To Main Proceedings Document

Applying System Dynamics to Scenario Based Software Project Management

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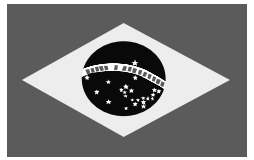
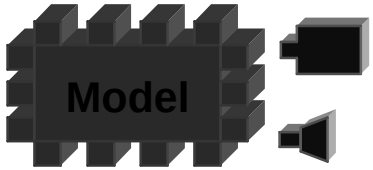
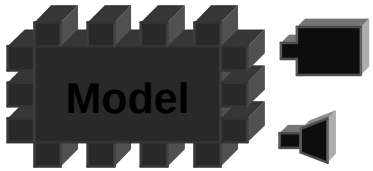




Motivation

- ".. most software projects use more resources than planned, take more time to be concluded, have less functionality and less quality than expected." (Pressman, 1992)

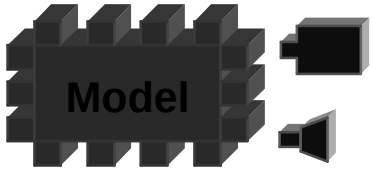
- Current management techniques require a project to have:
  - Clear and well defined objectives
  - At least one viable and known solution
  - Previsible schedule and resource needs
  - Well known operational environment
  - Predefined quality metrics



Motivation

- Complex software projects break these basic assumptions:
  - Innovative application domains
  - High requirement volatility
  - Ambiguity
  - Complexity
  - Discontinuity
  - Diseconomy of scale
  - Non linearity

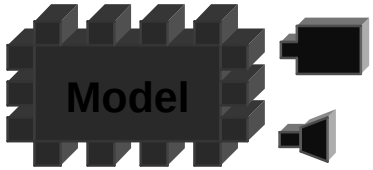
There is a growing demand for new management techniques !!!



Work Proposal

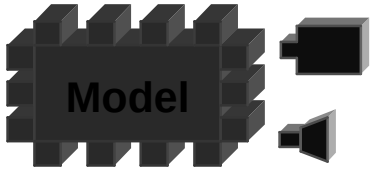
- Scenario based software project management paradigm
  - Project manager defines an expected project behavior
  - The behavior may be affected by unexpected events
  - Project behavior is studied in the light of these events

- Supporting technologies
  - Software risk management
  - Dynamic modeling
  - Continuous time simulation



Modeling

- Scenario based management uses two fundamental artifact types
  - A project model: documents known facts about a project
  - Scenario models: document actions that can affect the project
    - Potential events
    - Management theories, policies, and procedures
    - Strategic and tactical actions
- Scenarios models combinations are integrated to a project model to evaluate project behavior sensibility to scenarios

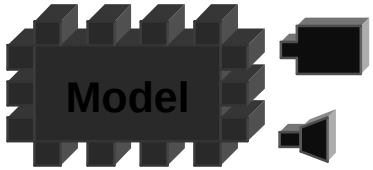


Project Model

- Based on an extended version of Abdel-Hamid and Madnick's system dynamics model and descriptive project models (DPM)

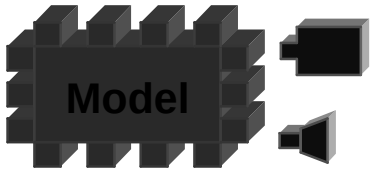
- DPM provides a high level representation for a project
  - A project is described in terms of its activities, artifacts, developer roles and resources

- The high level representation is translated to system dynamics constructors to allow project behavior simulation
  - The project model is a concrete model
  - It can be integrated to scenario models



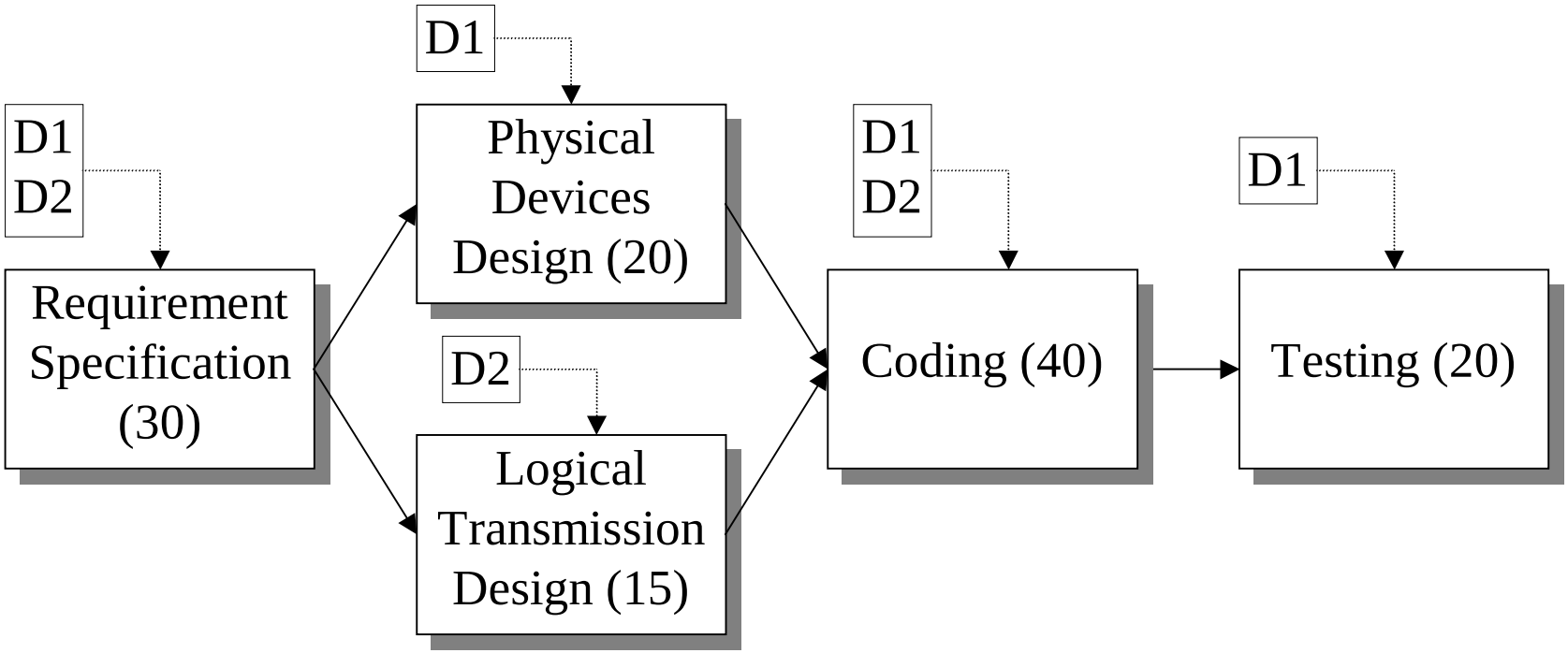
Scenario Models

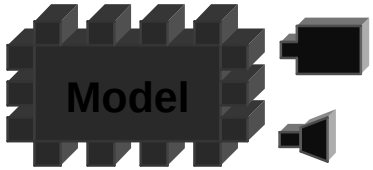
- Represent actions that can affect the expected project behavior
- The expected project behavior is analyzed through project model simulation
- Scenarios are integrated to the project model, allowing the simulation of their impact upon expected project behavior
  - Scenario models are associated to project model elements
  - Project model elements publish their properties
  - Scenario models can manipulate these properties and their instantaneous variation in each simulation iteration



Example - Project Model

- Telecommunications project (five activities, two developers)





Project - Scenario Model

- Communication overhead scenario
  - Associated to project activities (project element)
  - Access activity properties (duration and role count)
  - Affects activity property (duration)

```
TABLE COMMOVH 0, 0.015, 0.06, 0.135, 0.24, 0.375, 0.54;

RATE (SOURCE, <ACT:Duration>) COMMRATE
        VAR<ACT:Duration> *
        LOOKUP (COMMOVH, <ACT:RolesCount>, 0, 30);
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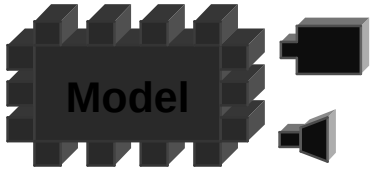
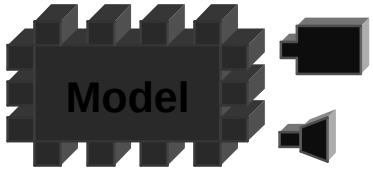


Integration Process

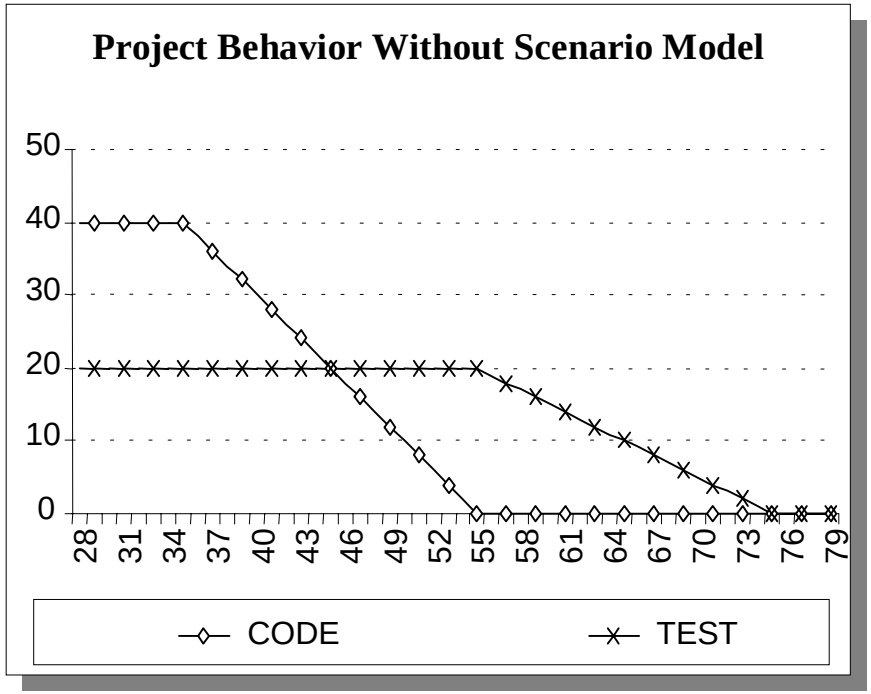
- Manager selects the elements that are affected by the scenario
  - The project manager indicates that the communication overhead scenario affects all activities

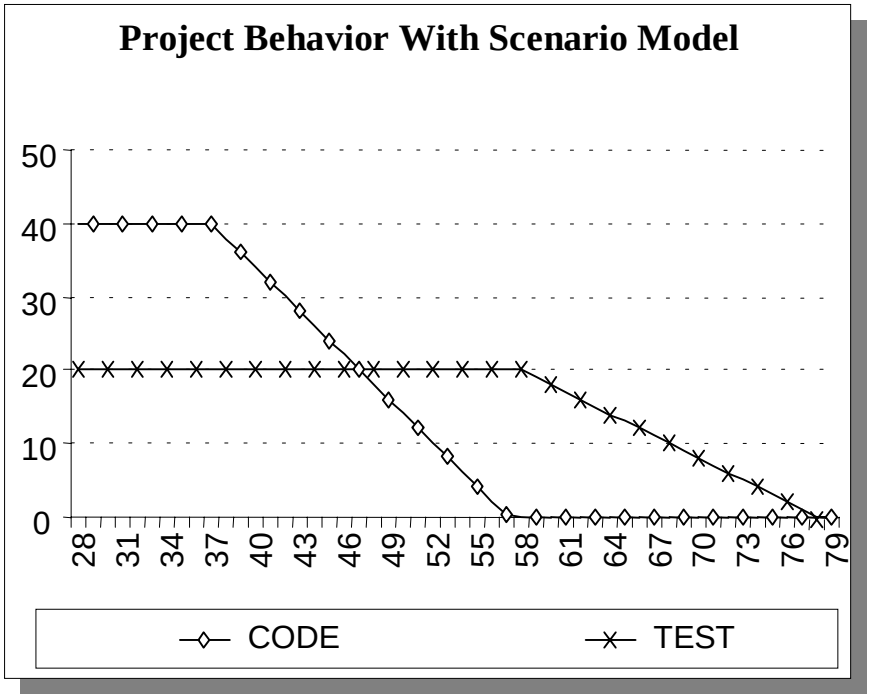
- Scenario equations are translated to system dynamics
  - Activity properties are represented by stocks
  - Scenario models can consult and change these stocks
  - Scenarios commands are translated to “pure system dynamics”

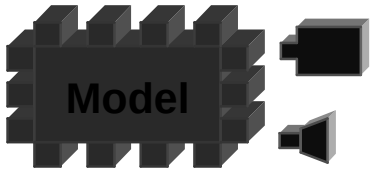
- A project-&-scenario model is generated and simulated



Example - Project Behavior







Main Contributions

- A high level project representation that can be translated to system dynamics constructors
- Separating facts from suppositions within a system dynamics software project model
- Defining an integration interface among project model and scenario models