GENSIM 2.0: A Customizable Process Simulation Model for Software Process Evaluation

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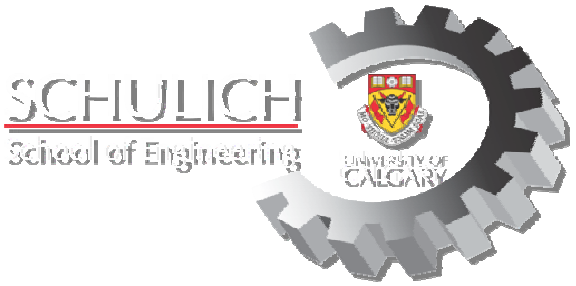

Outline

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- Generic Process Structures (Macro-Patterns)
- The GENSIM 2.0 Model
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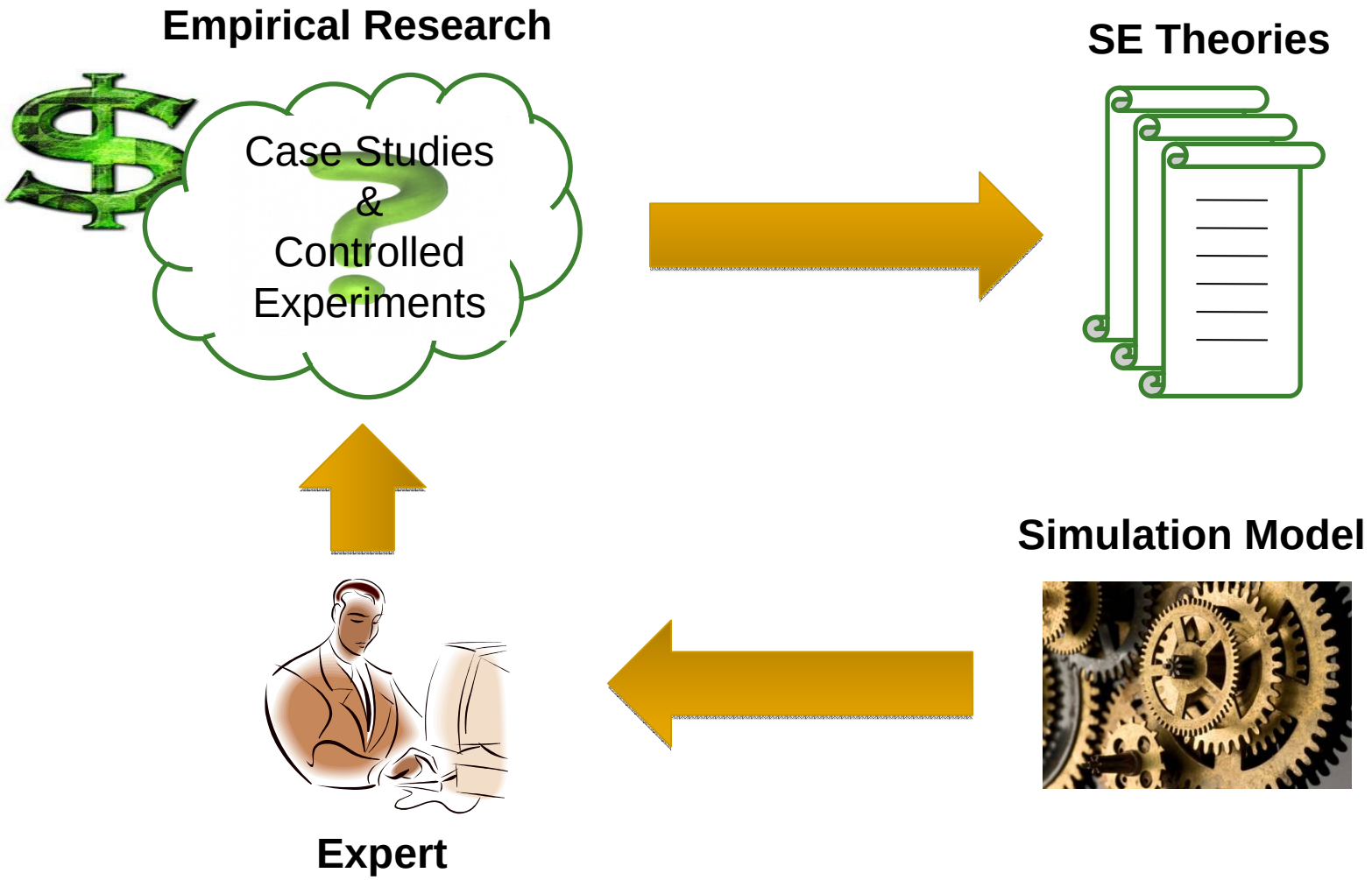
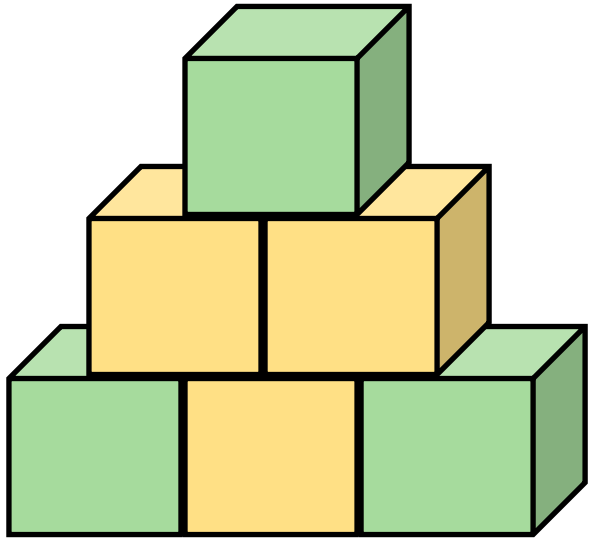
Motivation


Empirical Research
Case Studies
&
Controlled
Experiments
SE Theories
Simulation Model
Expert

Motivation

- Process Simulation Modeling is costly
  - Complex
  - Each time done from scratch
- Have an “Agile” modeling process by providing building blocks that can be reused and customized.



Simulation Model

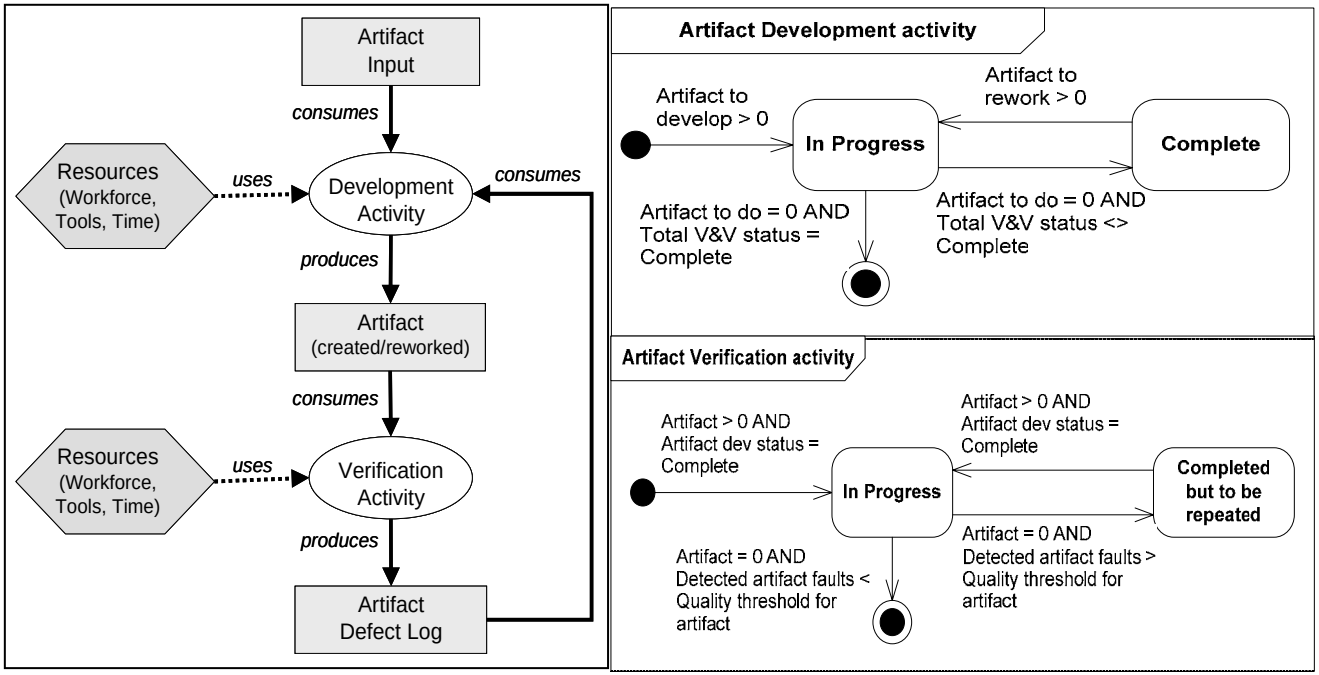
Motivation

- Current models have following shortcomings:
  - Too simplistic
  - Not completely published
  - Captures specific real-world development process with sufficient detail but fails to offer mechanisms to represent complex product and resource models.
  - Captures specific real-world development process (and associated products and resources) in sufficient detail, but is not (easily) adaptable to new application contexts

Related Work

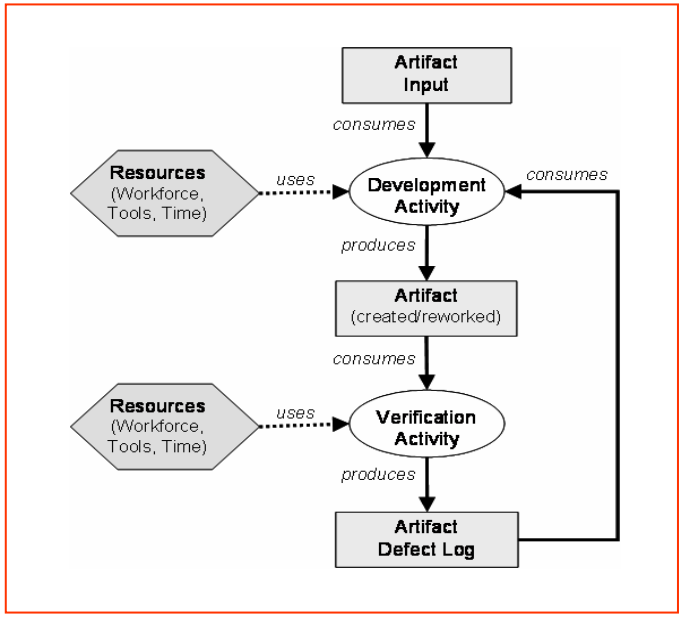
- Peter Senge
  - System Archetypes: generic process structures which embody typical behavior patterns of individuals and organizations
    - Limits to growth: “A reinforcing (amplifying) process is set in motion to produce a desired result. It creates a spiral of success but also creates inadvertent secondary effects...which eventually slow down the success”
  - Too generic
- Ray Madachy
  - A core set of reusable model structures and behavior patterns organized in an Object-Oriented hierarchy well suited for System Dynamics
  - Bottom-up approach (specific purpose SD structures)

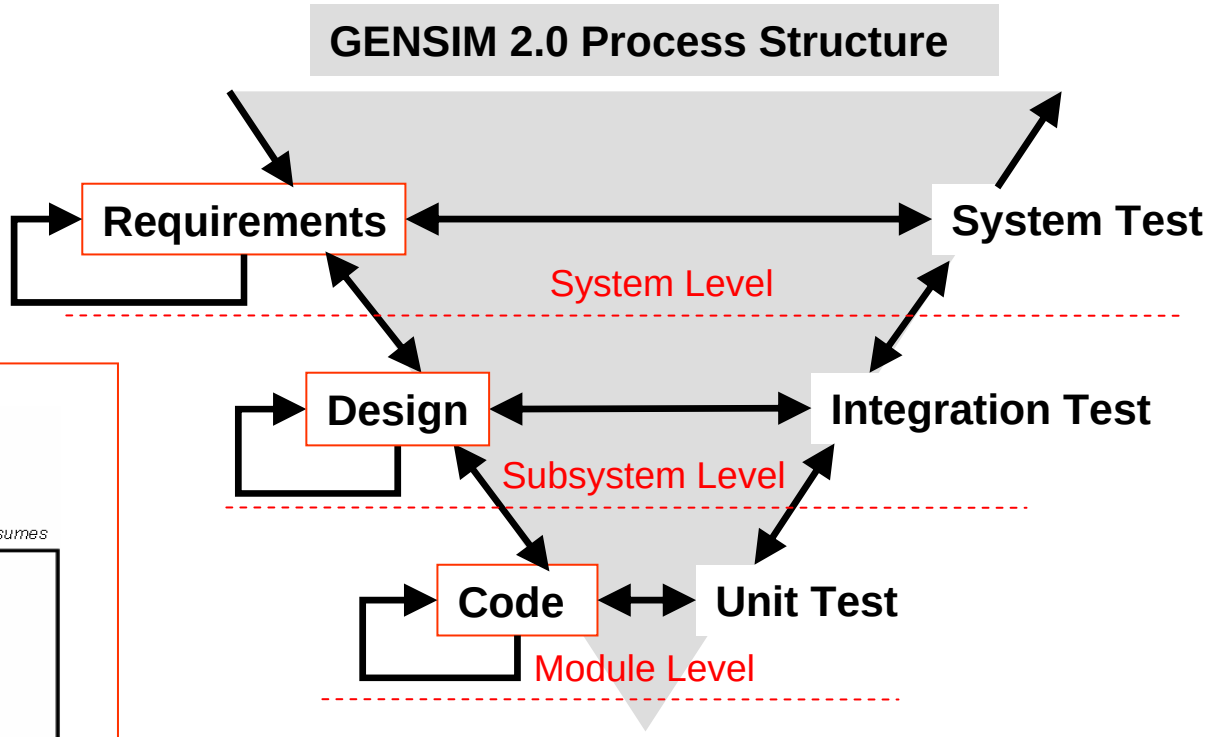
Generic Process Structures (Macro-Patterns)



Development/Verification macro-pattern

The GENSIM 2.0 Model



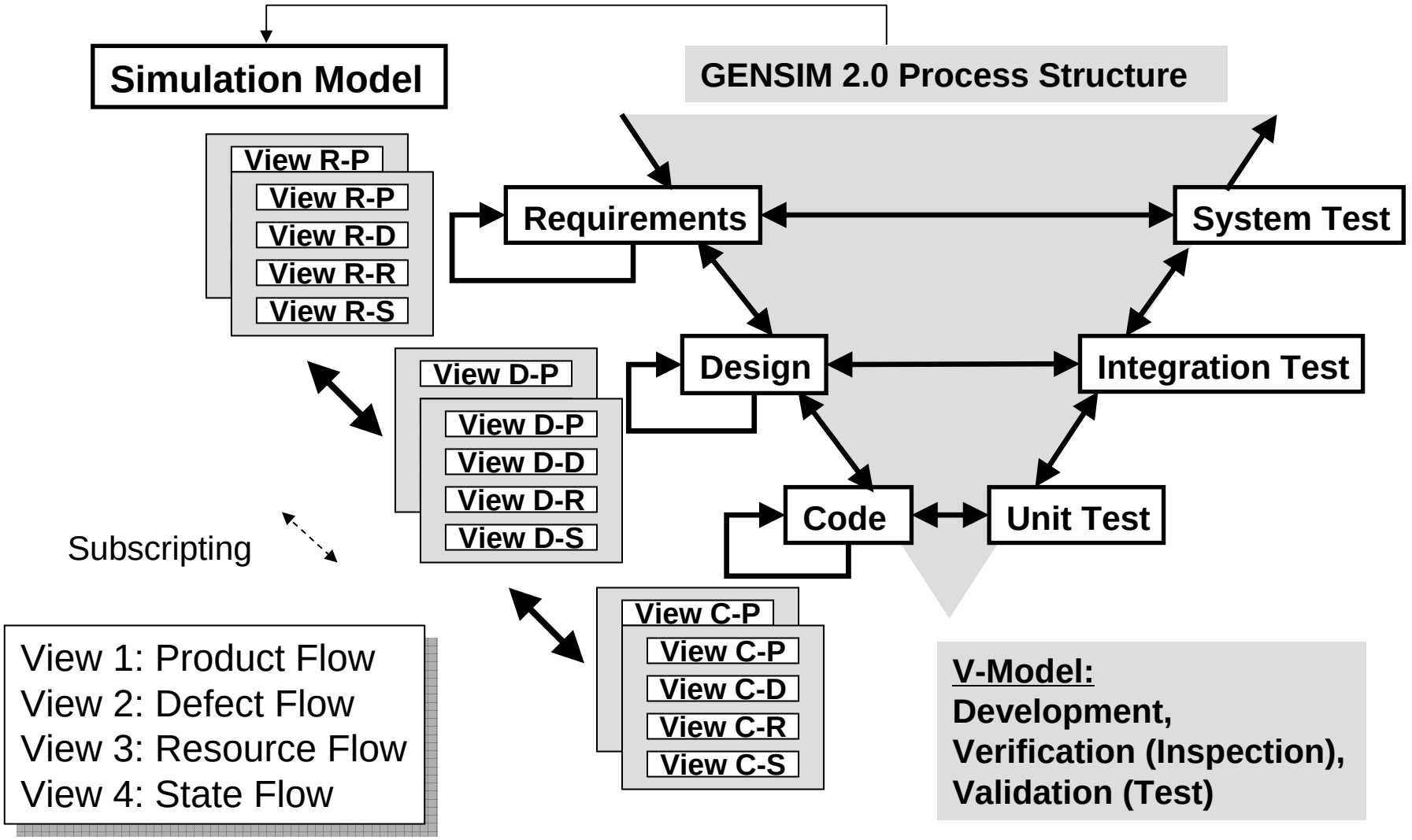


V-Model:
Development,
Verification (Inspection),
Validation (Test)

The GENSIM 2.0 Model: Implementation

- GENSIM 2.0 was implemented in Vensim®
- Besides application of macro-patterns, three features of Vensim® were used to add to the reusability of GENSIM 2.0:
  - Views: to capture the main dimensions of project performance, i.e., duration, effort and quality as well as the states of the software development process in different views
    - Increased Understandability
  - Subscripting: to model individual software artifacts
    - Customizable to different projects with different products
  - Dynamic Link Libraries (DLL): to extract organization-specific policies and heuristics from the model
    - Increased adaptability in various organizations

The GENSIM 2.0 Model: Implementation



The GENSIM 2.0 Model: Calibration

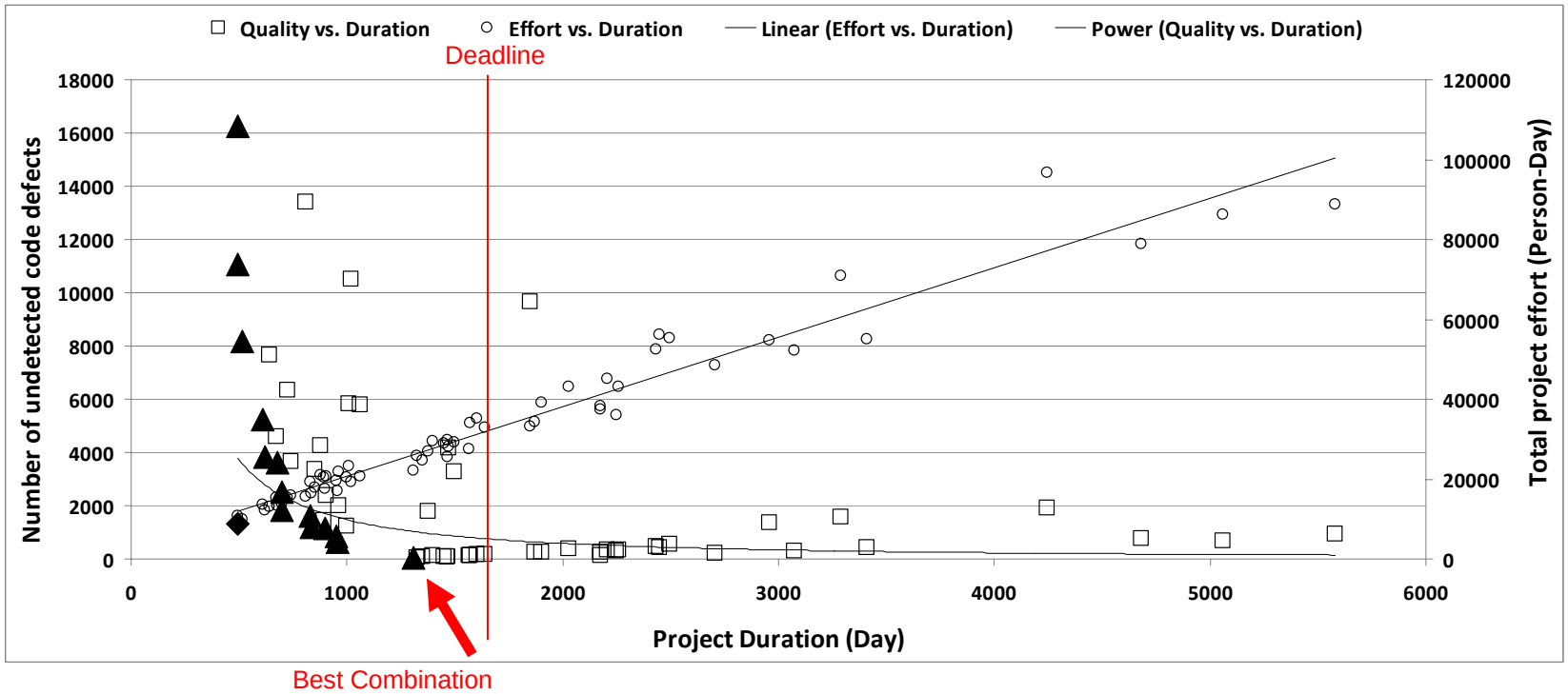
- Different sources for calibration:
  - Expert opinion
  - Organization-Specific repositories
  - Online repositories
  - SE Literature
- Detailed specification of all GENSIM 2.0 parameters and the way they can be calibrated, allows it to be calibrated to any of the above sources.

The GENSIM 2.0 Model: Application

- Which combination of V&V (Verification and Validation) activities is most suitable regarding specific time and quality constraints?
- All model parameters are set:
  - A software with 100 modules in 5 subsystems and total size of 380 KLOC, 40 developers with overlapping capabilities (e.g. can both test and develop).
- Different possible combinations of V&V activities are generated automatically e.g. (RI,DI,CI,UT,IT,ST), (-,DI,-,UT,-,ST)
- Simulation results (project performance measures including quality, effort and time) are plotted and analyzed for all combinations.

The GENSIM 2.0 Model: Application

- Color-filled triangles represent non-dominated (Duration, Quality) result values, i.e., simulation results to which no other simulation exists with both less undetected defects and less duration.



Conclusion & Future Work

- GENSIM 2.0 is a complex, publicly available customizable software process simulation model that:
  - Demonstrates an application and implementation of generic software process structures (macro-patterns)
  - Focuses on different project performance dimensions individually
  - Allows for detailed modeling of work products, activities, developers, techniques, defects and other entities.
  - Allows for easy modification of organization-specific heuristics and policies
- Future Work
  - Incremental Software Development
  - Variable staffing profiles