

# The Repository for Model Driven Development (ReMoDD) Project

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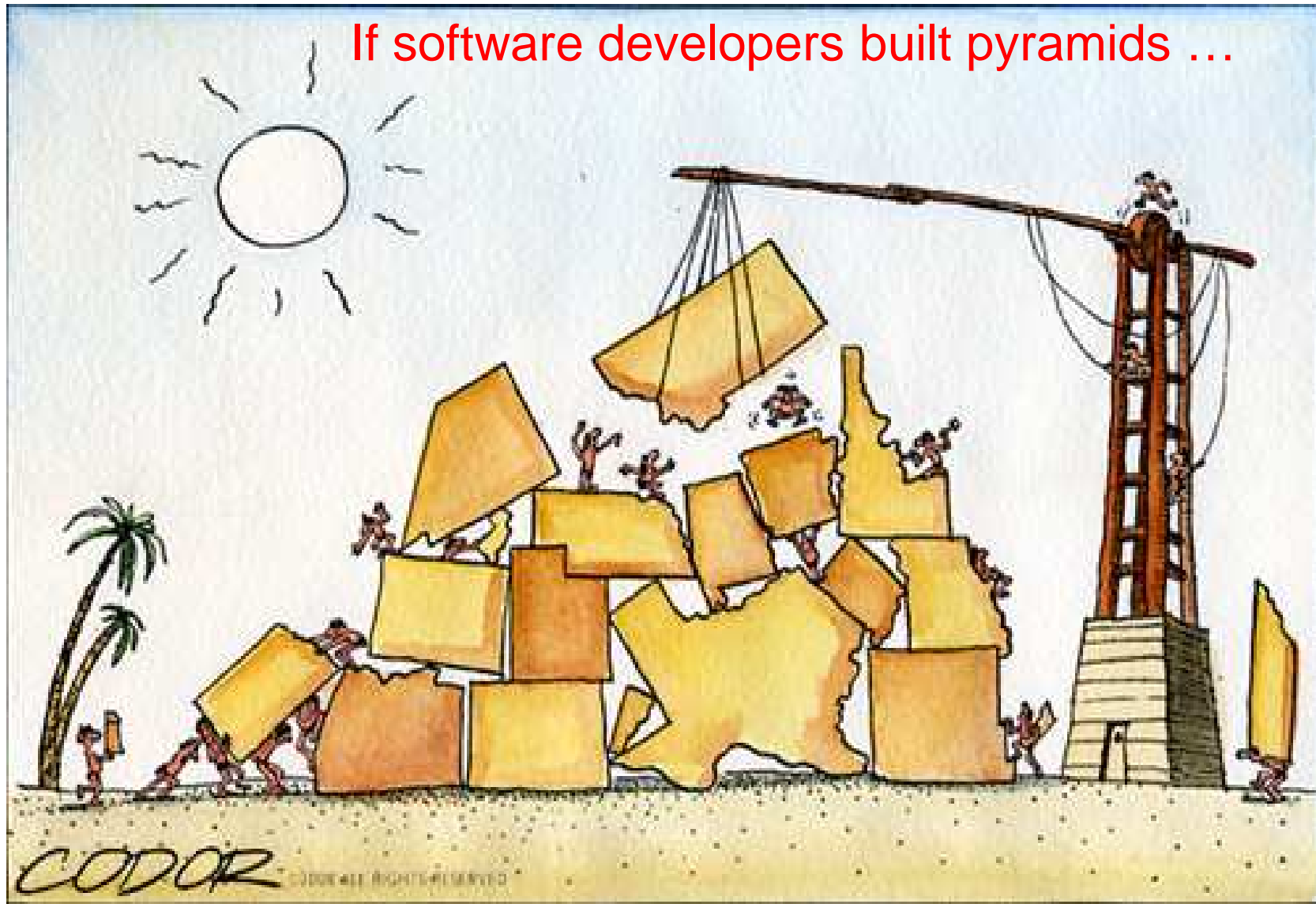
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# What is Model-Driven Engineering (MDE)?

# Coping with the evolving nature of software complexity



If software developers built pyramids ...



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“Model-Driven Engineering” (MDE) is concerned with ...

- reducing accidental complexities associated with bridging wide problem-solution abstraction gaps
- through use of technologies that support rigorous transformation of abstractions to software implementations

MDE is concerned with developing software tools to support the work of software engineers

# Role of modeling in software development

- Development involves **analyzing** problems and **synthesizing** solutions.
- Software modeling is concerned with imposing structure on problems and solutions to facilitate rigorous analysis and synthesis of implementations
  - Purpose-driven modeling
  - Provide requirements and design feedback through model animation/testing/static analysis

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# Early focus of MDE

- Models as documentation/communication artifacts
  - Early work on CASE technologies laid the foundation
- Models as artifacts for generating implementation and deployment artifacts
  - OMG's UML and MDA
  - Software development viewed as a transformative process
    - Model transformations as key enablers of MDA

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# Evolution of MDE

- Breathing life into models
  - Models as analyzable artifacts
  - Foundation provided by work on formal specification techniques
- Supporting exploratory development through compositional modeling
  - Making agile development **rigorous**
- Models as artifacts for managing and evolving runtime behavior
  - models@run.time
- Supporting domain-specific software development



# Why is modeling challenging?

Or why modeling seems to add accidental complexity

- Lack of good tool support
  - Many existing modeling tools do introduce significant accidental complexity
- Learning how to abstract is difficult
  - Current software development methods provide little or no abstraction guidelines
- Few facilities for gathering, evaluating and sharing of quality experience
  - Peer reviewed publications valuable, but more is needed

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# A MDE vision of software development

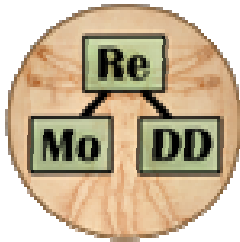
- Meeting the challenge of evolving software complexity
  - Need to incorporate domain-specific knowledge into the languages and tools we use to develop software
- The vision
  - A **MDE framework** provides concepts and tools that developers can use to build domain-specific development environments
    - Support creation and evolution of domain-specific languages and tools
    - Support multi-modeling and multiple models of computations
    - Support compositional development and analysis

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# Realizing the MDE vision

- Requires deep understanding of what abstractions can best serve specific modeling purposes
  - Understanding can only be gained through development of solutions, experimentation, and systematic accumulation and examination of modeling and software development practices and experience
- Need to share MDE experience and research results to build MDE knowledge base

# ReMoDD: What, Why, When



Is it here yet?



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# What is ReMoDD?

- An NSF-funded research infrastructure project
  - PIs: Robert France, Jim Bieman (Colorado State University); Betty Cheng (Michigan State University)
- Community resource for gathering, evaluating and sharing MDE research and education artifacts
- Planned contents:
  - Documented MDE case studies.
  - Examples of “good” and “poor” models.
  - Modeling exercises suitable for classroom assignments and projects.

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# Perceived ReMoDD Benefits

- Sharing of MDD-related research and teaching experience
- Community-based evolution of MDE knowledge
- Documented “lessons learned”
- Support for empirical studies of modeling phenomena
- Learning resource for MDE students

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# Timeline

- 2006-2008
  - Prototype developed by MSU students
- 2009
  - Funding for full-blown development provided by the NSF
  - Prototype demonstrated at MODELS'09
- 2011
  - Early limited release evaluated at Barbados AOM workshop
  - Planned release of ReMoDD v1 at MODELS 2011

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# Current ReMoDD Advisory Board

## Industry Members:

- Susan Wong, Microsoft.
- Brian Berenbach, Siemens.
- Frank Weil, Heng Software.
- Pascal Roques, Valtech.
- Richard Soley, OMG.
- Clay Williams, IBM.
- Bran Selic, Malina Software
- William Milam, Ford

## Academic Members:

- Joanne Atlee, U. Waterloo.
- Don Batory, U. Texas.
- Jean Bezivin, U. Nantes, France.
- Lionel Briand, Carleton U., Canada.
- Doris Carver, Louisiana State U.
- Alexander Egyed, U. Linz, Austria
- David Garlan, Carnegie Mellon U.
- Jeff Gray, U. Alabama.
- Mark Harman, Kings College, UK.
- Jean-Marc Jezequel, IRISA/INRIA France.
- Kevin Lano, Kings College, UK.
- Robin Lutz, Iowa State U.
- Atif Memon, U. Maryland.
- Spencer Rugaber, Georgia Tech.
- Bernhard Rumpe, U. Aarhus, Germany.
- Doug Schmidt, Vanderbilt Univ./SEI
- Perdita Stevens, U. Edinburgh, UK.
- Steffen Strecker, U. Essen-Duisburg, Germany



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# ReMoDDChallenges

- **Populating ReMoDD**
  - How can we encourage researchers and practitioners to submit useful artifacts?
  - What artifacts can be usefully shared?
- **Developing ReMoDD storage infrastructure**
  - What formats will be supported?
  - How will the artifacts be organized?
- **Accessing artifacts**
  - What interfaces are needed to support easy access to ReMoDD artifacts?
  - How can we interface with other related repositories?
- **Managing ReMoDD**
  - How do we manage users?
  - What mechanisms are needed to ensure provision of useful services to the MDE community?

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# Populating ReMoDD

- First generation of ReMODD artifacts
  - Examples of end-to-end MDD products (business to requirements to design to implementation models)
  - Examples of good and poor modeling practices
  - Other educational resources: modeling projects, specialized lecture materials by experts
- Targeted sources
  - Academia: Artifacts from modeling workshops and research projects, exemplar models used in classroom, student projects
  - Standards organizations (e.g., OMG): models used in standards work
- Encouraging submissions
  - Provide facilities for citing accepted submissions
  - Recognition of submissions with earned distinctions (e.g., highest rating, most downloaded)

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# Population Issues

- Legal sharing of artifacts from industry
  - Non-Disclosure Agreements (tiers of users)
  - Serve as a broker for a P2P (peer-to-peer exchange)
    - Broadcast industry needs
  - Sanitized data
- Submission quality control
  - New submissions will be reviewed for utility
  - Users will be able to provide constructive comment on published artifacts
  - User will be able to rate artifacts

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# Storage Infrastructure Issues

- Supported formats
  - ❑ Providing artifact previews: Submissions must include artifacts in pdf format
  - ❑ Other formats can be submitted, but viewers will not be provided within ReMoDD
- Artifact organization
  - ❑ Multi-faceted classification
  - ❑ Support for user-defined facets and system-defined facets
- Artifact revision
  - ❑ Users can revise artifacts after they are published
  - ❑ But, currently no support for versioning

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# Accessing ReMoDD

- Web-based access
  - ReMoDD implemented as a Drupal installation
  - Search/browse capability:
    - By modeling language
    - By submitter
    - By model types (e.g., class, state, sequence, etc.)
    - By application domain
    - By other facets
    - ...

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# Managing ReMoDD

## ■ Managing users

- ❑ Users must register and be approved before they can access or submit artifacts
- ❑ Once registered users can freely submit, post comments, form and manage groups
- ❑ Users are required to respect the code of behavior
  - Abusive users will be “de-registered”

## ■ Supporting community activities

- ❑ Users can form open or closed groups within ReMoDD
- ❑ Files can be shared among group members

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# Obvious usage scenarios

- ReMoDD as a source of artifacts for empirical studies
- ReMoDD as a source of instructional resources
- ReMoDD as a vehicle for disseminating research results

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# Other usage scenarios

- Provide supplemental publication material
  - ❑ Conferences can form groups in which authors can post supplemental information that cannot be presented in submitted papers because of page limit
  - ❑ Supplemental information for published papers can be disseminated via ReMoDD
- Crowd sourcing of MDE problems
  - ❑ Modeling challenges/competitions
- Supporting pre- and post-workshop activities



But is it here  
yet?



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# Phase I: Prototype Development

- Establishment of ReMoDD user community
- Elicitation of ReMoDD requirements
- Development of ReMoDD Prototype
- Demonstration of ReMoDD use with sample artifacts

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## Phase 2: Development of ReMoDD v1

- Development platform: Drupal
- Implementation of basic features
  - Submit single-file artifacts
    - Supported formats: pdf, compressed files
  - Browse/Search
  - Support for community interaction
    - Forums
    - Groups

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## Phase 3: Evaluation

- April 2011: Evaluation at AOM workshop
- Summer 2011: Evaluation by advisory board and other interested parties
- October 2011: Public release (MODELS 2011)

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## Phase 4: Development of ReMoDD v2

- Provide support for
  - Uploading multi-file models
- Also considering
  - support for versioning
  - support for specifying relationships across submissions
  - Richer forms of queries (e.g., queries on model relationships and types)

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# Accessing ReMoDD

- To contribute models, access ReMoDD via
  - <http://www.cs.colostate.edu/remodd/prod-v1>
- Contact information:
  - [remodd-project@cs.colostate.edu](mailto:remodd-project@cs.colostate.edu)
- Demo