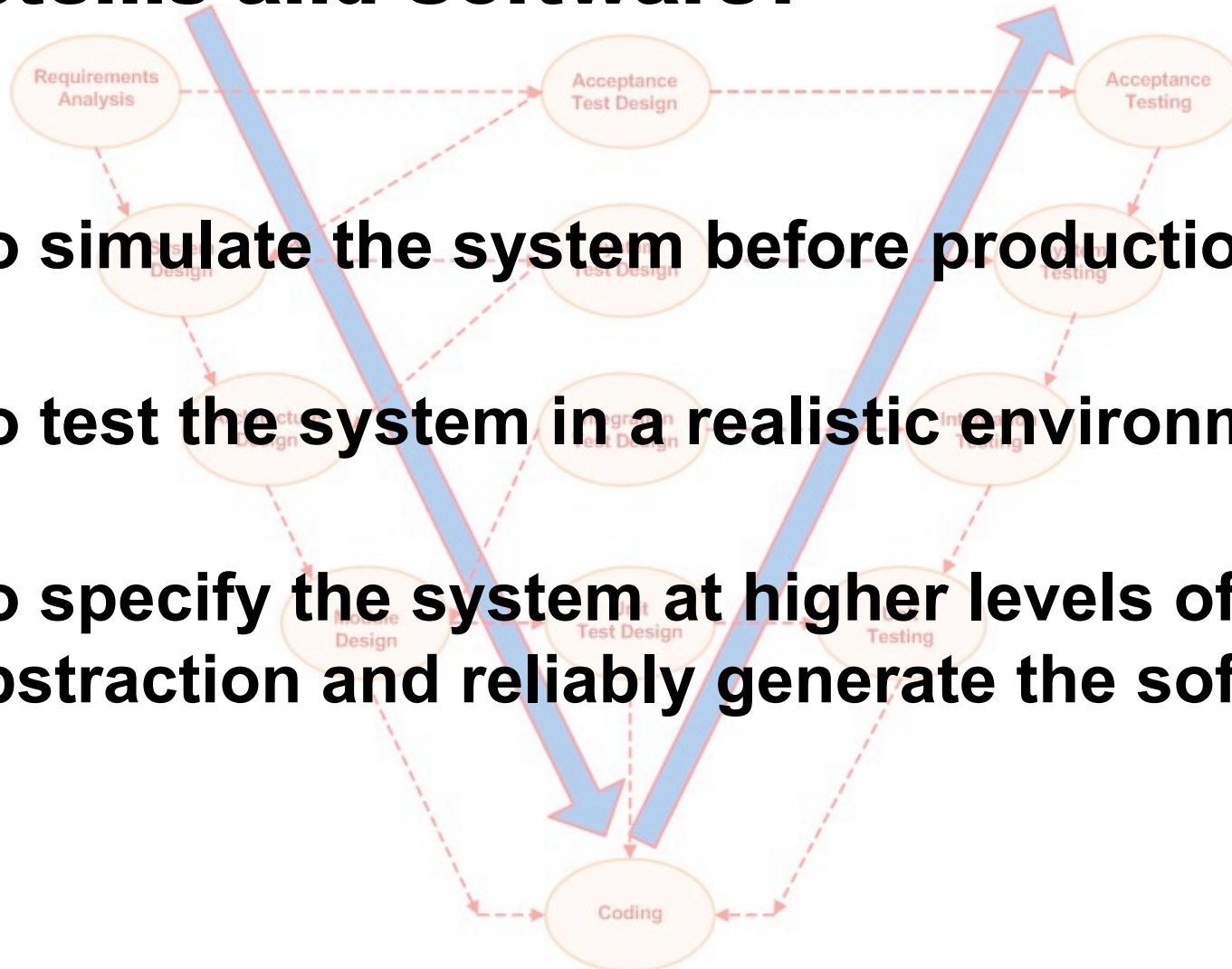 and discuss it for a minute**

How do we use Models in Engineering?

- **To understand/specify the needs/requirements**
- **To describe the system timing and interfaces**
- **To specify the performance and quality**
- **To communicate the system architecture**
- **To design the software/hardware systems**
- **To specify the interactions and behaviors**
- **To validate the requirements and verify interfaces**
- **To simulate the system and run key tests**
- **To verify the design**
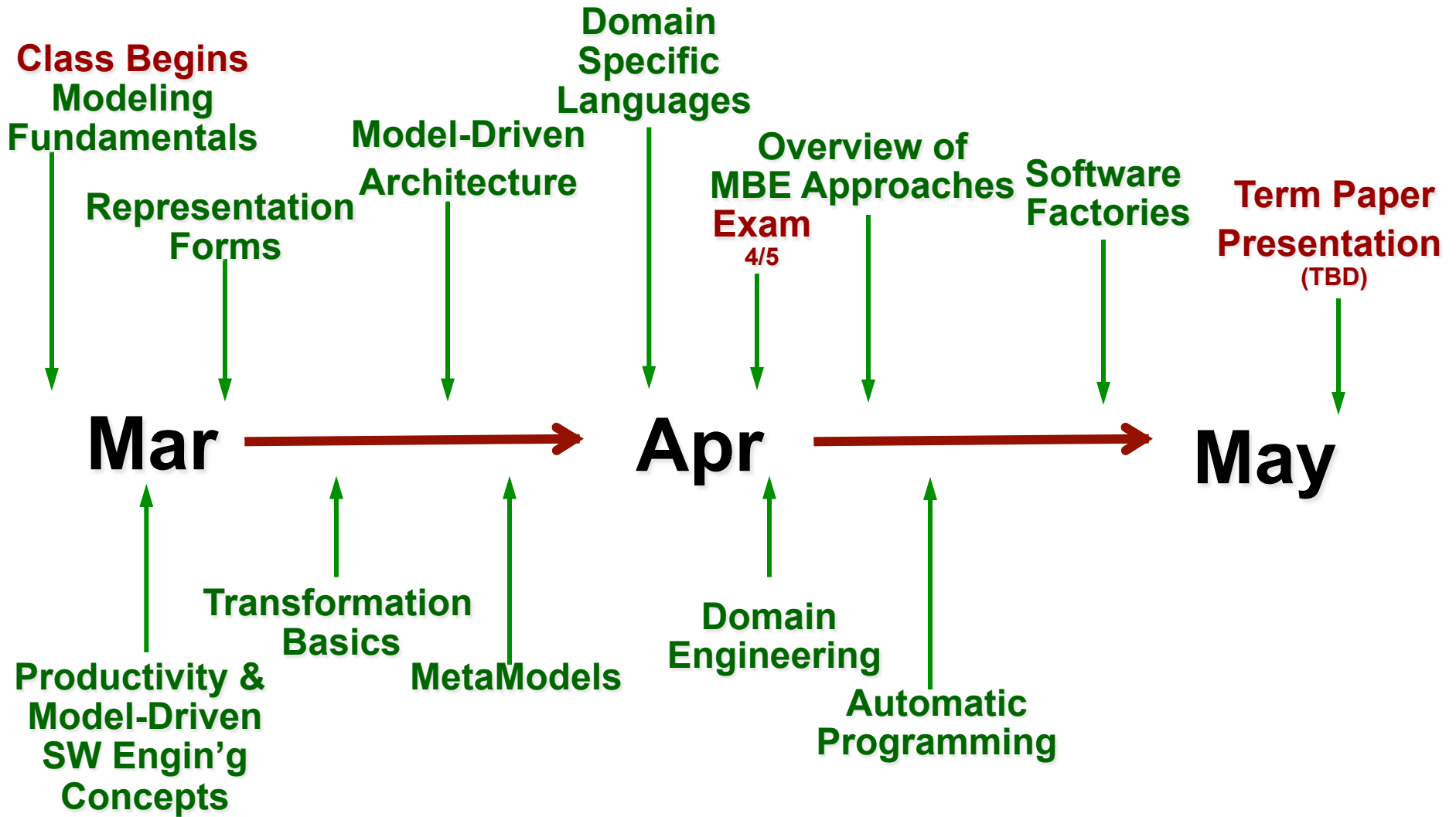- **To specify the source code and execute it…**

How can we use Models in Engineering Systems and Software?

- **To simulate the system before production**

- **To test the system in a realistic environment**

- **To specify the system at higher levels of abstraction and reliably generate the software**

Tentative Spring Quarter Timeline

Class Begins
Modeling
Fundamentals

Domain
Specific
Languages

Model-Driven
Architecture

Overview of
MBE Approaches

Software
Factories

Representation
Forms

Exam
4/5

**Term Paper
Presentation**
(TBD)

Mar ⟶ **Apr** ⟶ **May**

Productivity &
Model-Driven
SW Engin'g
Concepts

Transformation
Basics

MetaModels

Domain
Engineering

Automatic
Programming

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Plan for Today

- **Approach to an Advanced Topics Course**

- **Course Outcomes and Related Goals**

- **Modeling - What is it?**

- **Guidelines and Expectations**

- **Homework Assignments**

Advanced Topics Course

- **A lot less formal – less "sage on the stage"**
  - ☐ **Unless you prefer it ☺**

- **A lot more discussion / class participation**
  - ☐ **Reading discussions can be led by students**
  - ☐ **Friday's could be a lab day to work on project**

- **No text is sufficient – Ours is a starting point**
  - ☐ **Readings assigned each week to augment text**
  - ☐ **Suggestions from students welcome**

Learning Outcomes: Models

Explain the fundamental principles of modeling.
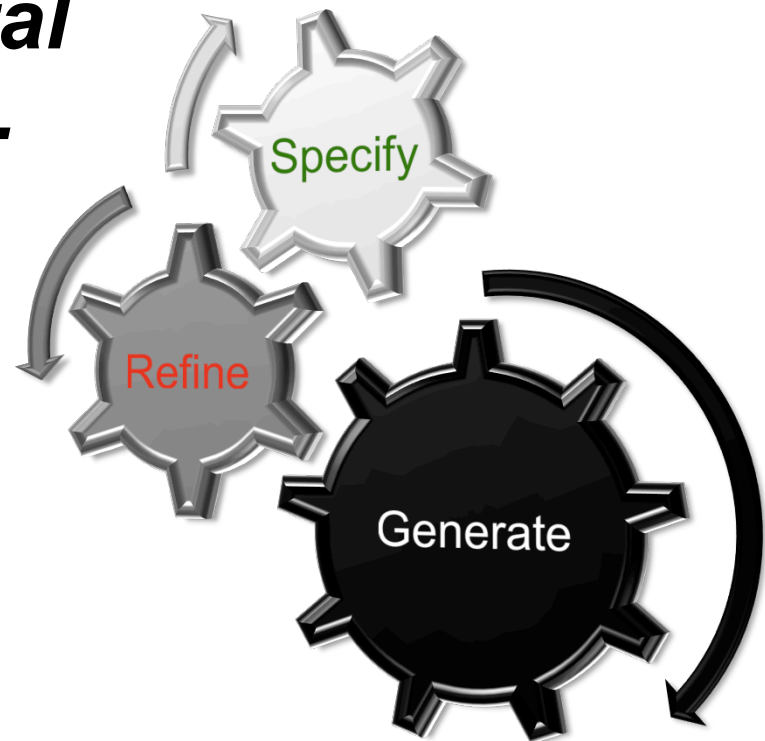
Learning Outcomes: Modeling in Software

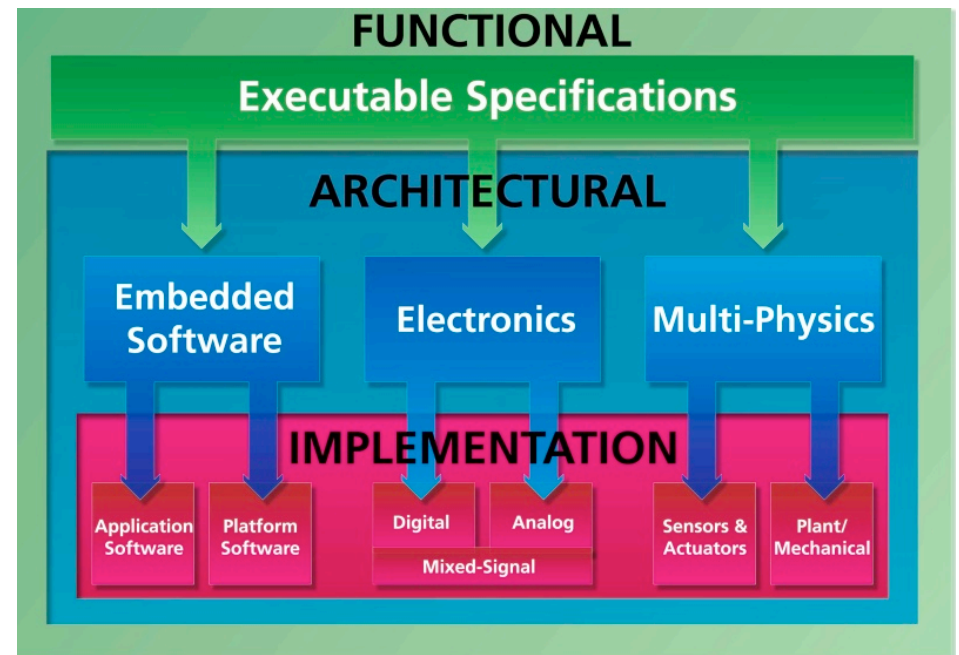*Apply modeling principles to software*

Learning Outcomes: MBE Discipline

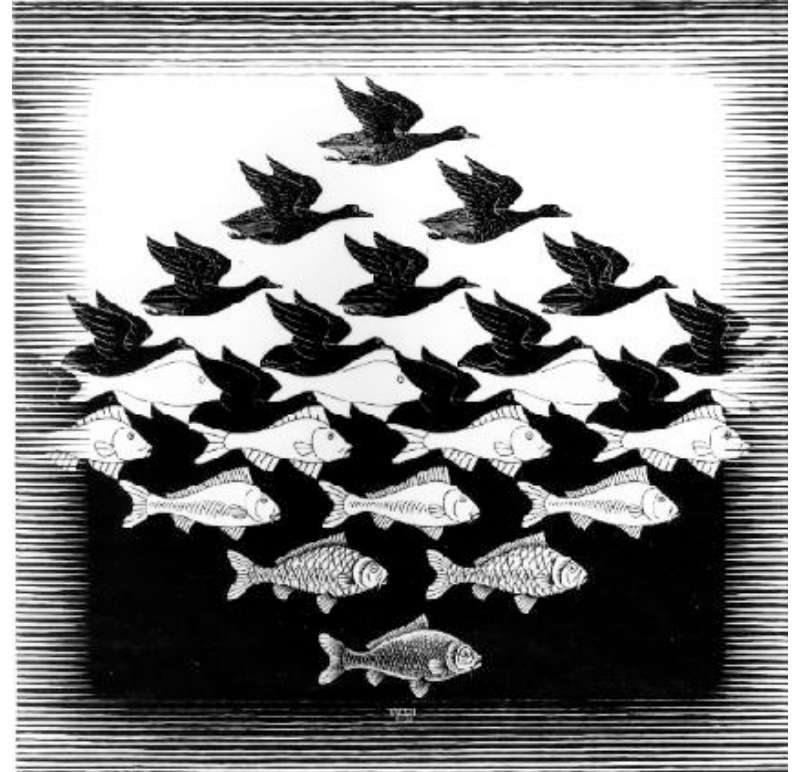*Relate Model-Based Engineering as an engineering discipline.*

Learning Outcomes: Architecture Description Languages

Demonstrate the fundamentals of Architecture Description Languages (ADL).

Learning Outcomes: Transformations

Define transformation rules for abstraction and refinement.

Learning Outcomes: Metamodels

Design a metamodel for a model-based software system.

| M3 level |
| Meta-metamodel |

↑ instance-of

| M2 level |
| Metamodel |

↑ instance-of

| M1 level |
| User-defined model |

↑ instance-of

| M0 level |
| Object diagram |
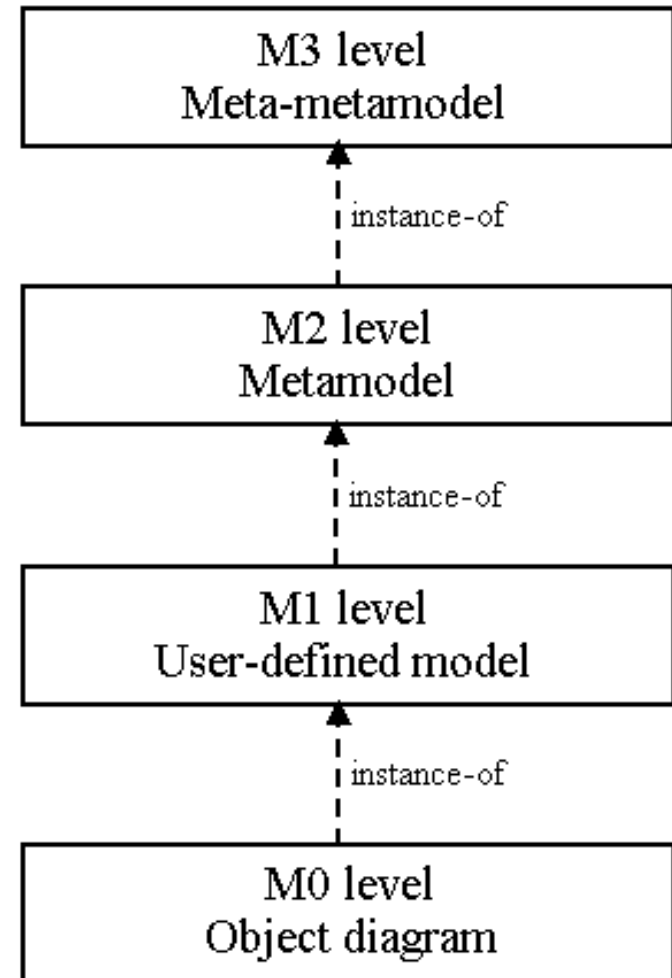
Learning Outcomes: Evaluate MBSE

Evaluate model-based software engineering principles and strategies.
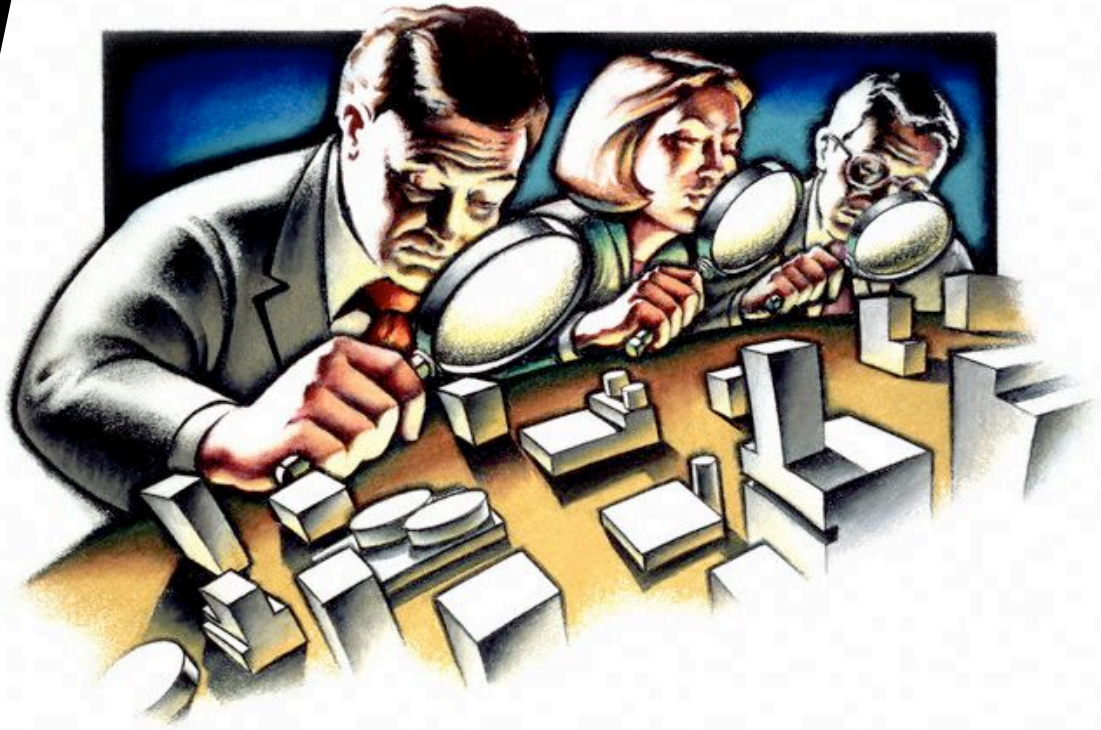
Learning Outcomes: Demonstrate MDA

Conduct the Model-Driven Architecture (MDA) approach on a software example.

Continuing: What is a Model?

- **A description of observed behavior, structure, or activity simplified by ignoring certain details**

- **<u>Bohner'ism:</u> A model is an abstraction of some reality that helps <u>explain</u>, <u>analyze</u>, or <u>understand</u> the entity modeled in a context**

Why Model?

- *Understanding*
  - ☐ Modeling "answers questions" about what is modeled

- Helps Arrive at *Consensual Reality*

- "See" opportunities to improve

- Key Point: Model(s) provide the means to express and integrate key information needed to generate software systems

"Model" is to "Reality" as _____ is/are to _____?

- **Again, think for 15 seconds…**
- **Turn to a neighbor and discuss it for a minute**

UML Notations Used in CSSE 374

Analysis

- Domain models (DM)
- System sequence diagrams (SSD)
- Operation Contracts
- Logical architecture diagrams
- Package diagrams
- Design class diagrams (DCD)
- Interaction diagrams (ID)
  - ☐ Sequence diagrams (SD)
  - ☐ Communication diagrams (CD)
- Activity diagrams
- Deployment diagrams

Architecture

Logical Design

Bus. Process Modeling

Physical Design

Course Textbook and Readings

- **Required Textbook**
  - "Model-Driven Software Development: Technology, Engineering, Management,"
  - by Thomas Stahl, Markus Voelter
  - Wiley (2006).
  - ISBN 10: 0470025700

- **Readings will be also be assigned from relevant papers**


Model-Driven Software Development
Technology, Engineering, Management
Thomas Stahl, Markus Völter
with Jorn Bettin, Arno Haase and Simon Helsen
Foreword by Krzysztof Czarnecki
Translated by Bettina von Stockfleth
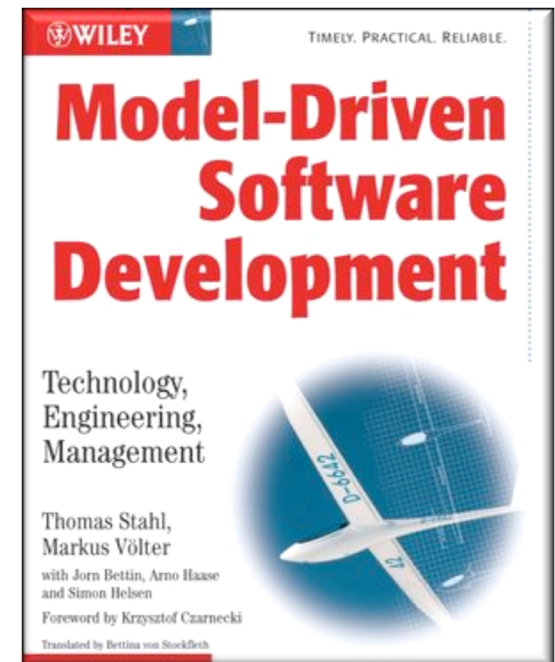
Course Mechanics

- **7th periods here in Olin 167**
  - ☐ **Class meetings: Monday, Tuesday, & Wednesday**
  - ☐ **Project Lab: Friday**

- **Find most material on Angel**
  - ☐ **Grades and Drop boxes will be on Angel**

- **Daily Quizzes?**

- **Let's have some fun!**

Hear

See

Do
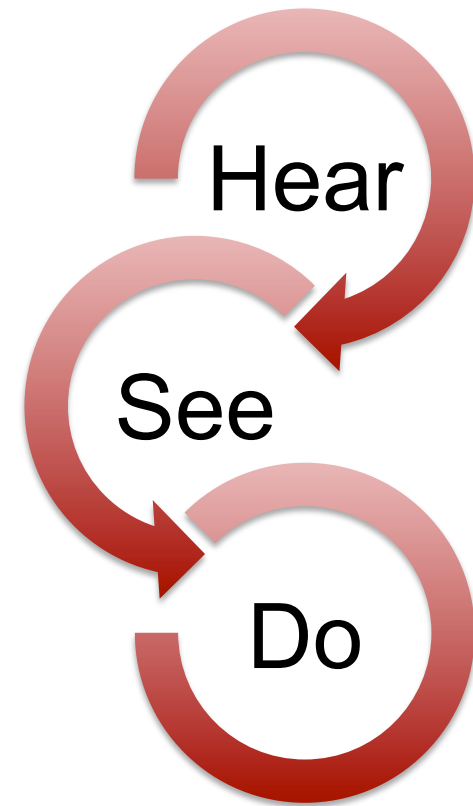
Guidelines and Expectations

- **Demanding Course**: 8+ hours/week outside of class

- Please read the assigned material before class

- Check Rose email & Angel course website daily

- Participation – Teams and Class activities

  - ☐ You will be working in teams on some assignments

  - ☐ Be fair to your team members…they will be evaluating you!

- Be mindful of the CSSE Honesty Policy

- Electronic Distraction Policy

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Grading and Evaluation

- ## 30% Theory
  - ☐ **Examination (20%)**
  - ☐ **Quizzes/Discussion (10%)**
- ## 70% Practicum
  - ☐ **Homework/Case Studies (15%)**
  - ☐ **Term Paper/Presentation (20%)**
  - ☐ **Project Deliverables (35%)**

Grade Scale
    The usual point scale will apply (subject to curve).
Statute of Limitations
    Any questions (or concerns) about the evaluation of an assignment must be raised within two weeks of the posting of score information.

Rewarding Contributions

- ## Fairness Principle
  - ☐ Reward extraordinary contributions
  - ☐ Discourage freeloading

- ## Mechanism: Performance Evaluations

	Fred	Dino	Barney
Fred	8 ~~10~~	8	8
Dino	8	9	8
BamBam	7	10	8
Individual Avg.	7.67	9	8
Team Avg.	8.22	8.22	8.22
Raw Weight	93%	109%	97%
Clamped Weight	93%	105%	100%

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Late Work

- **Legitimate reasons for late work,**
  - ☐ **Must be acknowledged before due date**

- **Late buffer of 2 assignments**
  - ☐ **Can spend 1 on any homework assignment**
  - ☐ **Can earn 1 per assignment**
  - ☐ **Use survey on ANGEL <u>before the assignment deadline</u> to spend/earn late days**

Deadlines

– **Deadlines temperamental beasts,**
  … you hug one too close and it's liable bite you!

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Homework and Milestone Reminders

- **Read Chapter 2 of MBSD Text**
  - ☐ **Start Chapter 3 for Thursday**

- **Let's talk tomorrow about why MBSE may be solution for productivity gap issues…**