

**Structural Modeling Testbed**  
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# Structural Modeling Testbed Objectives

- Reduce the cost of testing for developers
- Foster adaptation to many modeling formalisms
- Spur further advancement of the ISM algorithm
- Ensure quality of implementations

# Evolving Inference Engine for the Knowledge Acquisition Bottleneck

- 1960's ~  $O(n^2)$  Exponential Order of Growth in inquiry time in matrix methods ie. Unified Program Planning (a.k.a. Quality Function Deployment) and Rule-Based Systems
- 1970's **Interpretive Structural Modeling** Algorithm (**ISM**) reduces inquiry time by 70%-85% as  $n$  grows ~  $O(4n)$
- 1980's-2010's Many advances in ISM but proprietary but many small, isolated projects
- Cost of testing is very high and no standards
- Diffusion of Innovation Impeded

# Structural Modeling Misadventures

## Basic

- Transitive Closures
  - Failure to Infer
  - Improper Inference
- Catastrophic Condensation of Cycles
- Incorrect Structure
- Unscalable (Sparse Matrix) Processing

## Interpretive

- Misrepresenting a Relation (in Matrix)
- Multipli-representing a Relation
- Structural Misinterpretation
- Multiple Interpretations
- Path Dependencies

# Structural Modeling Testbed Objectives

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- Foster adaptation to many modeling formalisms
- Spur further advancement of the ISM algorithm
- Ensure at least a baseline quality of implementations
- Establish a simple touchpoint of collaboration

# Role of Testbed in SM Initiative

- **Community of Practice** – BSM Testbed as a starting point for collaboration for both proprietary as well as open source initiatives
- **Community of Interest** - Encourage user communities of specific ISM implementations by coordinating adaptations of the method
- **Interface to Modeling Platforms**
- **Research Outreach** to Related Techniques in Systems Modeling, Structure Identification, Knowledge Acquisition, and Information Fusion

# Baseline BSM Testbed Components

- Test Cases
  - BSM Structures & Inquiry Paths
- Agreed Package of BSM Output
  - Adjacency Matrix, Reachability, Log File of Inquiry
- Measures
  - Substructure Identification
  - Inquiry Efficiency (Orders of Growth Estimation)

# Testbed Challenges

- BSM/ISM Developers Scattered
- Original Community of Practice
  - Aged
  - Some Companies Gone
  - Competitive / Proprietary Attitude
- Community of Interest still seems sporadic
- Centers of Innovation Geographically Disperse
- ISM interest spans ISSS, INCOSE, ASC



# Testbed Approach

- Social Media Outreach
  - LinkedIn, Google+ Group, Website/Blog
- Monthly Google Hangouts
- Bridge one proprietary & one open project
  - Future Worlds Center – Cyprus / Michigan
  - Basic Structural Modeling (Simpsons et al.)
- Invitation to Authors of ISM Journal Articles
- Inquiry with Modeling Platform Developers?
- Cultivate a Society Working Group?