

# ***Challenges to MDE***

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# ***Requested Controversial Statement***

I hate modeling software designs....

... and my developers hate them more

.... It's always a question of  
personal/developer value



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# ***General Motors and Modeling...***

- Have over a decade experience of applying modeling in the industrial context
  - Prototyping
  - Specification
  - Code Generation
- Currently GM is heavily model based
  - Using UML and Simulink
  - Significant usage of Code Generation
    - Wrote our own code generator for UML
  - Heavily value Domain Specificity
  - Models are significantly more than “simply” behavior
  - Pervasive usage for traceability
  - Multi-perspective
  - ... and being successfully used on production programs



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# ***What is Model Driven Engineering?***

- Isn't this the “easy” question?
  - MDE is the fundamental change of the engineering processes to be driven through use of models as the primary artifact
- The “hard” question is what is a ***model***?
  - We can define it by what it isn't
    - Just pretty (or ugly) pictures
    - Just behavior
  - Ideally this is a higher order level of expression that captures ***knowledge***
    - MDE is so much more than simply replacing “software” with a graphical model
      - Or modeling a software design
    - So MDE utilizes a more expressive language (models) to drive the engineering process
      - And significantly more than simply behavior



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Modeling must be associated with a change in perspective!

# Can we achieve the goals of MDE?

- Assuming the goals are loosely are Productivity & Quality
  - The best answer would be ... An *emphatic* YES!
    - With many of today's systems...but we need to ask if we are moving fast enough to address the complexity of future CPS and ULS systems
- What are the critical gaps in the state of the art to reach these objectives?
  - Expressivity -> Using models as a higher order of abstraction
    - Models should address the “accidental complexity” problem
    - Often more usage than “technology” ... we aren't comfortable with the possibilities yet!
  - Coherency -> Utilizing all of the advances in an integrated and coherent fashion
    - Addressing the “splinters” of advancement into the whole ... there is no guidebook to MDE
  - Scale -> Growing MDE to be capable for large scale systems which isn't just straight scalability but also the social and management aspects that we do “better” in the strictly software engineering world (when we want to!)
    - Modeling has grown from the single user environment, but the constraints of multi-user and multi-perspectives are more than just bigger models



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# ***Industrial Usage of MDE?***

## ■ Benefits

- Greater and Flexible Expressivity
  - Ability to meet the user and their need with language and perspectives
- (Provable) Concepts of Correctness
  - Assertions of correctness of description and transformation are potentials
- Richer Set of Possible Relationships
  - Enables a more through integration to real process flows rather than tool driven expectations

## ■ Drawbacks

- Perception as a “Silver-Bullet”
  - Often expressed as a 10x improvement with little discernable context on how or why... misguided perceptions are often a disappointment
- Still a significant investment
  - Requires change in process and change in focus to meet the objectives
- Lacks practical knowledge base to execute
  - The “Missing Manual” for MDE is both not well founded but an issue for “correct” adoption



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# ***Maturity and Growth of Industrial Usage***

## ■ Do we have sufficient maturity?

- Yes ... but we lack consistent maturity
  - We have fragmented splinters of capability
    - Requires adopters to “pick” technology and “implementations”
- Cost of entry is significant
  - Capability
  - Legacy Costs
  - Quality tool costs (don't see as much OSS movement for modeling)

## ■ Which industries will achieve the most benefit and soonest?

- Those that can “manage” the investment costs
  - The values of MDE (when done correctly) are required for the product/business domain
- Logically this means organizations
  - That have significant product family investments
  - That have significant desire for quality improvements
  - That have significant desire for multi-domain integration
- And logically excludes
  - One time products
  - Fast turnover
  - High technology dependence (as a value not as a constraint)



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# ***Obstacles and Resolutions***

## ■ Biggest Obstacle(s)

- Rumors and Innuendo!!!
  - That modeling is an elixir that cures ills
  - That modeling generates quality
  - That modeling creates productivity
- Lack of Developer Focus
  - Code Generation, Formal Analysis, ....
  - Where are the productivity and cognitive aids for developers?
- Lack of Group Focus
  - Tools and practices in modeling are not geared to groups
  - Or large geographically diverse groups

## ■ Research, Education, & Industrial Resolutions

- Stronger foundations on the path of modeling knowledge
  - e.g. Generic Languages or Domain Specific Languages
- Coursework on modeling as a practice with value
  - And not simply as a replacement for coding, but true higher orders of abstraction
- Industry needs to identify cases of success
  - We need a better body of literature and knowledge on the practical application of models in industrial application (as well as there failures... but that tends to be much more difficult)



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# Adoption of MDE

- Can there be levels of Adoption? And what are the benefits/drawbacks?
  - There *has* to be for MDE to be **successful**
    - This is the issue of investment costs and legacy adoption
  - Benefits
    - Lowers the investment costs
    - Eases organizational transition
  - Drawbacks
    - Often valuable payback only appears when a “threshold” has been reached
    - Moving from an existing flow may inhibit valuable changes in flow enabled by MDE
- If there are levels what are they in a roadmap of adoption
  - MDE might not start where it is assumed to be logical
    - More triggered by the current organization’s capability and legacy than a particular “type” of model to create
    - Focus should be on the capturing of knowledge that
      - Either was unable to be captured before ...
      - Or was buried in design decisions
  - Highly likely that it is unique for each organization.... there isn’t on software language or development style so we are not likely to see it here as well...



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# ***Best Reason not to use MDE***

- The investment cost does not meet the value
  - Because what you do already works for your business
    - Something different is likely not better
  - Waiting for the “shrink-wrapped” version
  - Lacks organizational backing
    - The case has not been made yet
  - You are waiting for the expertise on how to apply MDE (may be the best reason!)



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*All of these should decay over time!*

# ***Best Reason to Use MDE***

## ■ Opportunity to leverage Knowledge independent from Design

- To increase quality
- To increase productivity
- To increase flexibility
- ...

## ■ However...

- Does not come risk free, just doing modeling doesn't resolve the issues
  - It is the *form* in which modeling is done
  - It is the *manner* the organization is engaged
  - It is the *personal* productivity and quality that developers identify



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*Modeling will simply be the way we do Software in the future!*



# ***Questions???***

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