# Empirically Evaluating Regression Testing Techniques: Challenges, Solutions, and a Potential Way Forward

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ALLEGHENY COLLEGE

1st International Workshop on Regression Testing
Co-Located with the 4th IEEE International Conference on Software Testing, Verification and Validation
Berlin, Germany, March 2011

# Presentation Overview

Regression Testing Community

# Presentation Overview

Current Trends

Regression Testing Community

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Current Trends

**Increased Interest**

Regression Testing Community

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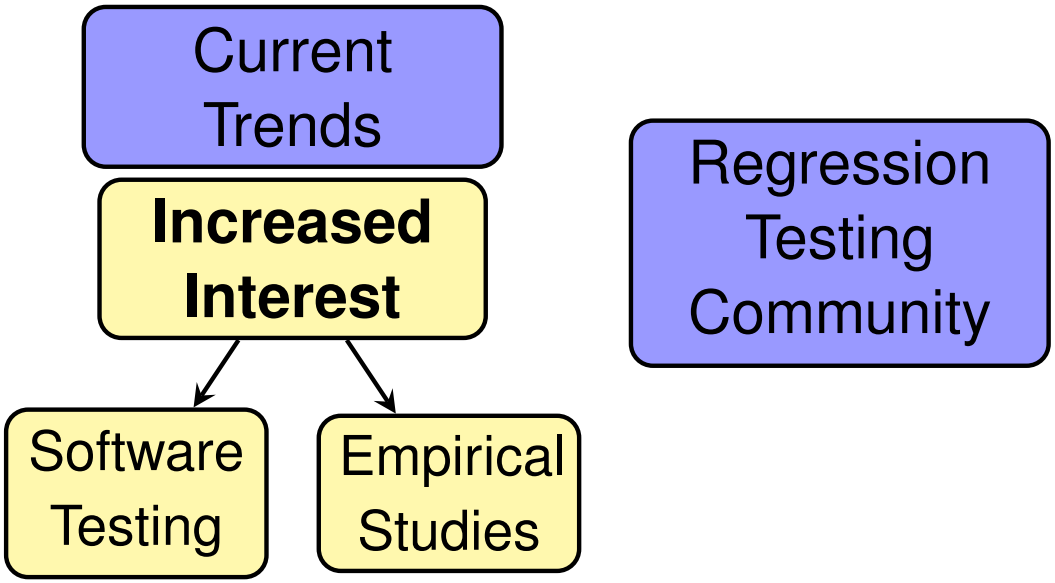

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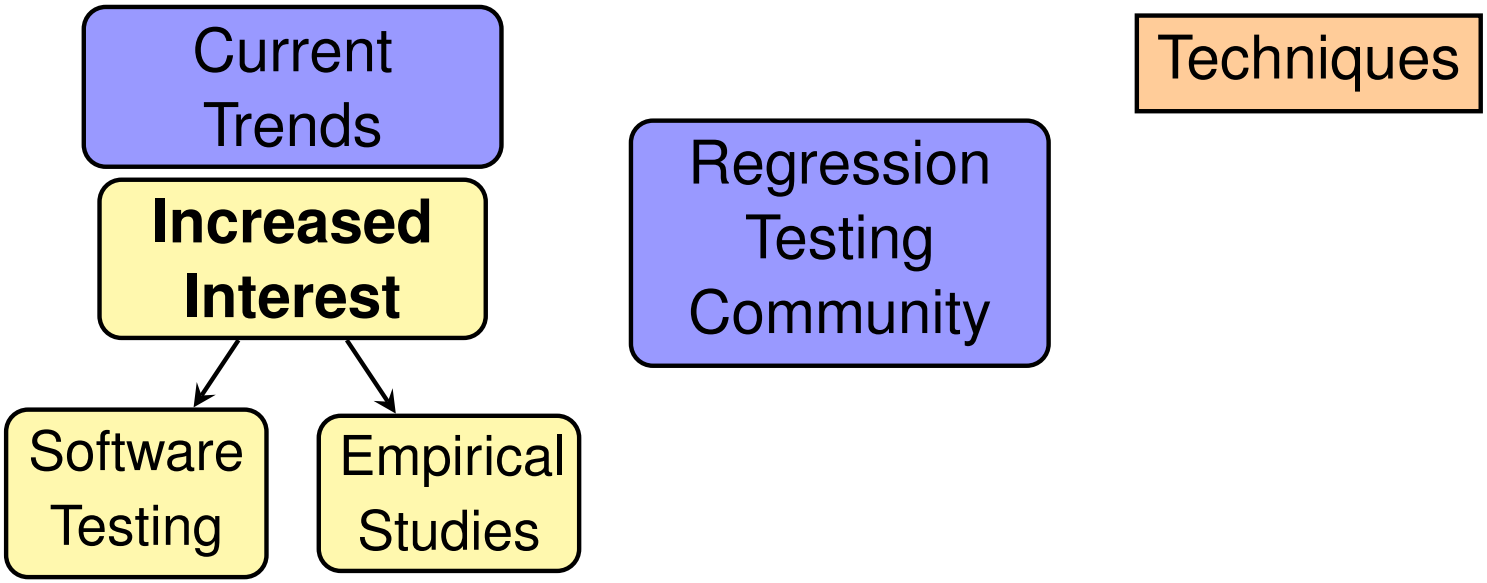

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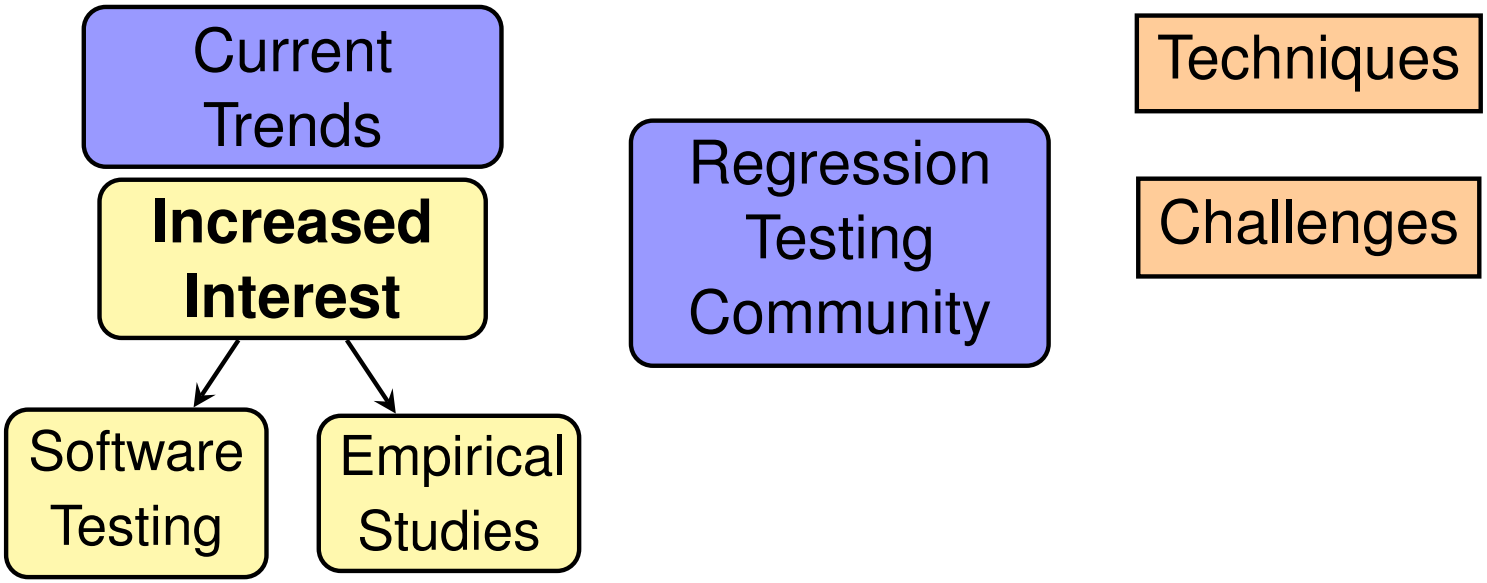

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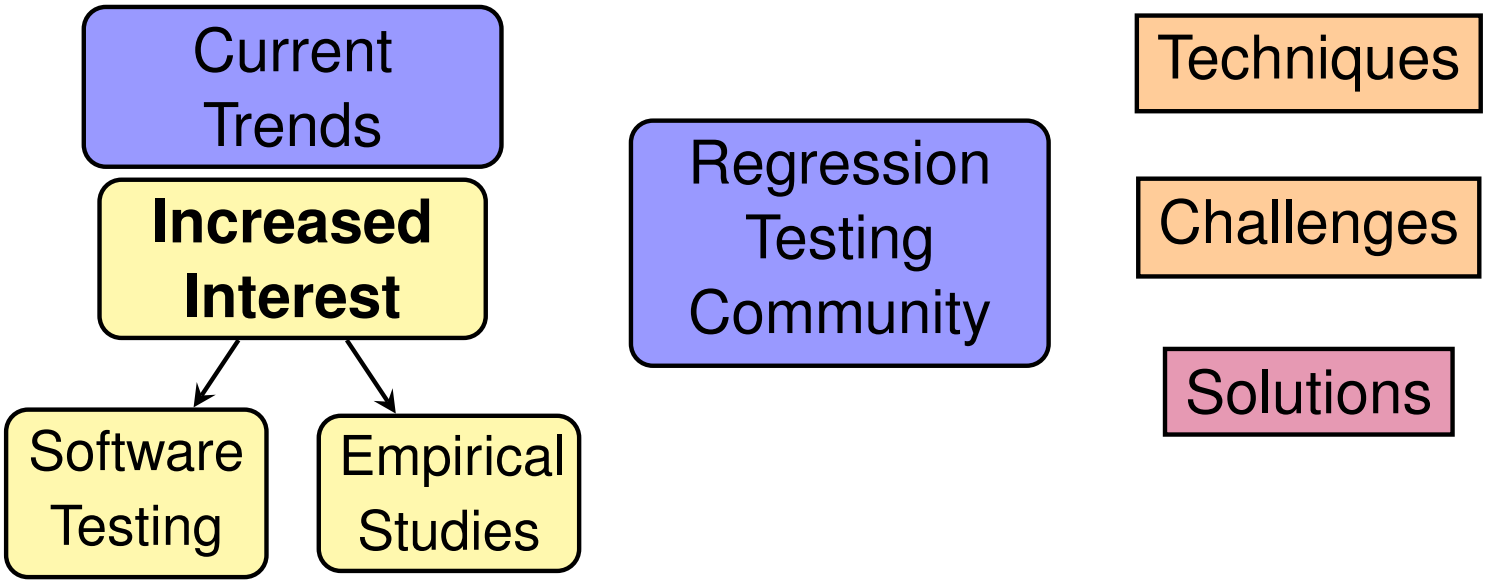

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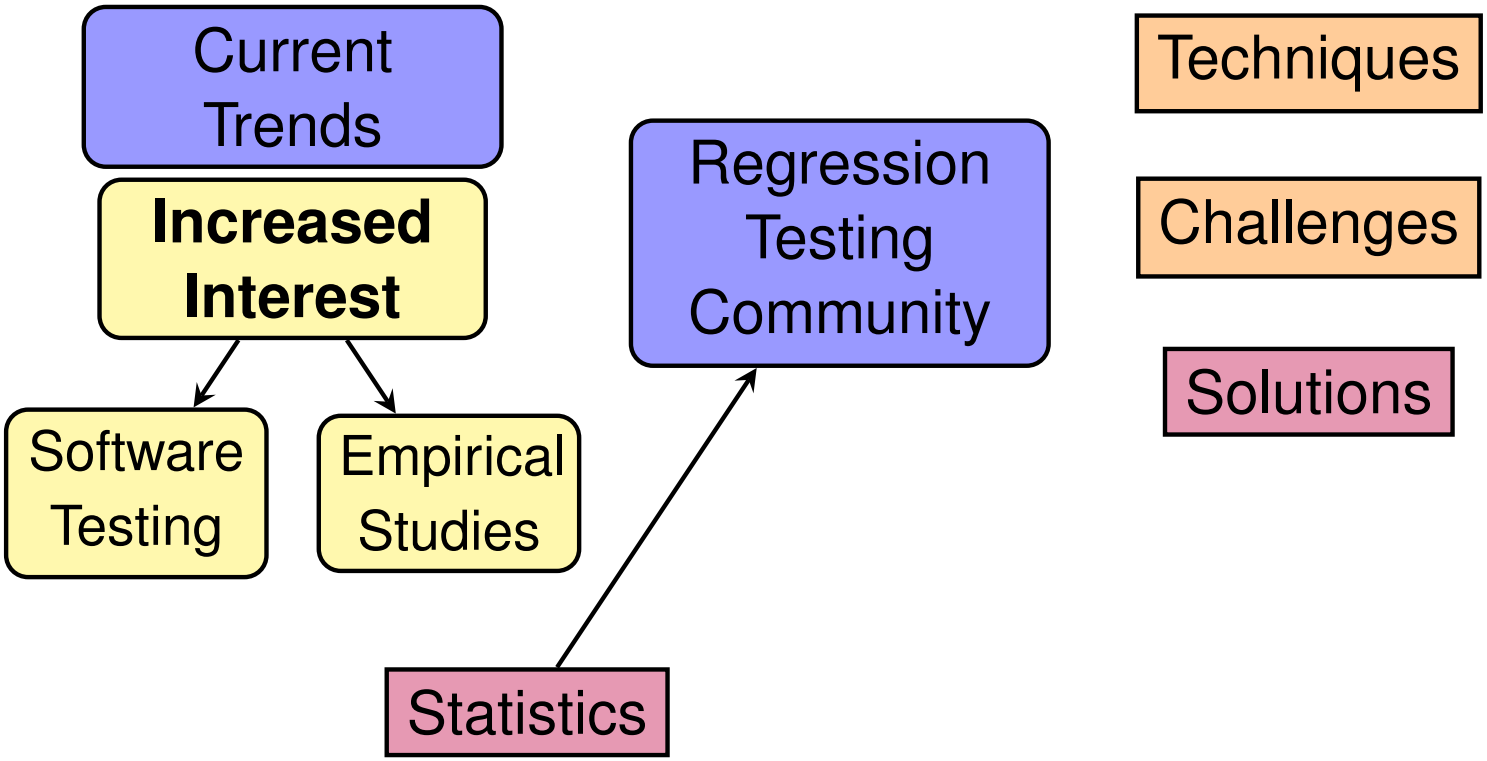

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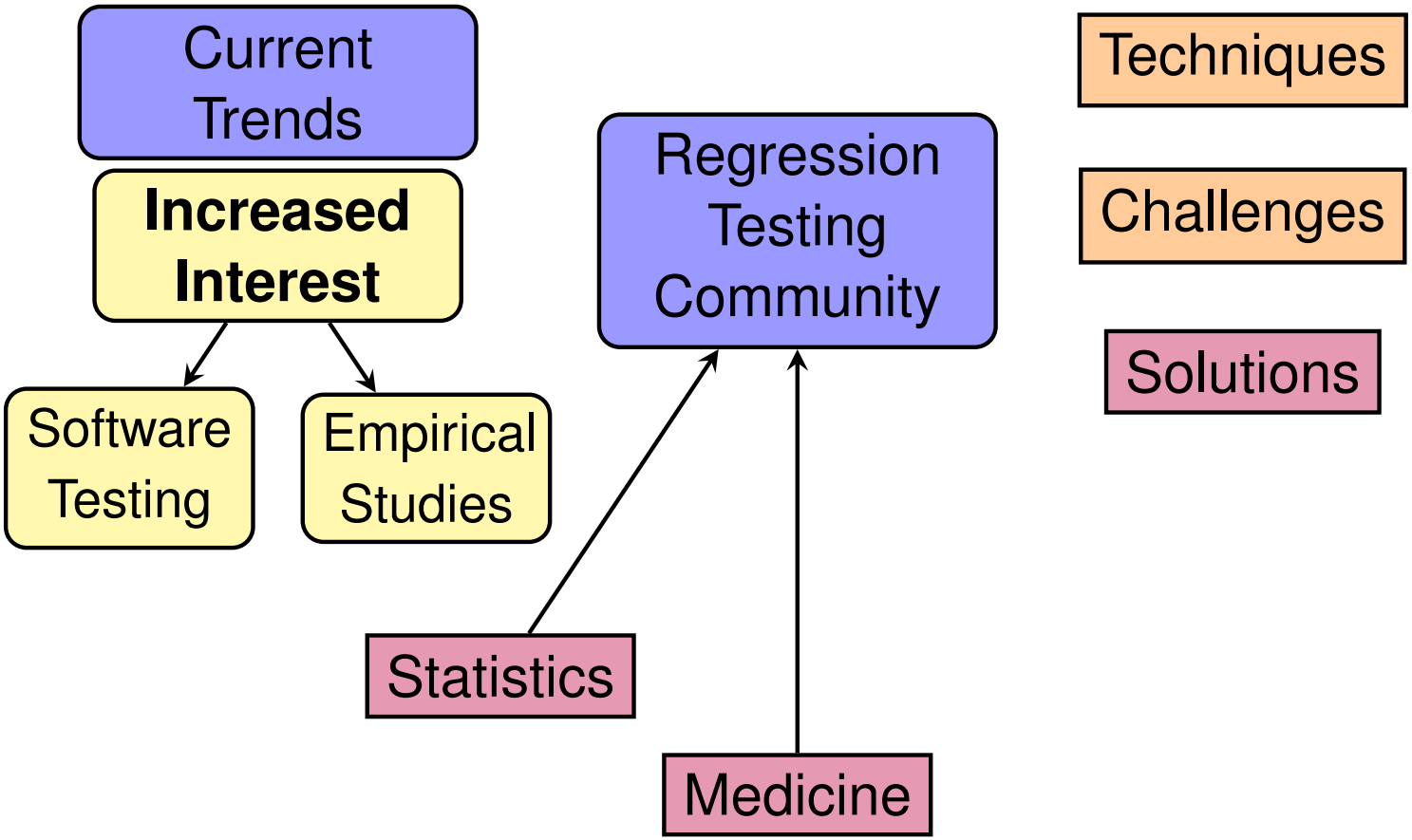

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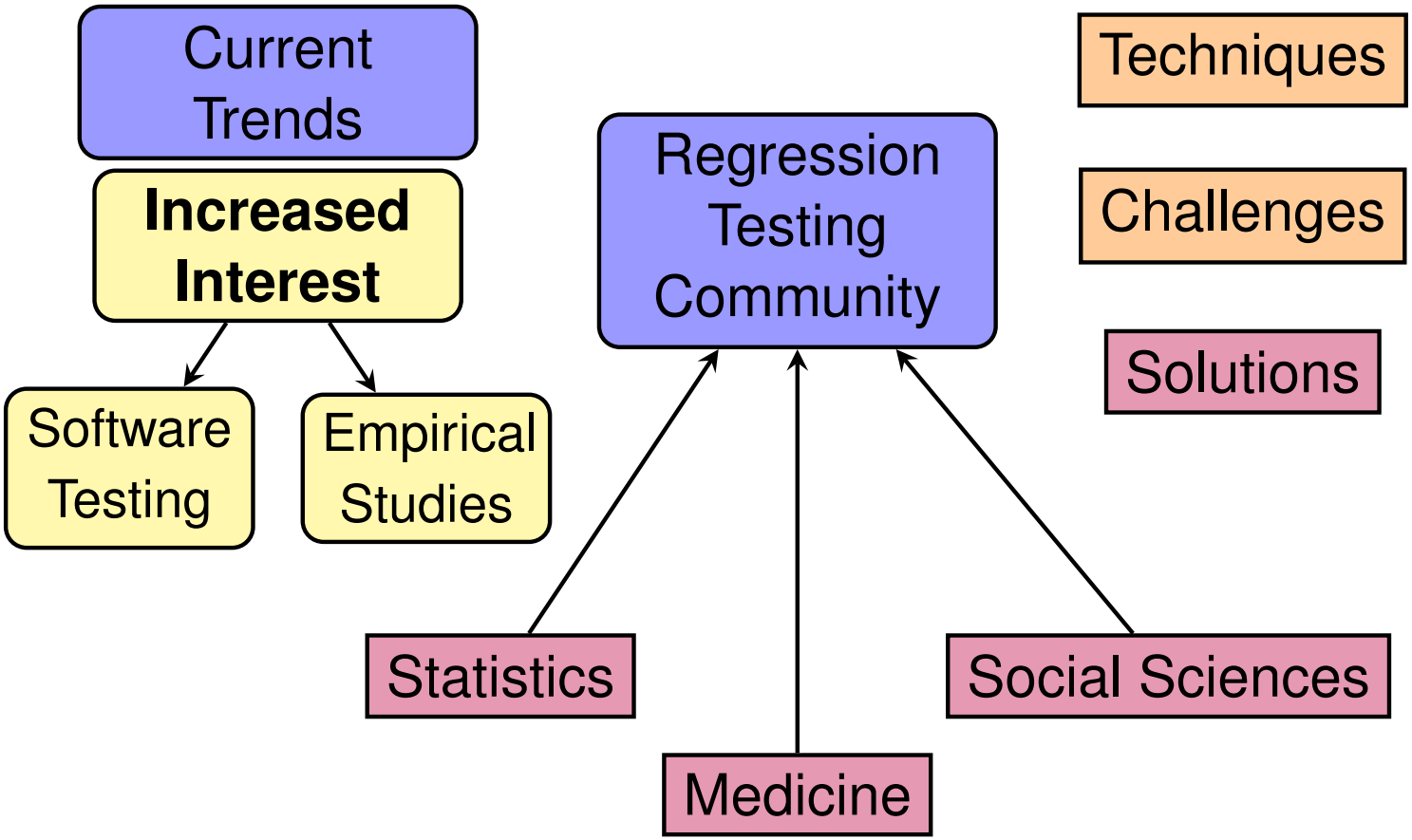

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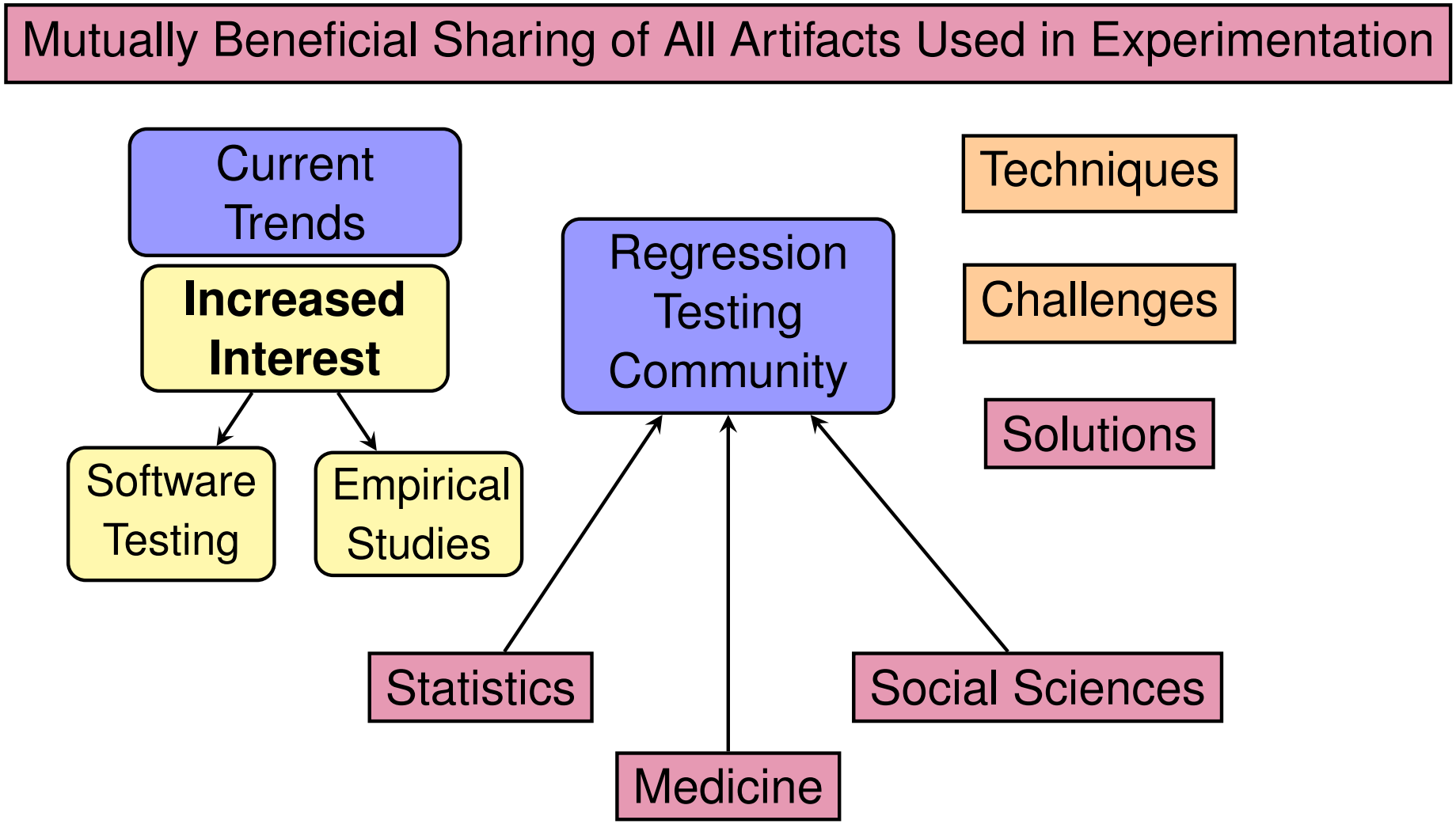
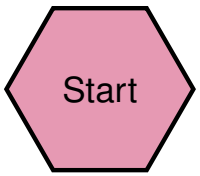


# Model of Regression Testing



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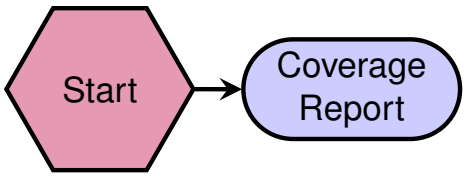

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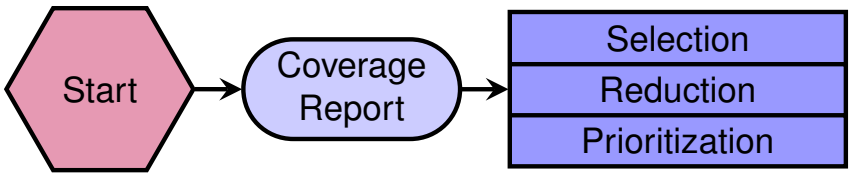

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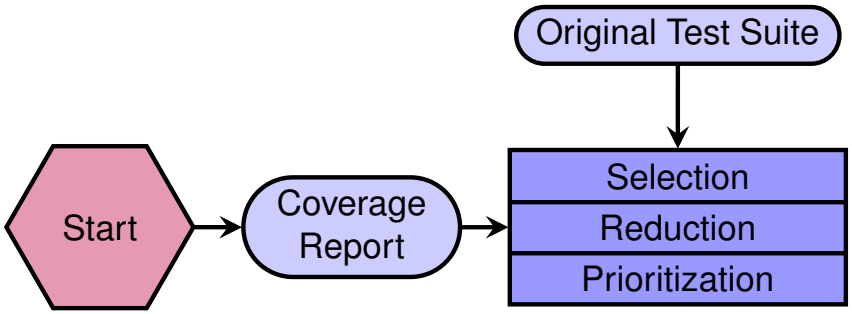

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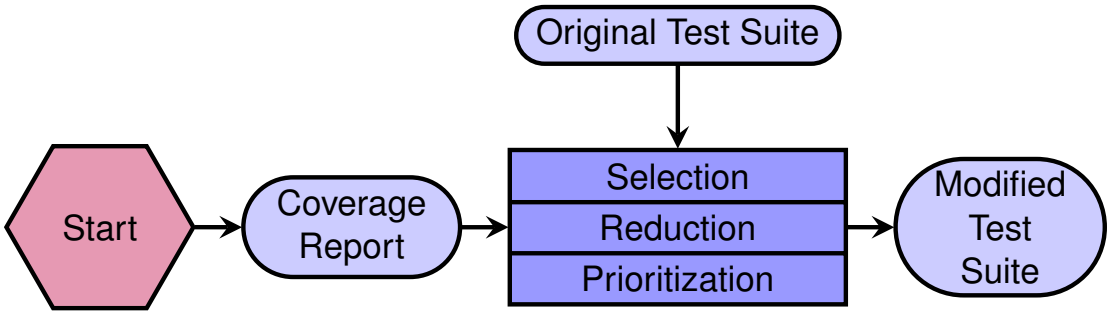

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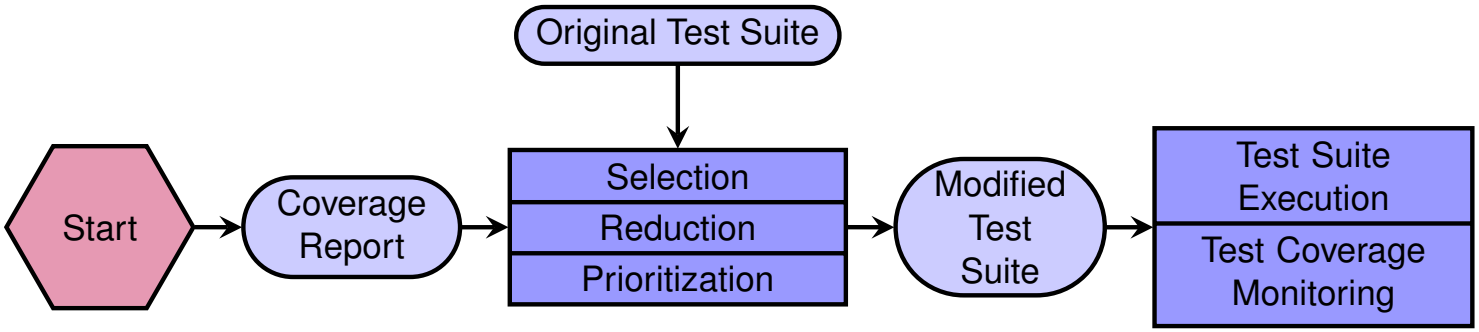

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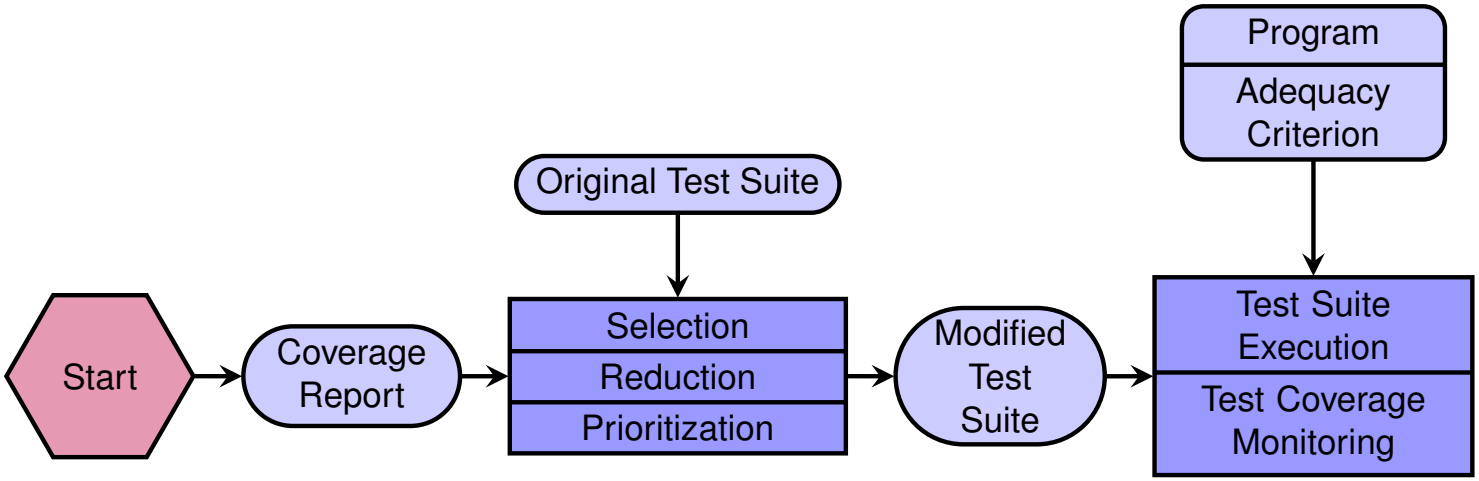

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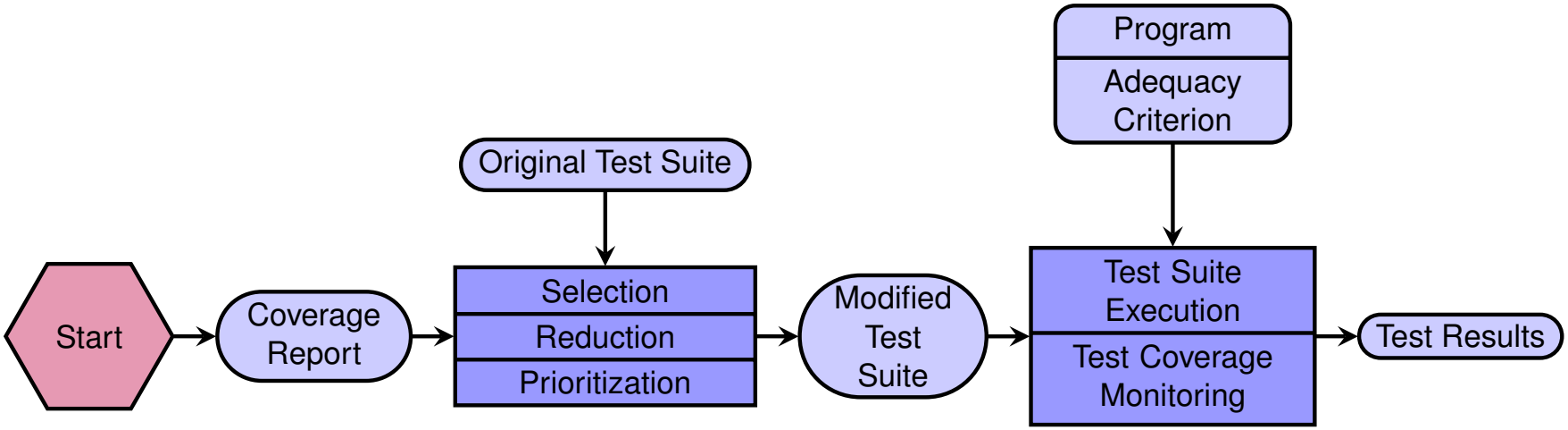

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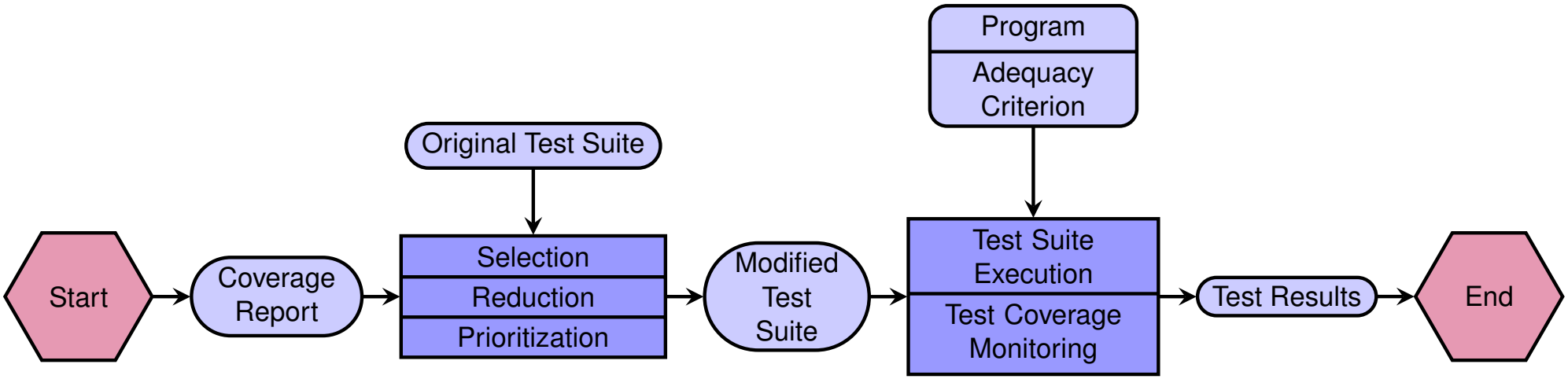

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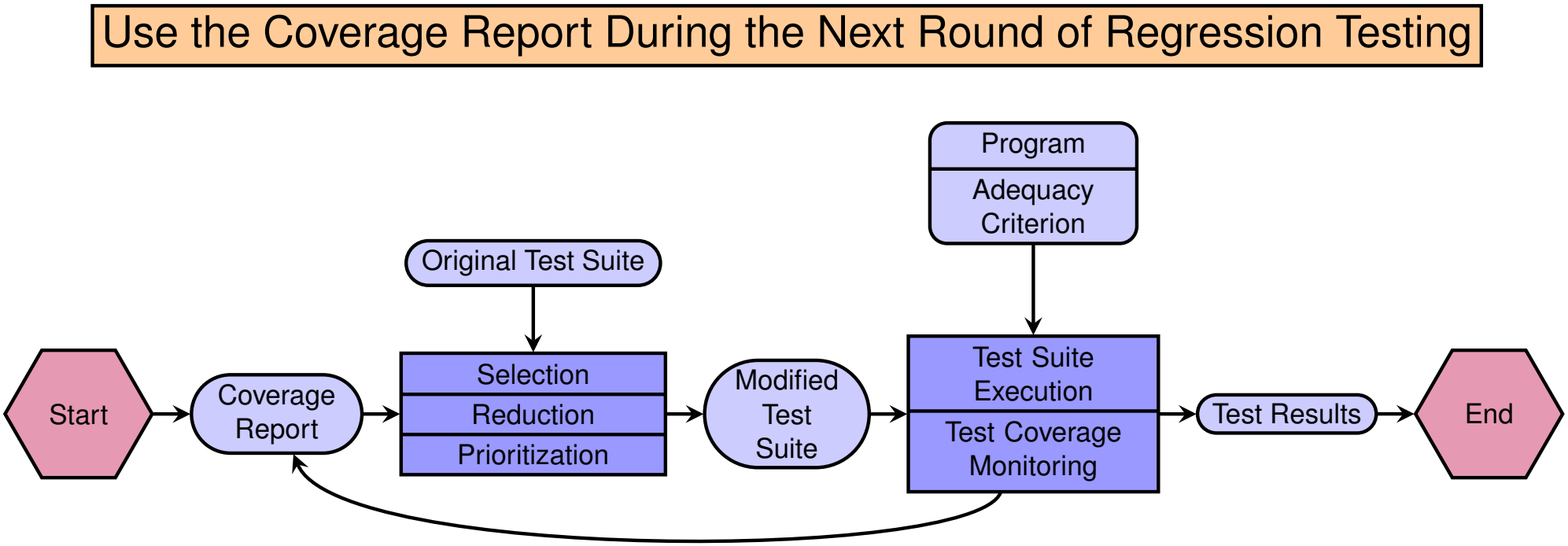
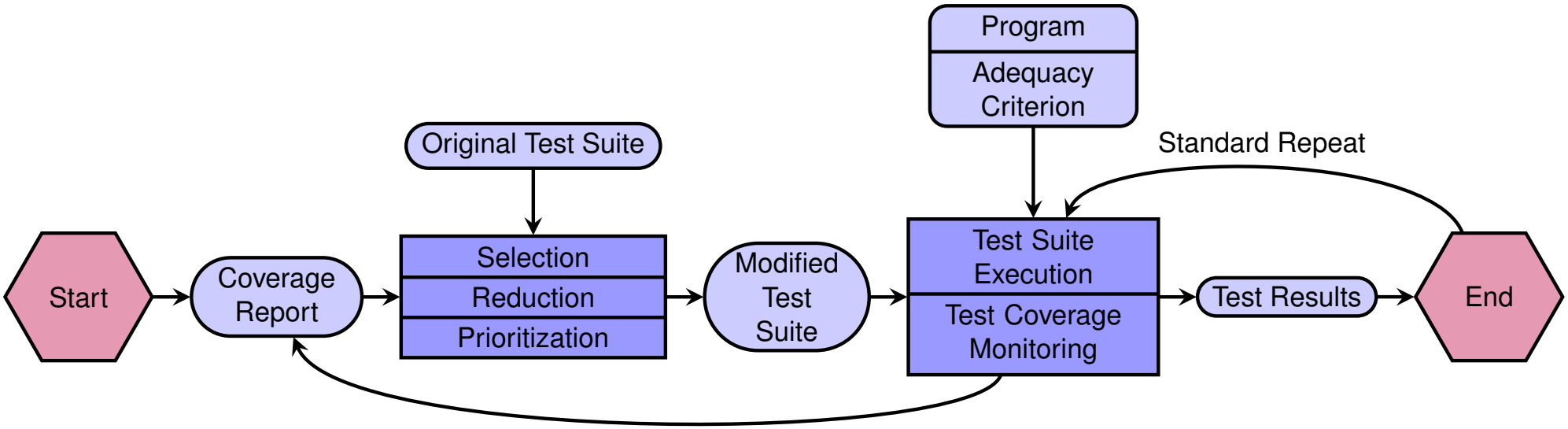


# Model of Regression Testing

Use the Same Test Suite for the Next Round of Regression Testing



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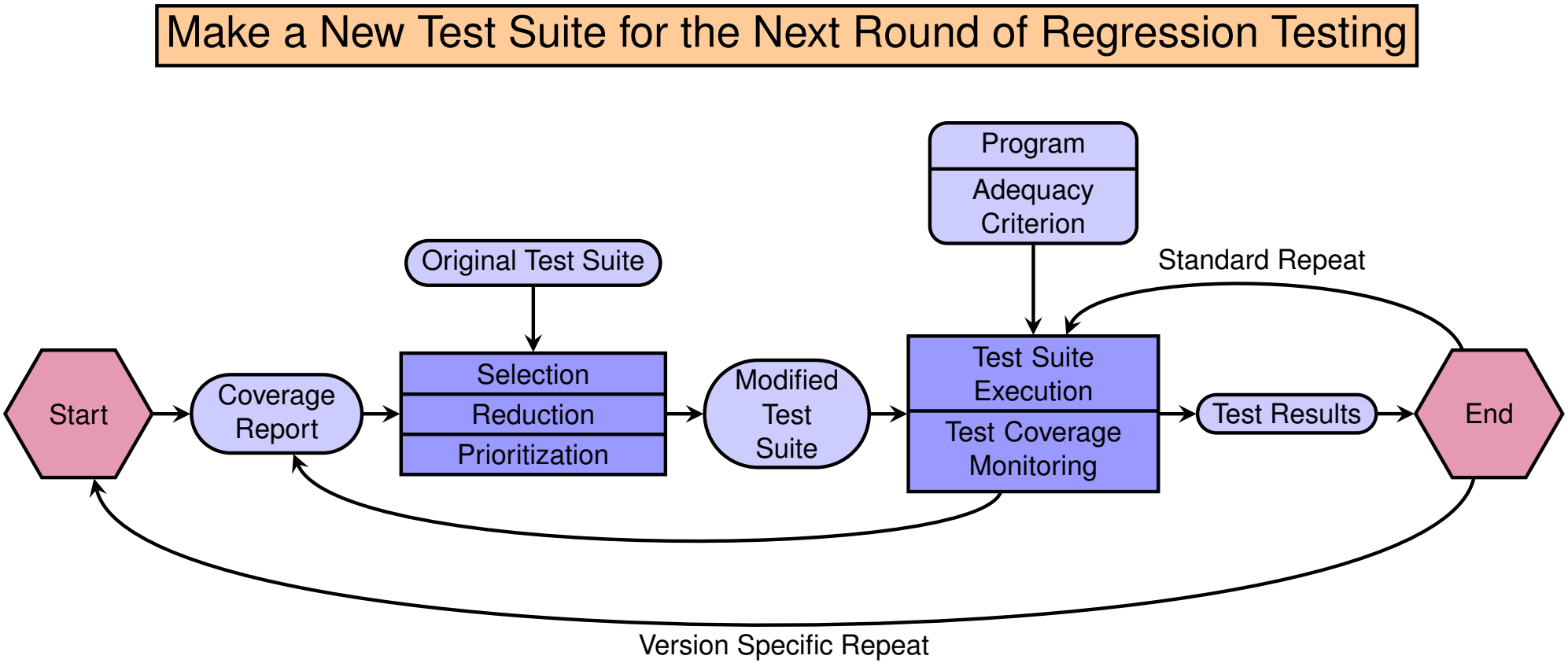
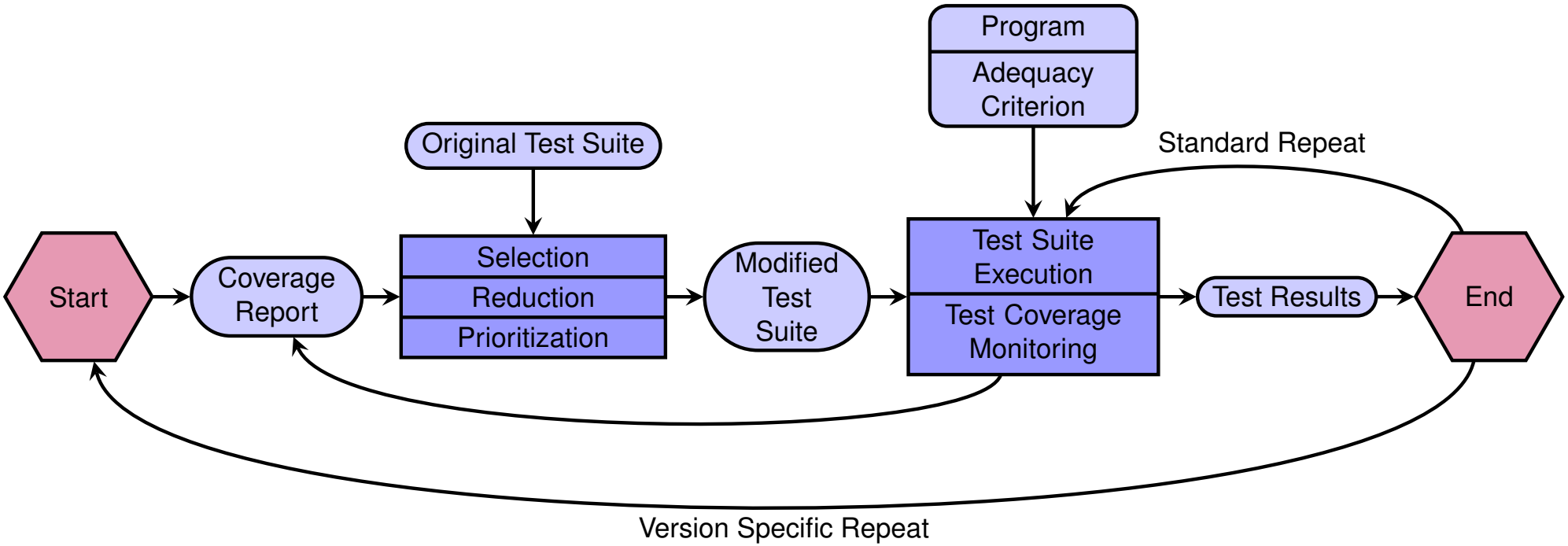


# Model of Regression Testing

Practitioners are unwilling to use methods for “lack of empirical studies” [12]



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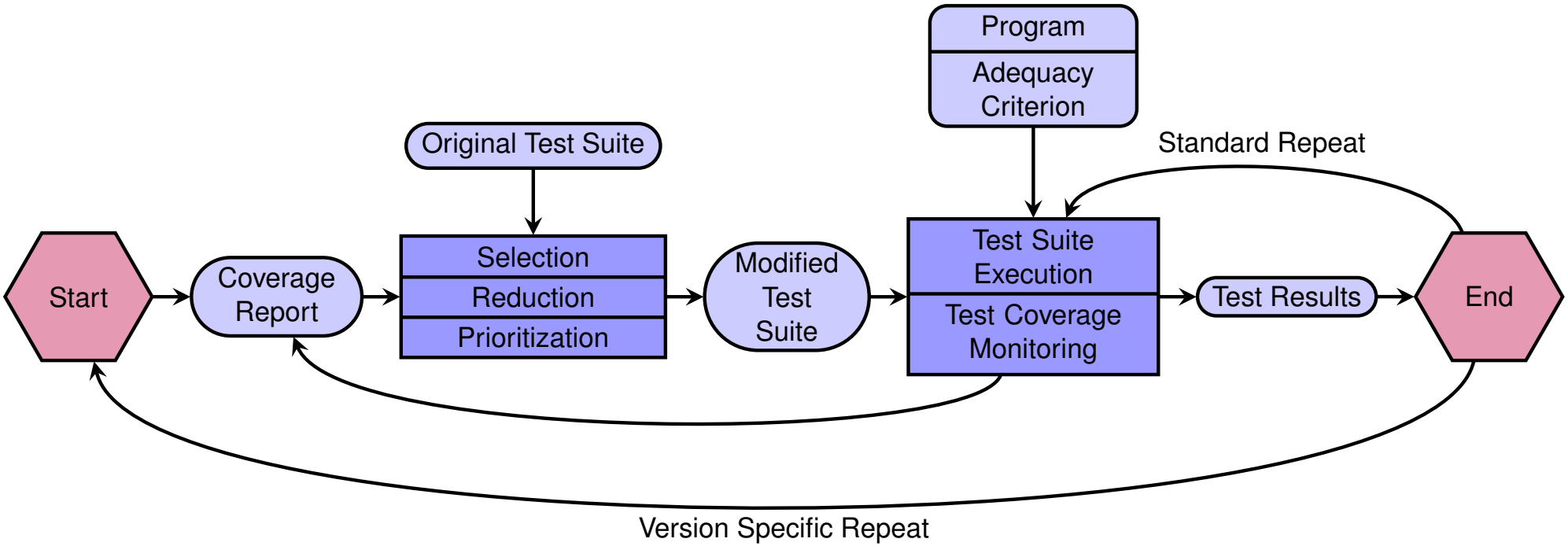


Testing tools do not produce outputs in the best format (e.g., per-test coverage)

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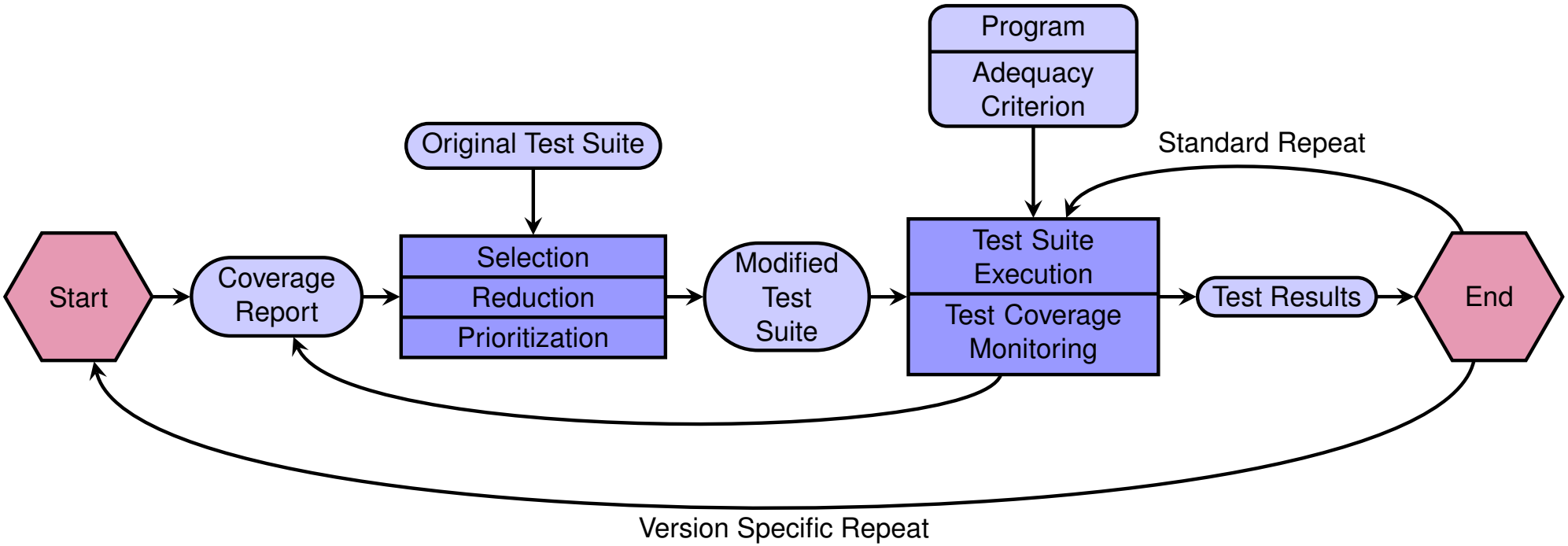
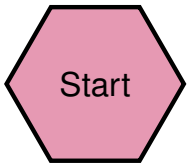



Experimental assessment could stagnate due to inaccessibility of artifacts

# Model of Experimental Evaluation



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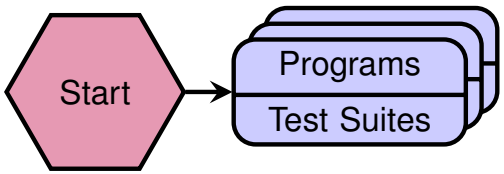

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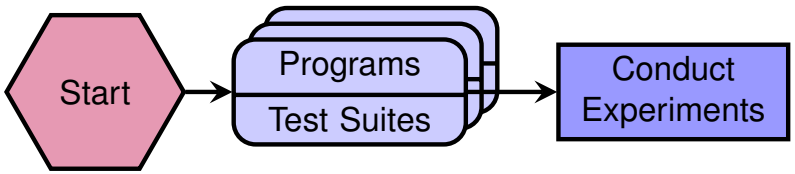

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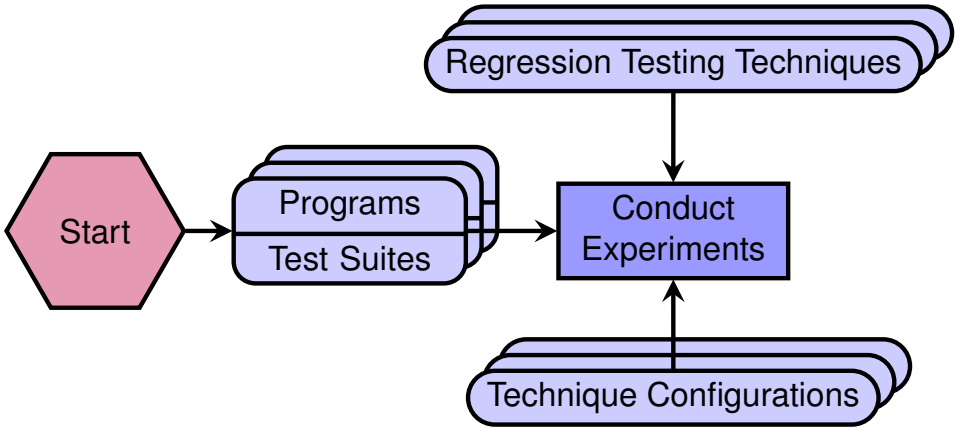

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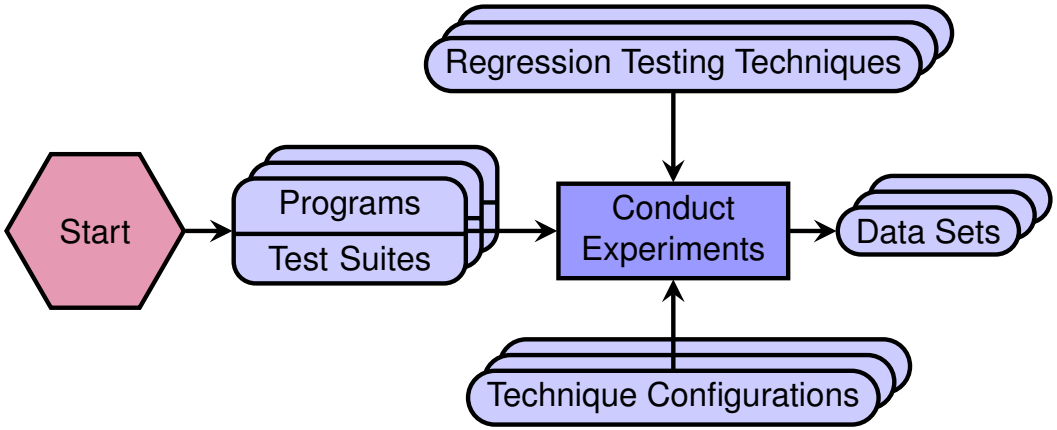

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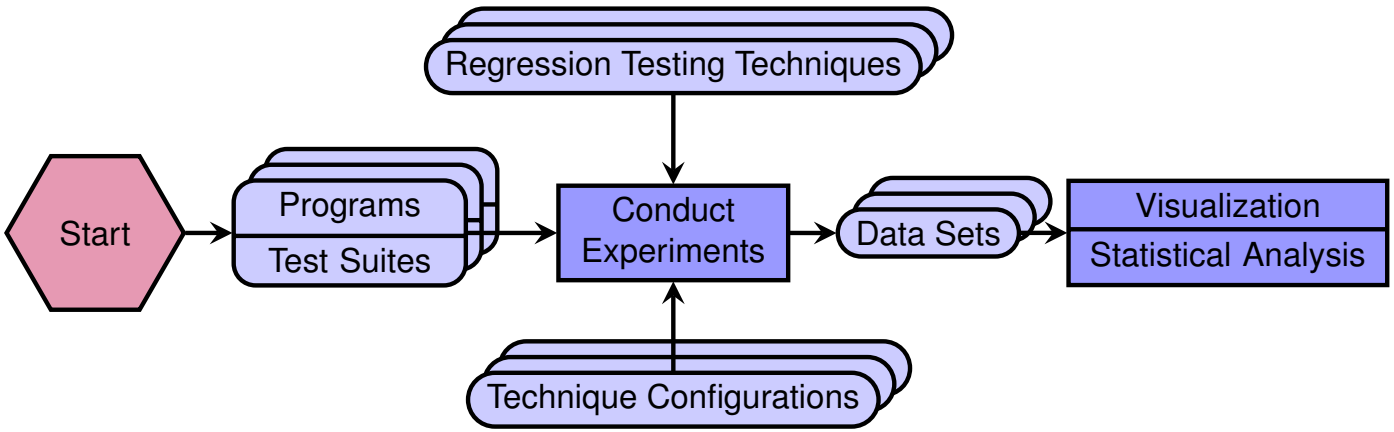

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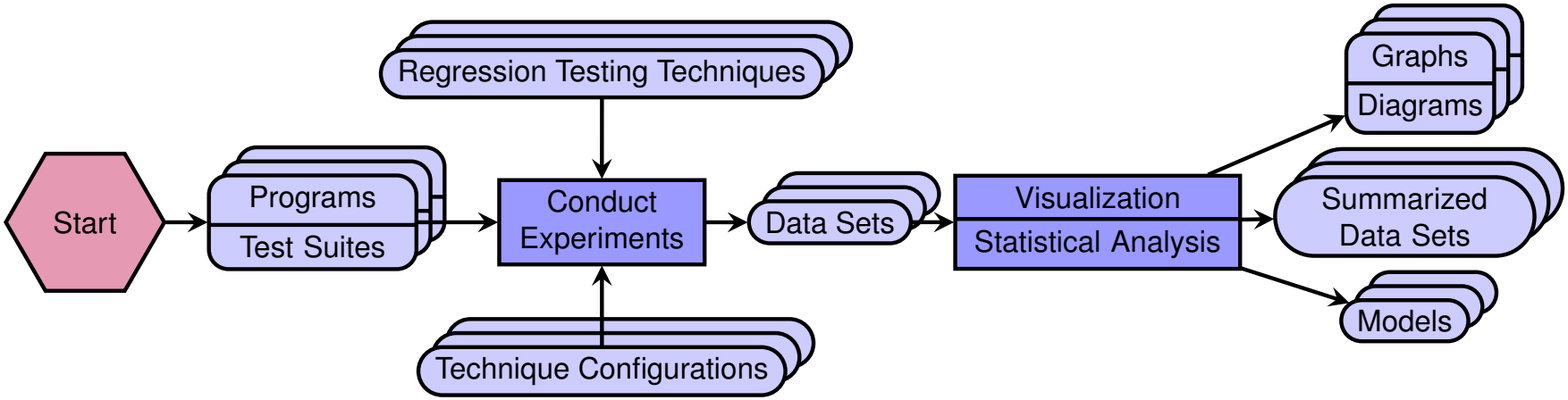

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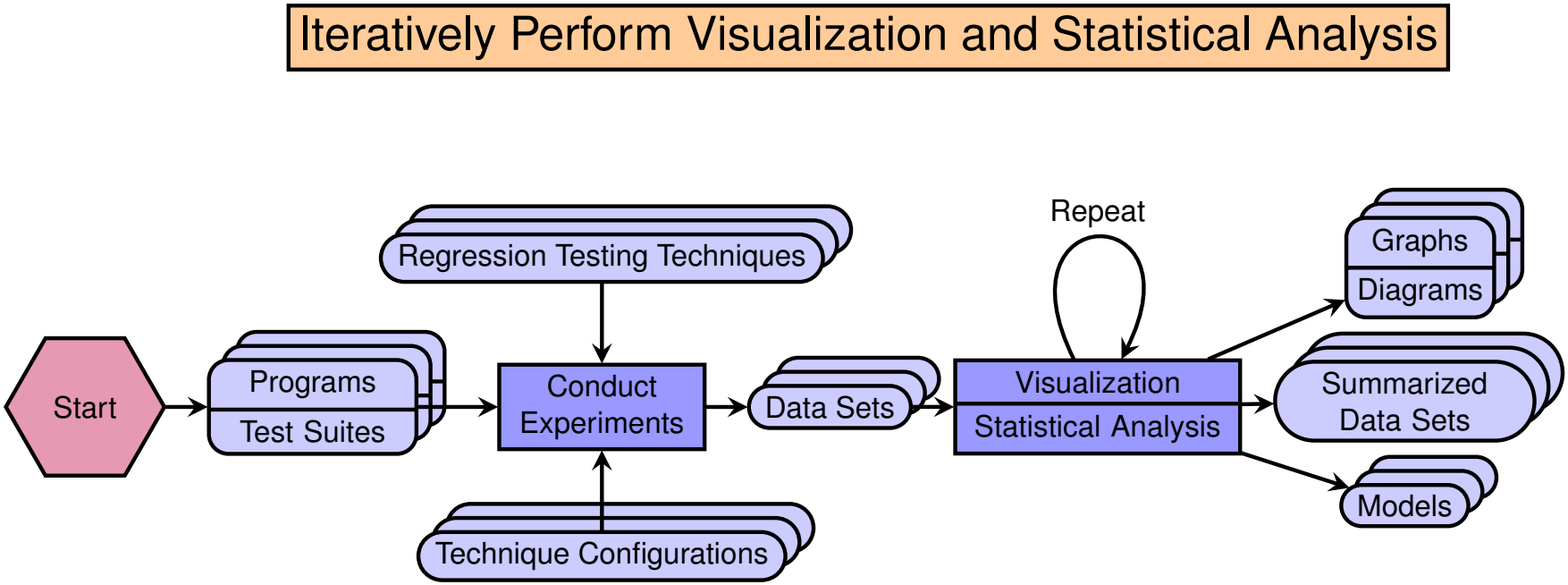

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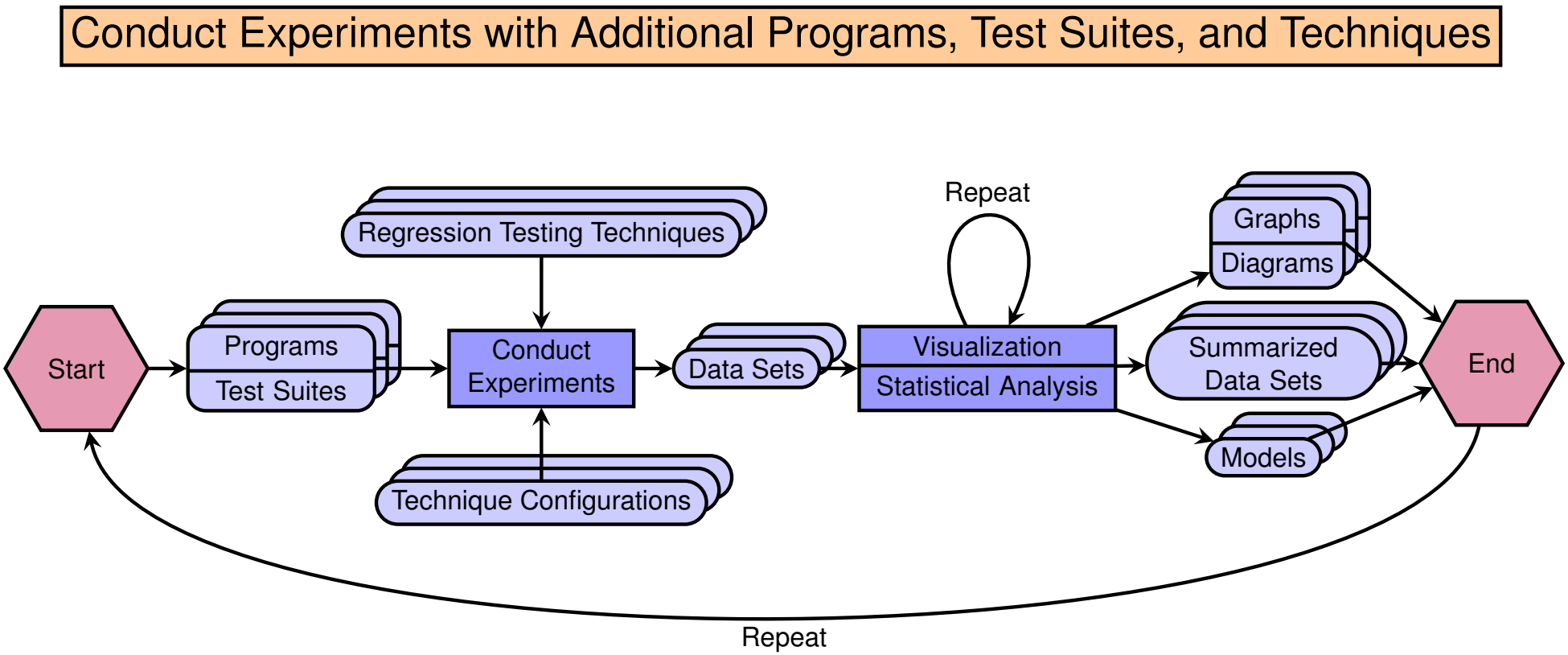
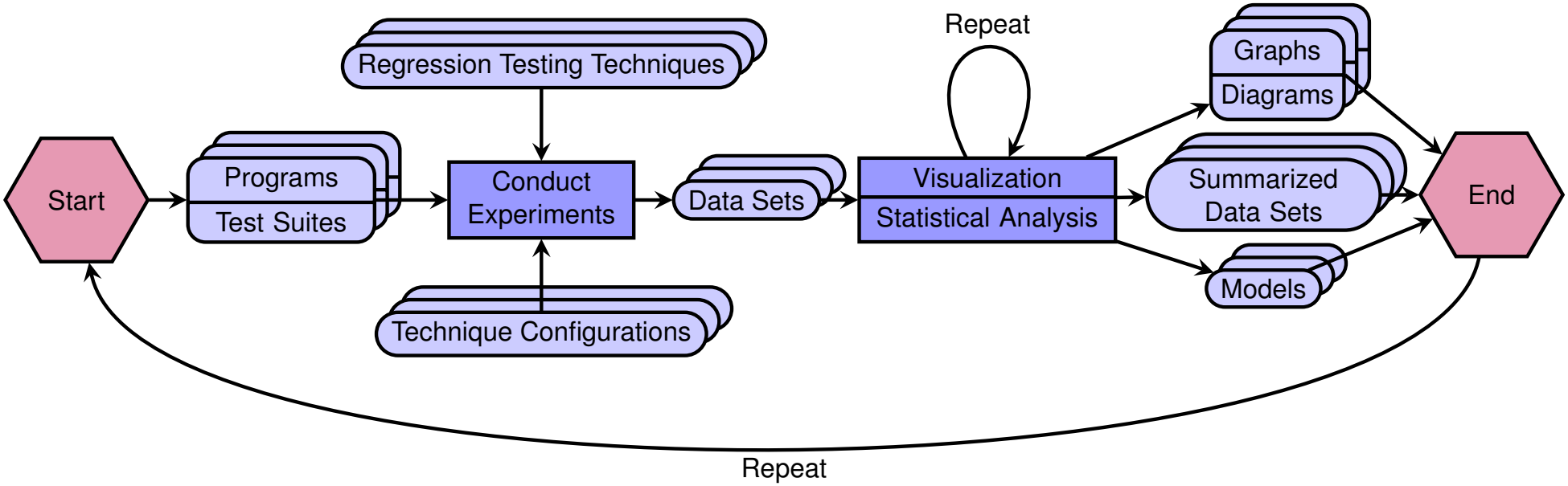


# Model of Experimental Evaluation

Conduct Experiments with Additional Programs, Test Suites, and Techniques




56% of Papers Surveyed by Yoo and Harman Only Used the SIR Programs [3]

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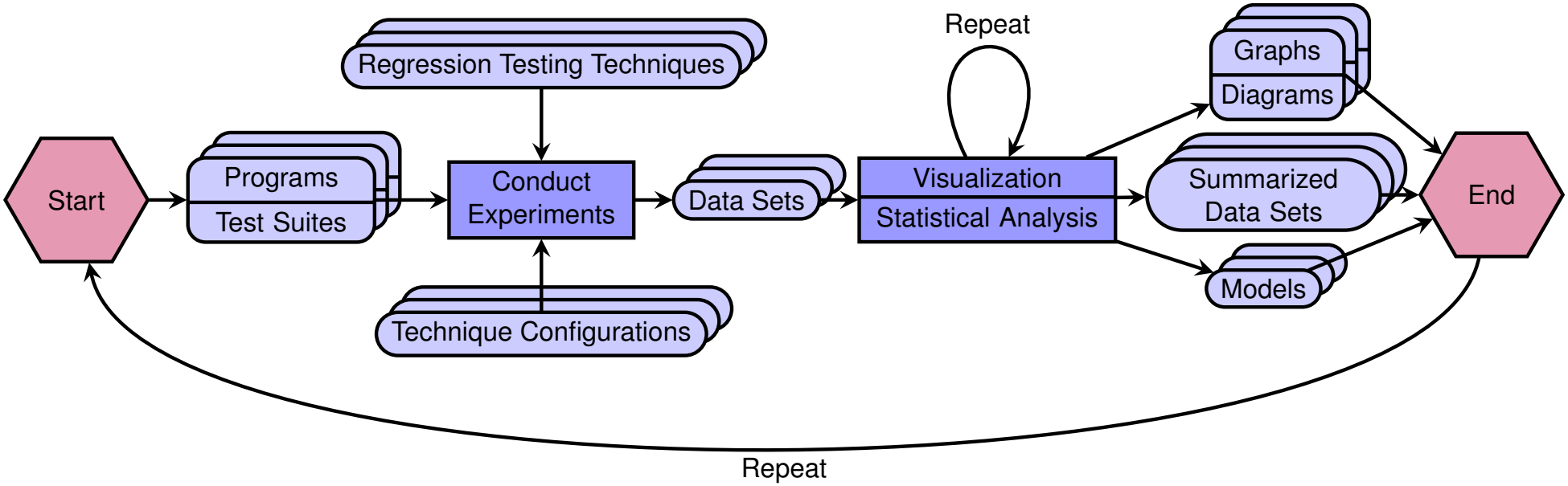


Few Papers Report on the Efficiency of the Regression Testing Techniques

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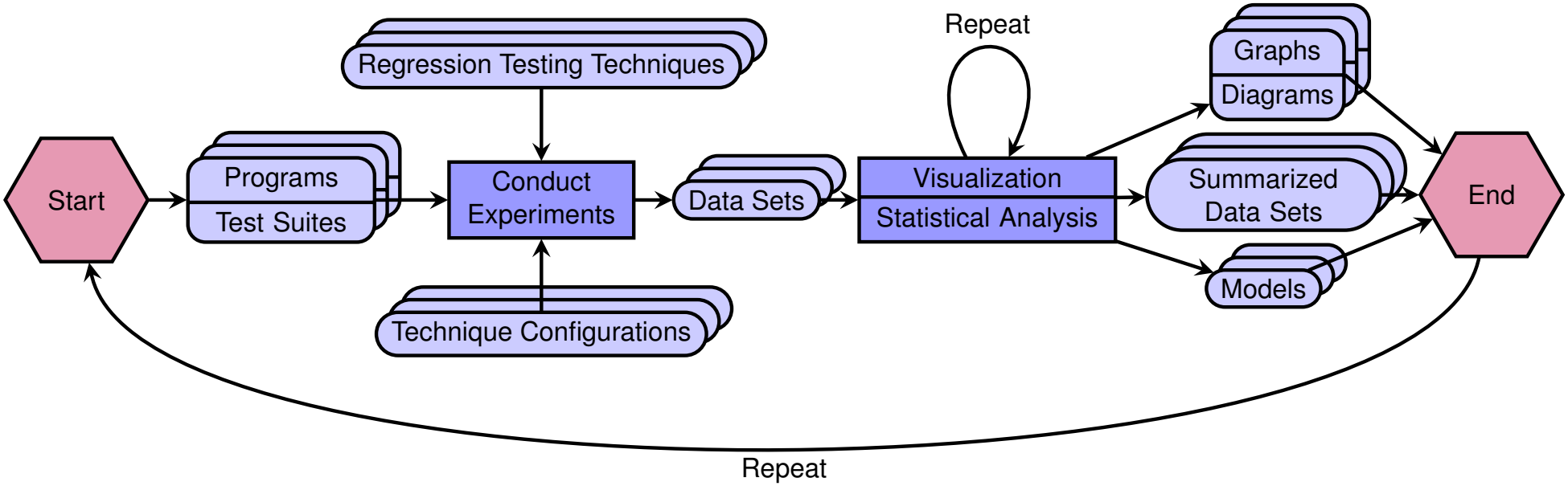


Authors Do Not Release Tools That Conduct Experiments and Analyze Results

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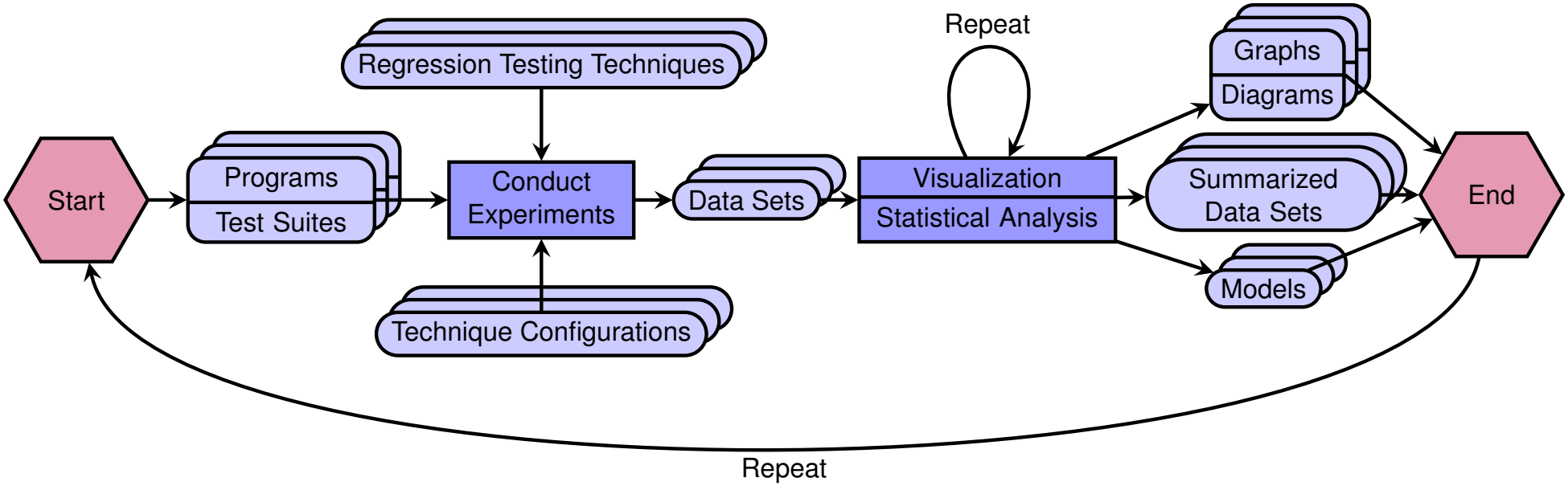


Without Using Data Mining Methods, Researchers May Miss Important Trends

# Thought Provoking Assertions

Jonathan B. Buckheit
and David L. Donoho
Department of Statistics
Stanford University

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For a field to qualify as a science, it is important first and foremost that published work be reproducible by others.

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Does the Regression Testing Community Want to be Scientific?

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Does the Regression Testing Community Want to be Scientific?

What Does it Mean for Research to be Reproducible?

Jonathan B. Buckheit and David L. Donoho
Department of Statistics
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# Thought Provoking Assertions

Gary King
Department of Government Harvard University

# Thought Provoking Assertions

**Reproducible**: sufficient information exists with which to understand, evaluate, and build upon a prior work if a third party can replicate the results without any additional information from the author.

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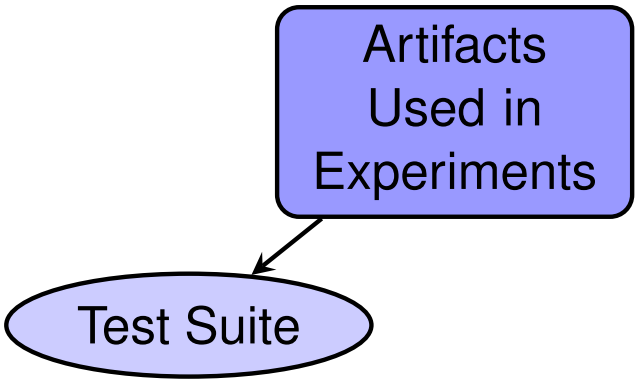
Can the Regression Testing Community Adhere to This Standard?

Gary King
Department of Government Harvard University

# Reproducible Research Through Sharing

Artifacts Used in Experiments

# Reproducible Research Through Sharing



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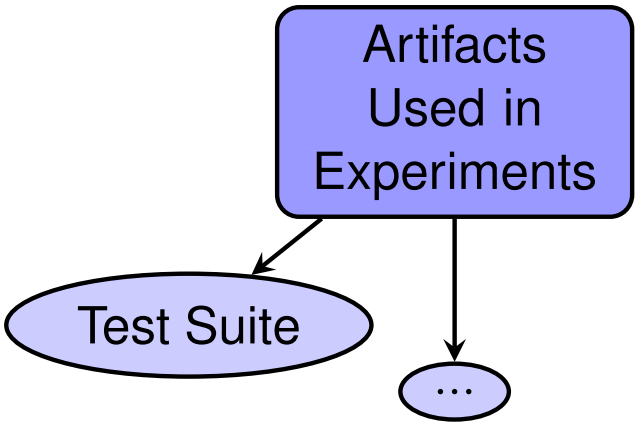

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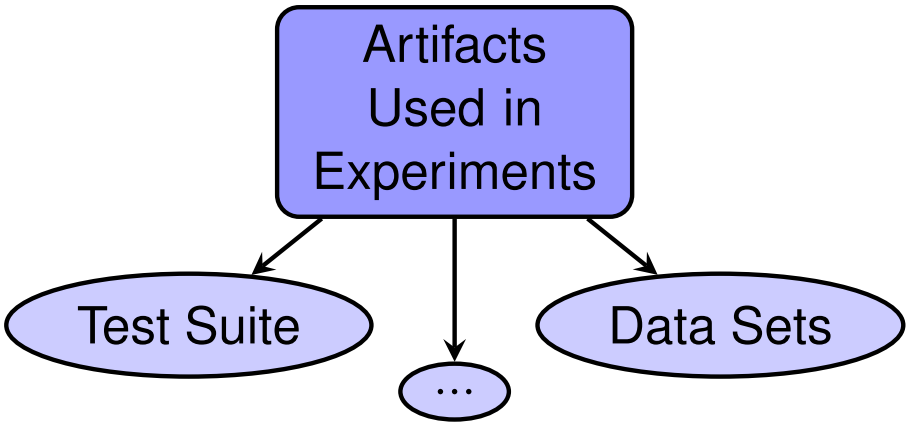

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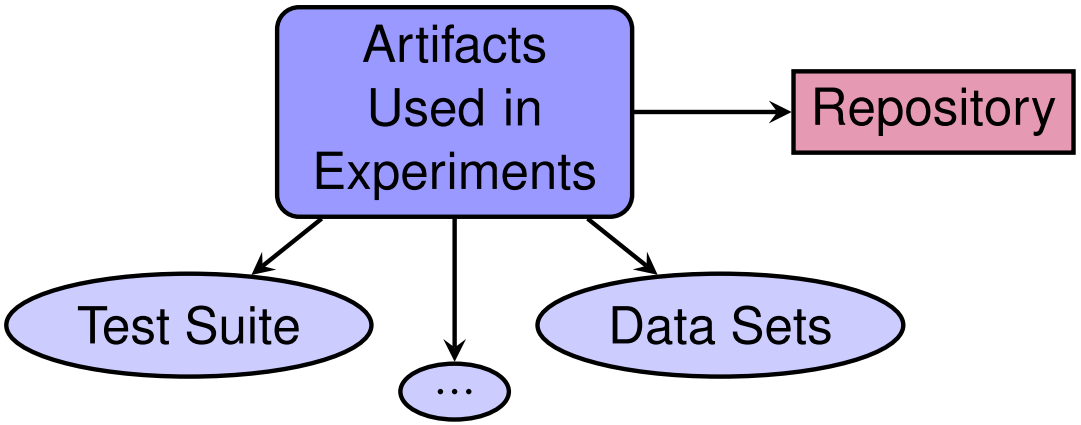

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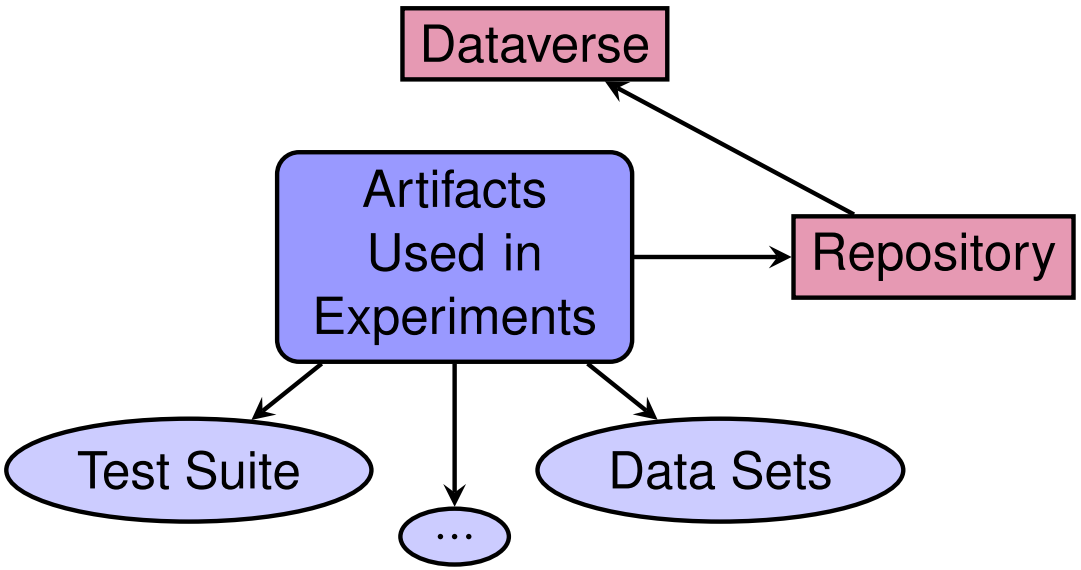

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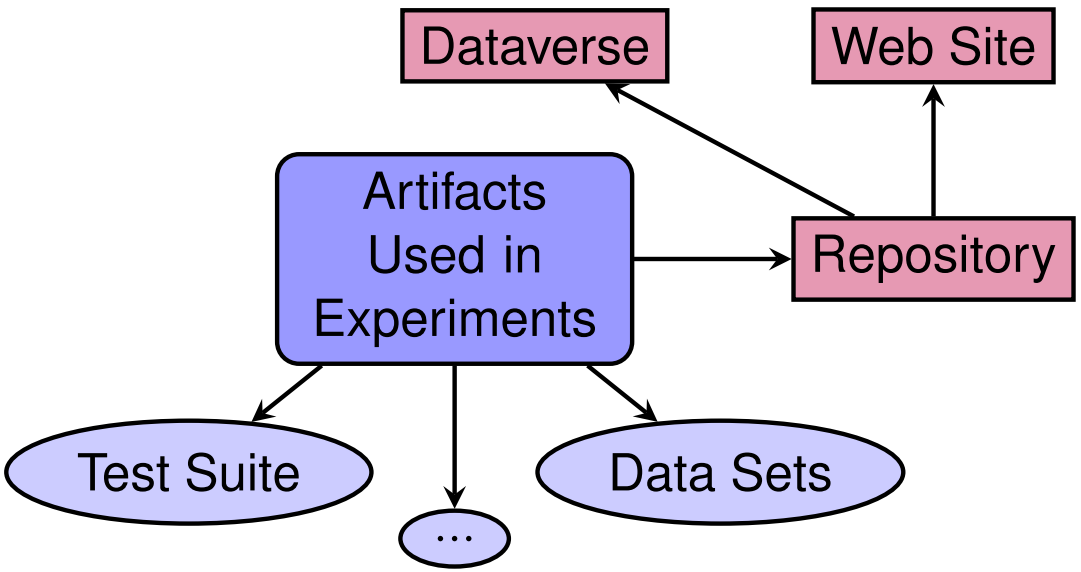

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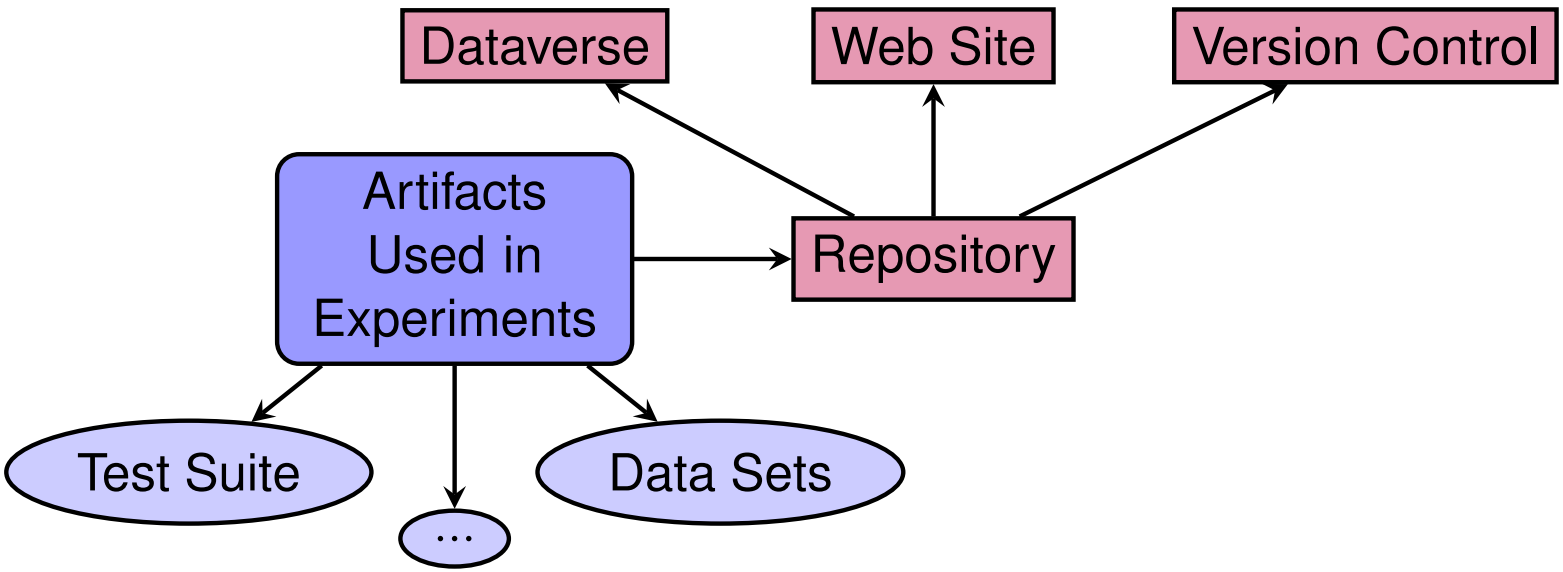

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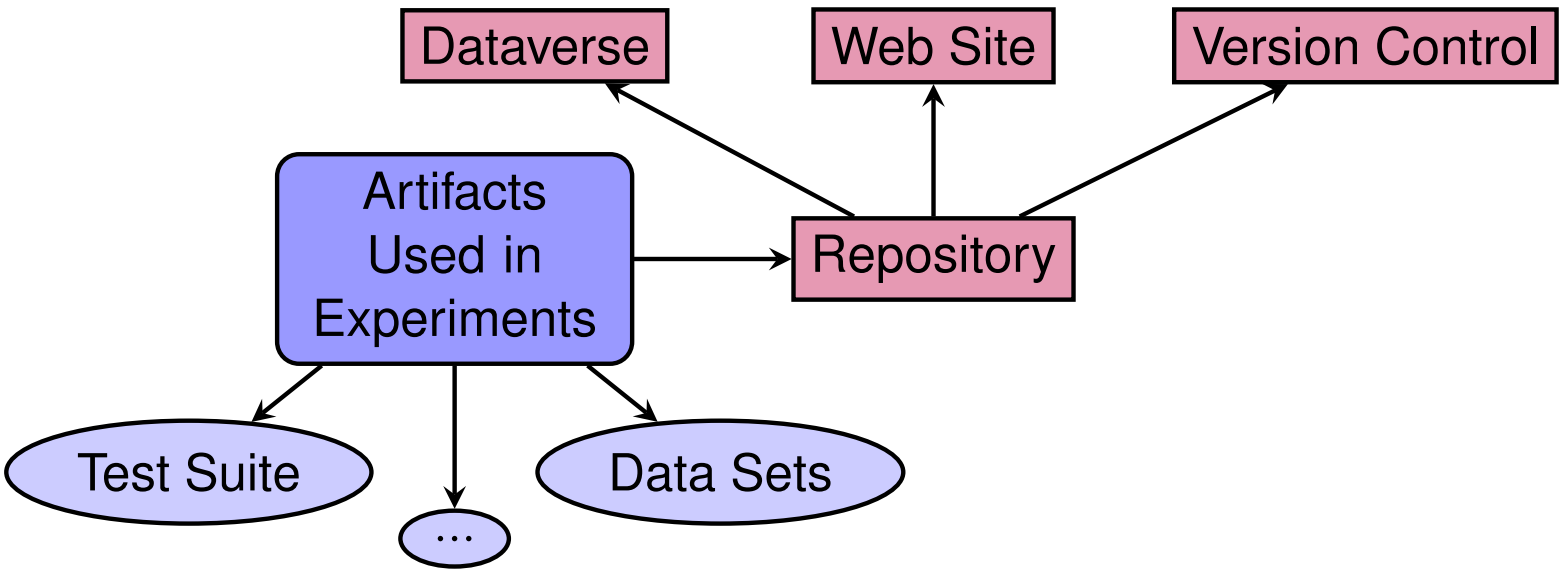
Deposit the Artifacts from Experimentation in One or More Repositories



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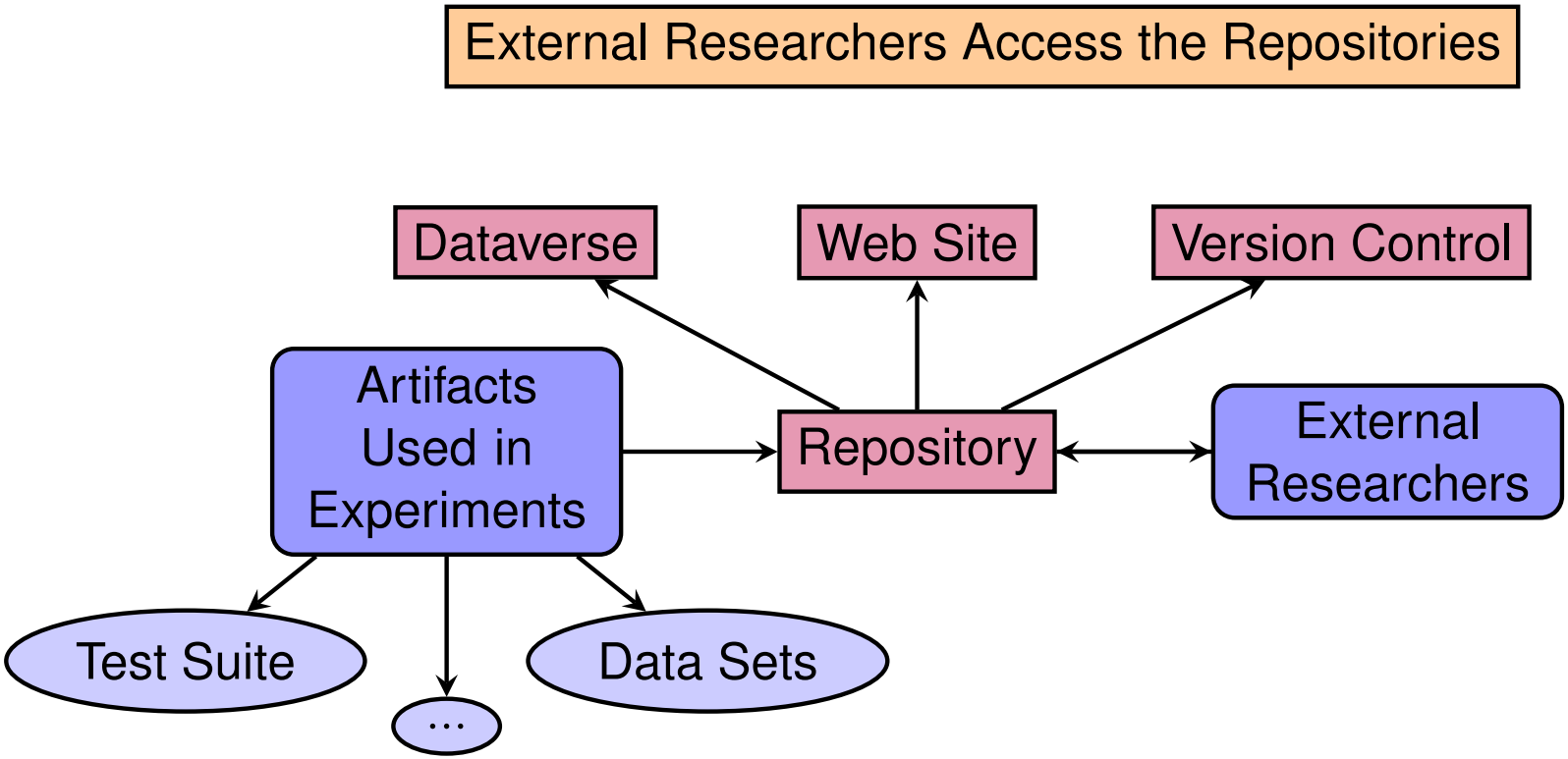

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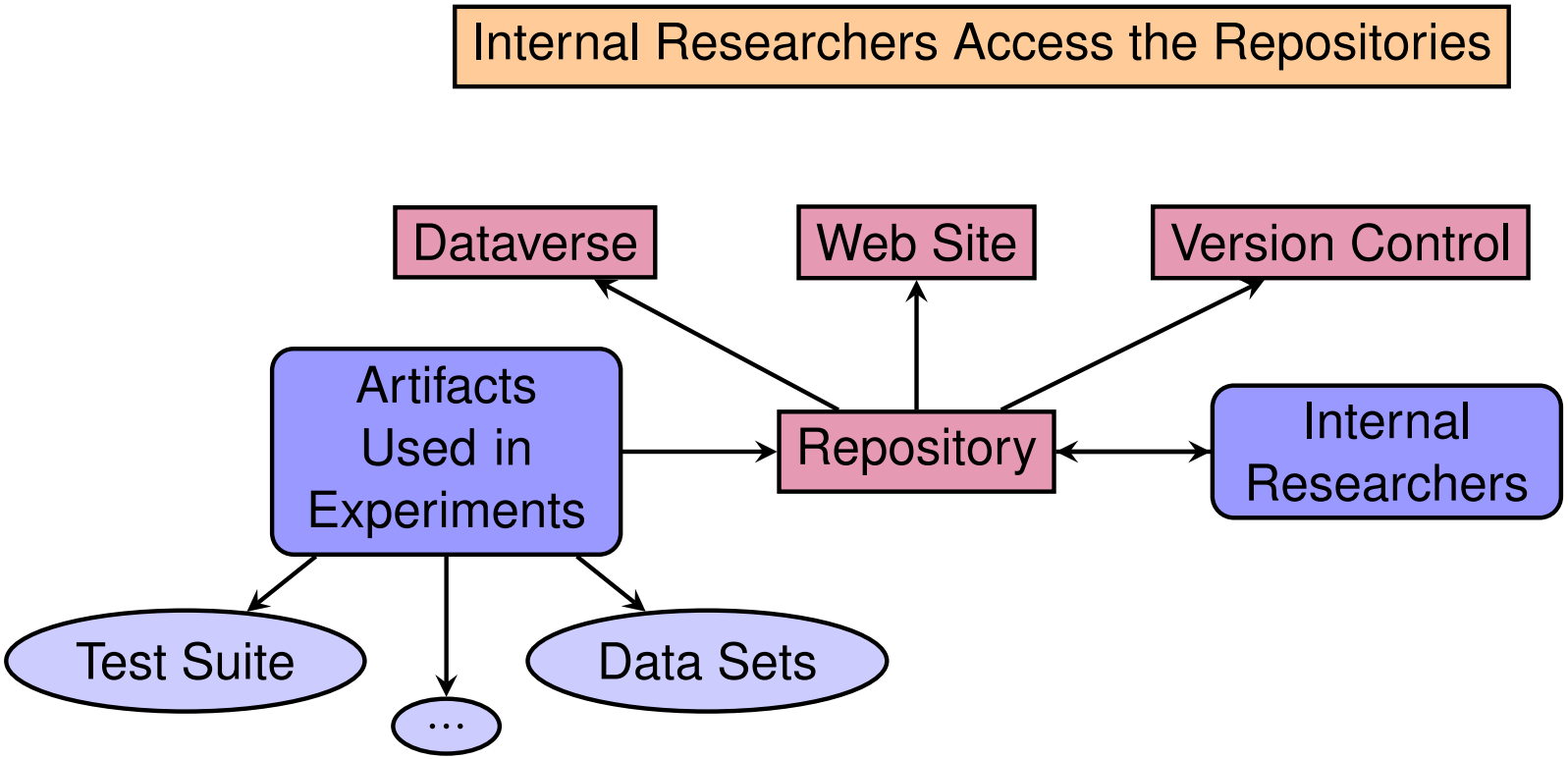

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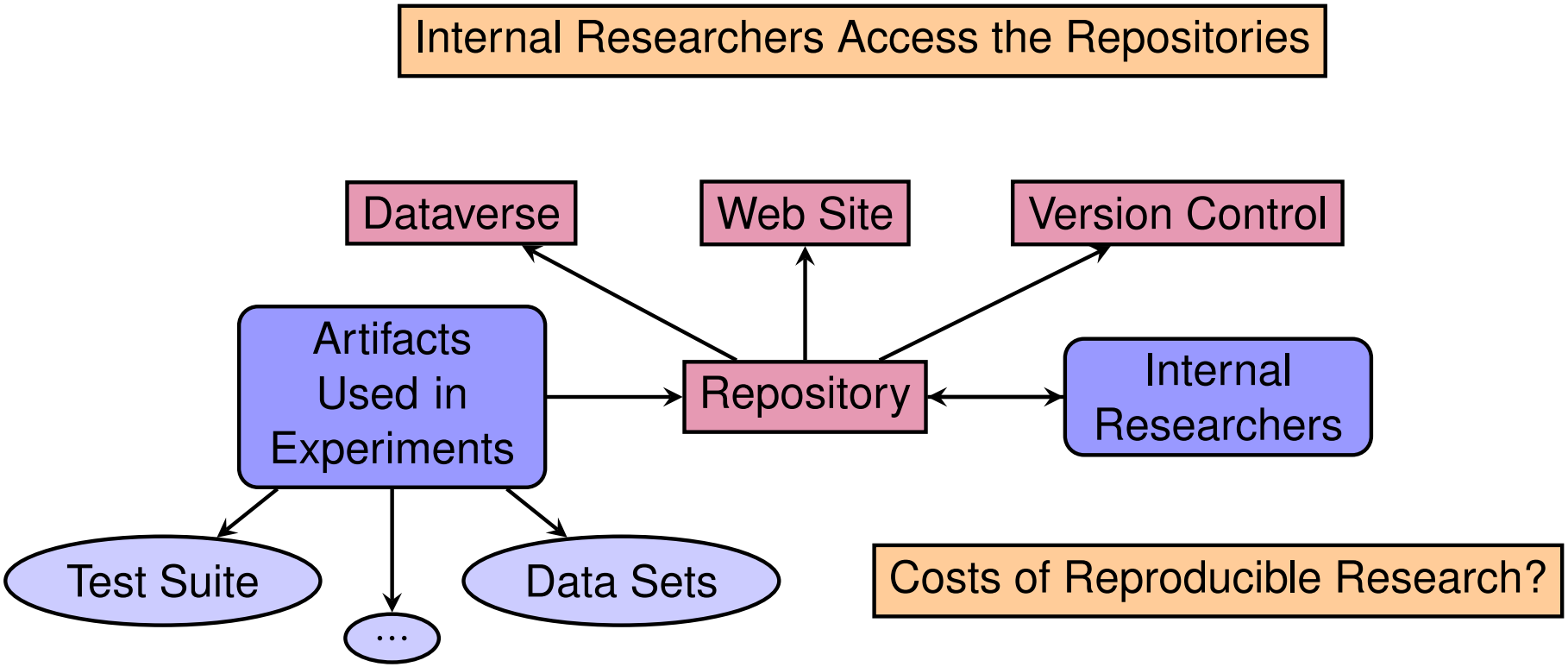

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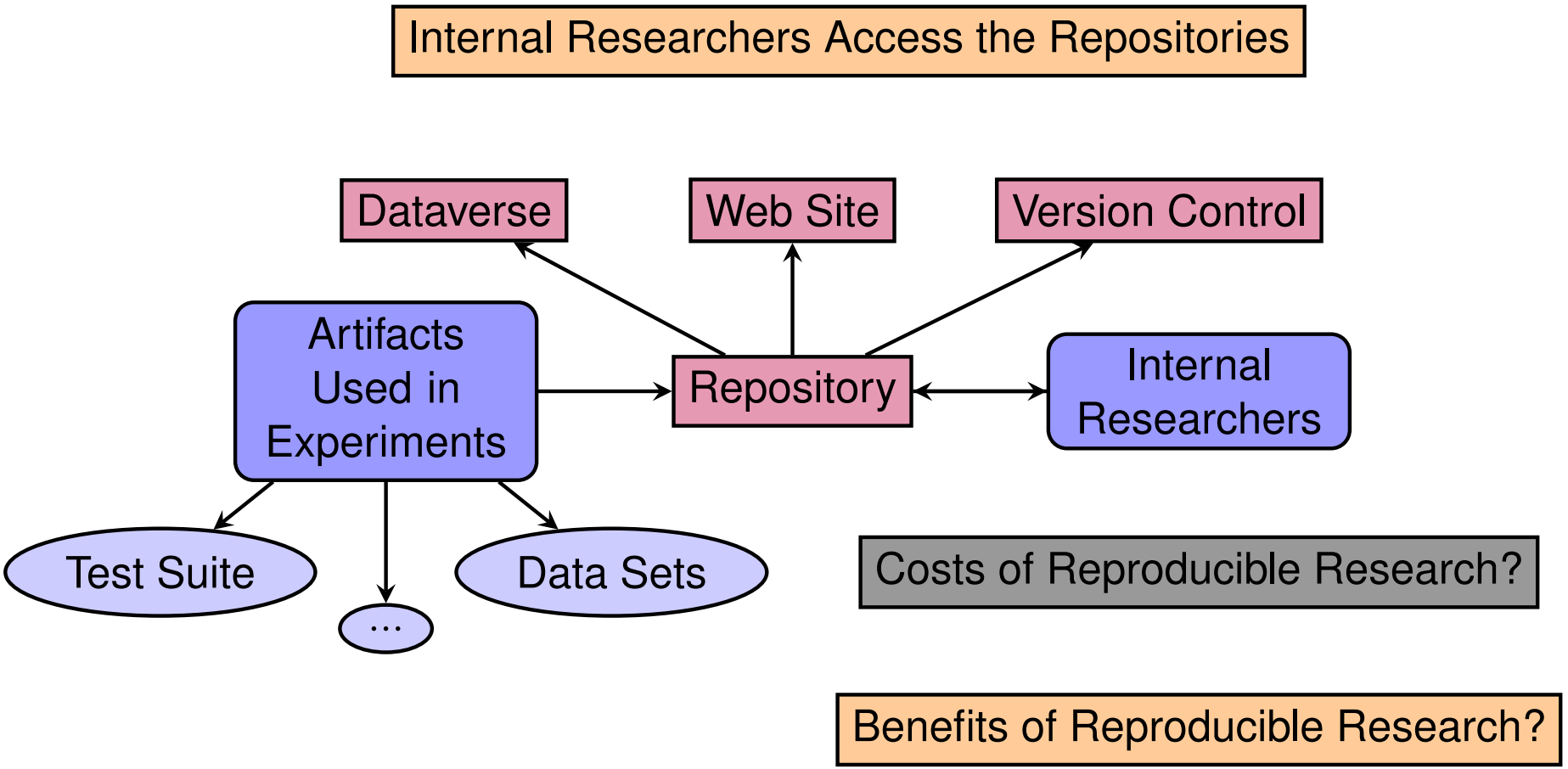

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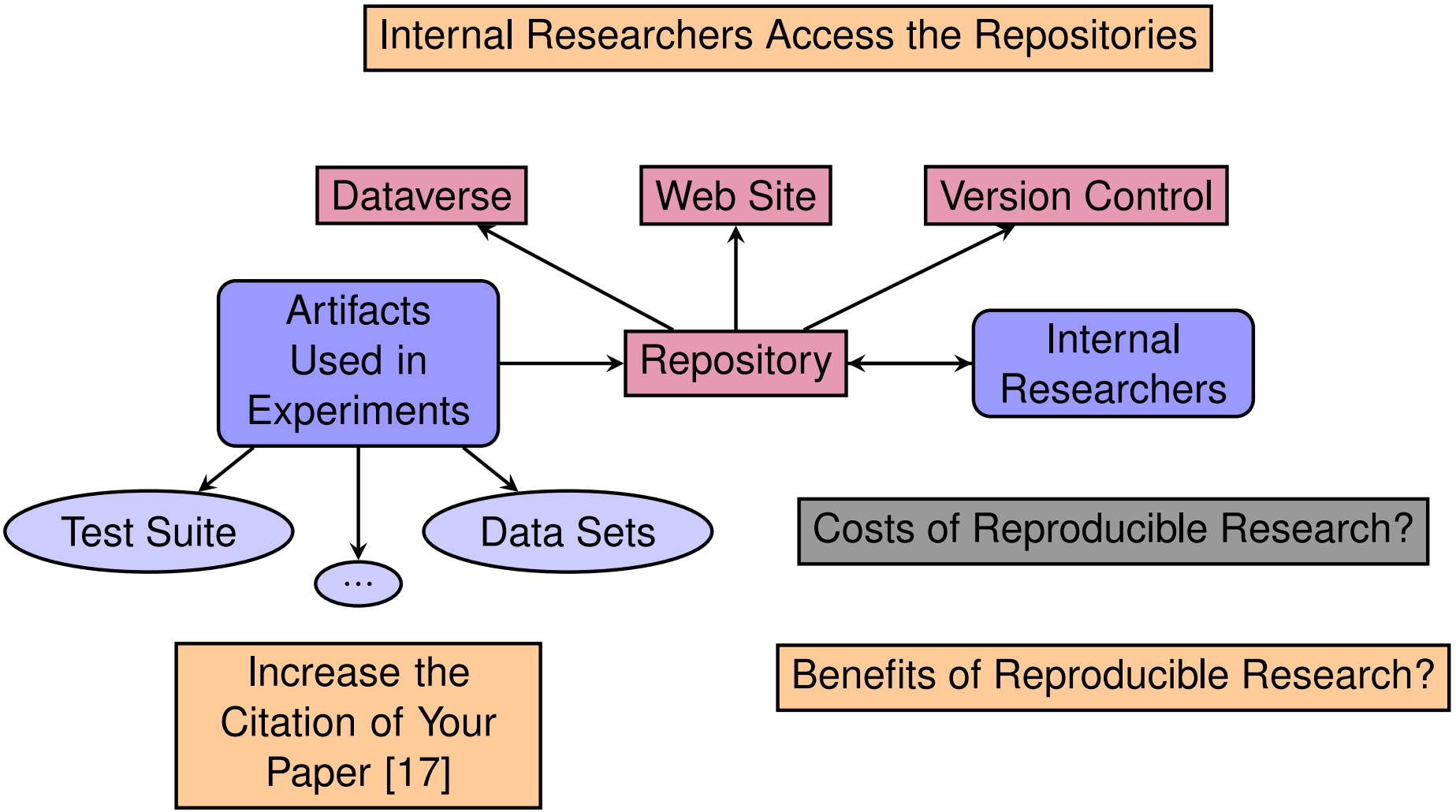

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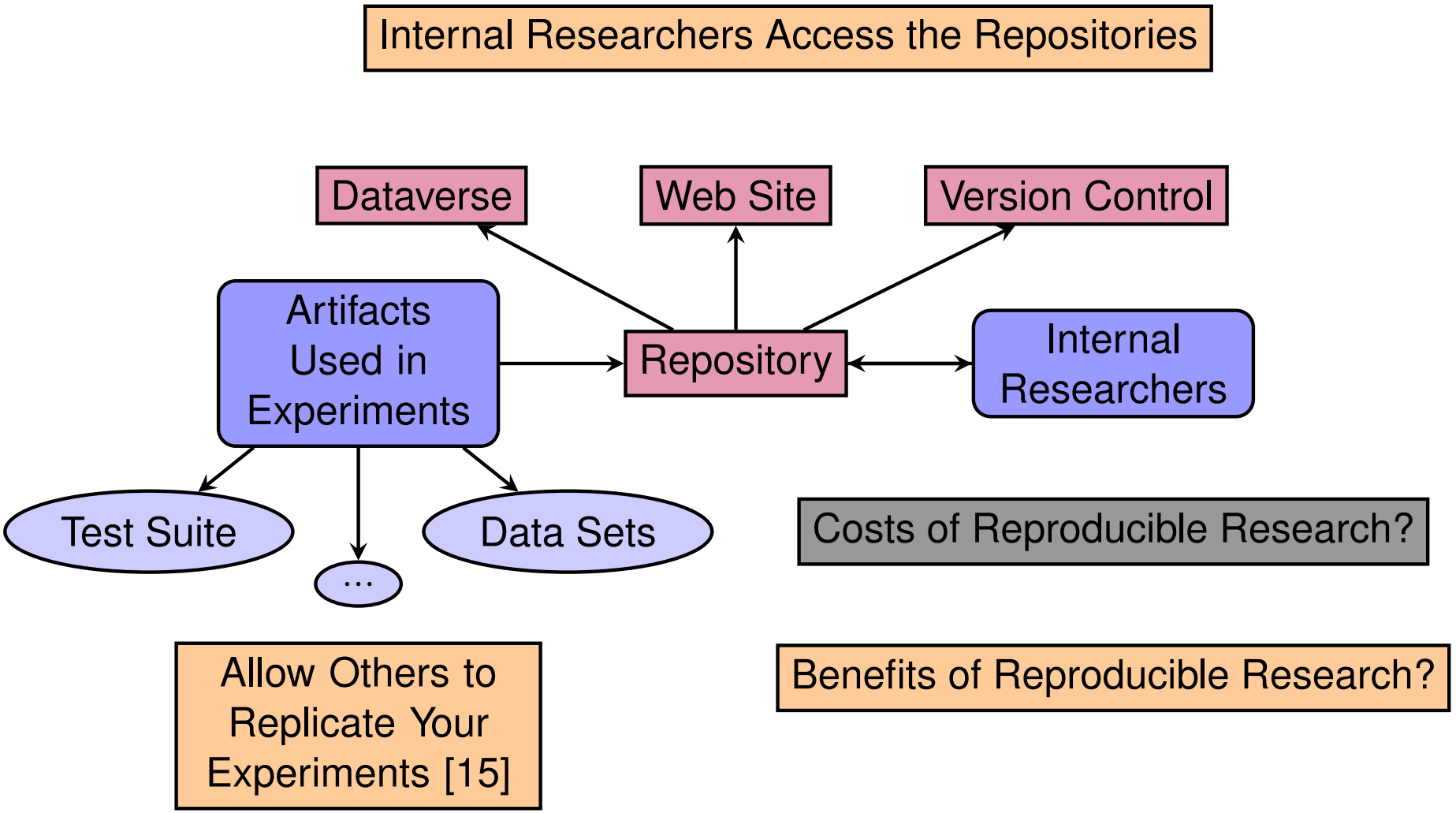

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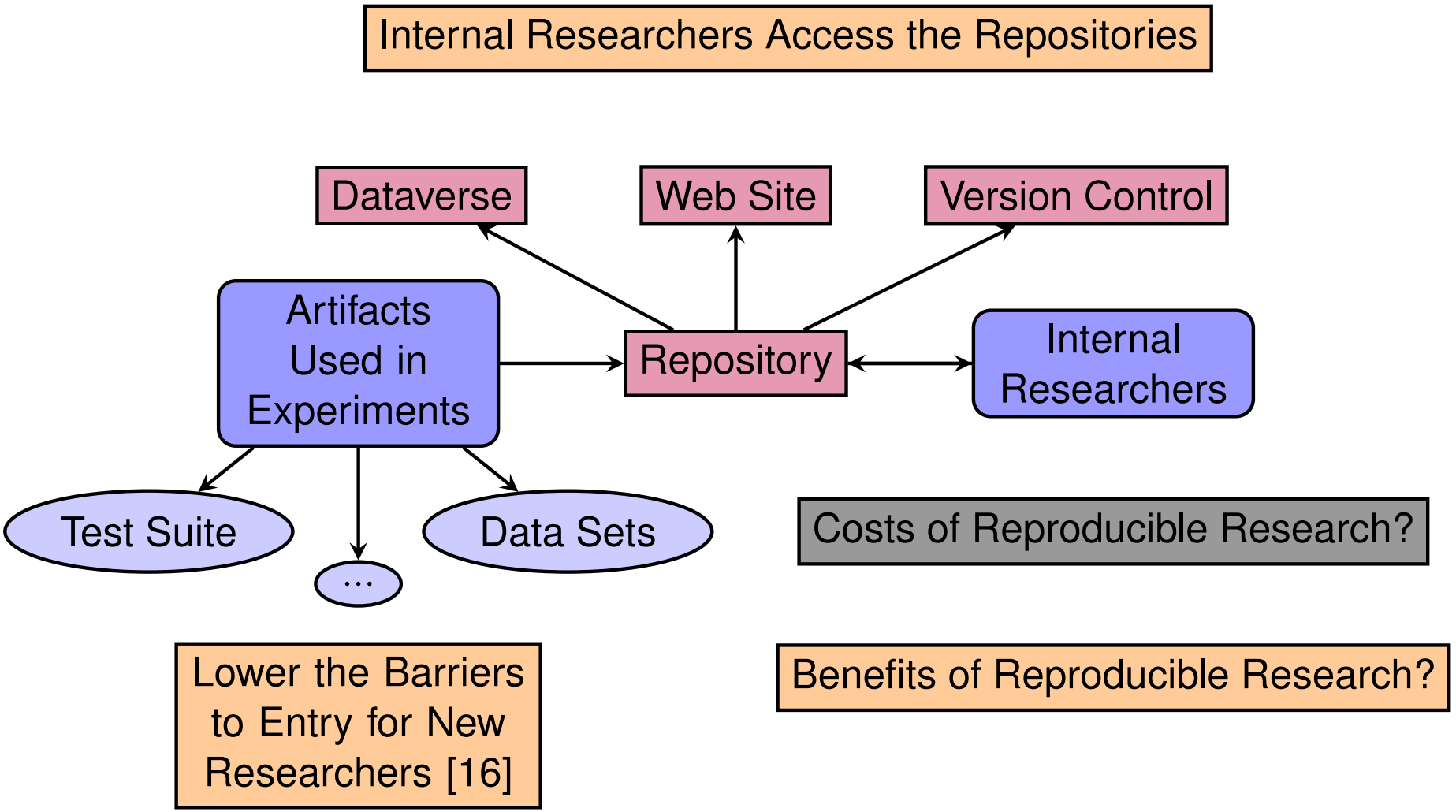

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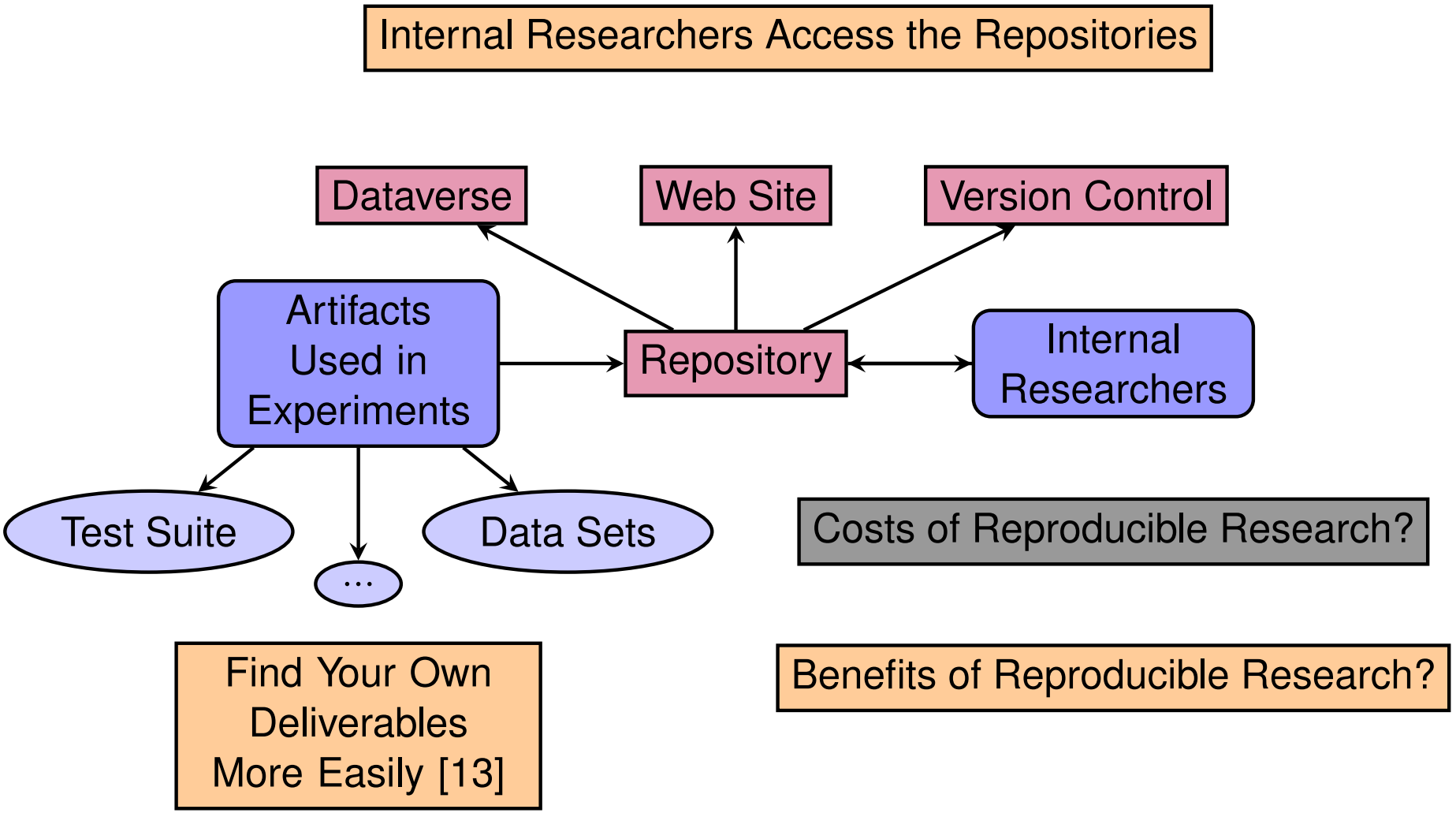

# Practical Suggestions: Pick Tools Carefully

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Use the R Language for Statistical Computation When:

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- Data Mining

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Simple Shell or Full-Featured IDEs

Use the R Language for Statistical Computation When:

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- Visualizing Data
- Data Mining

# Practical Suggestions: Pick Tools Carefully

Simple Shell or Full-Featured IDEs

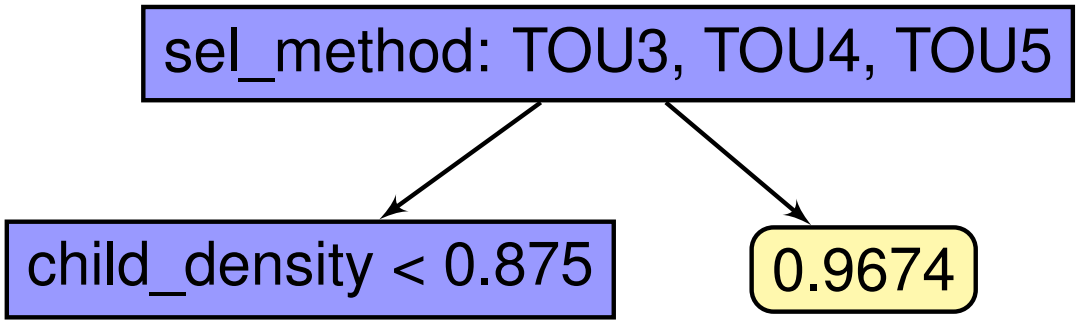
Use the R Language for Statistical Computation When:

- Conducting Experiments
- Visualizing Data
- Data Mining

Advanced Data Analysis Methods

# Practical Suggestions: Use Tree Models

**RM**



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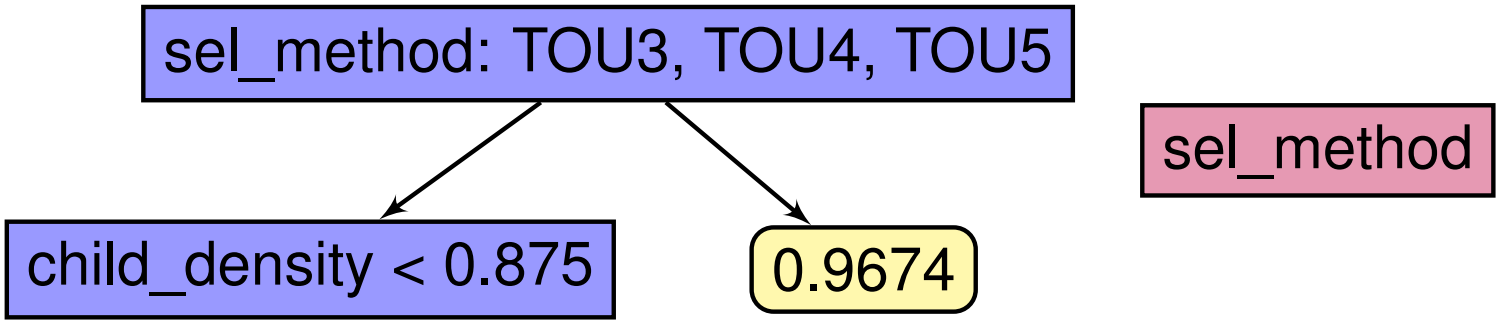

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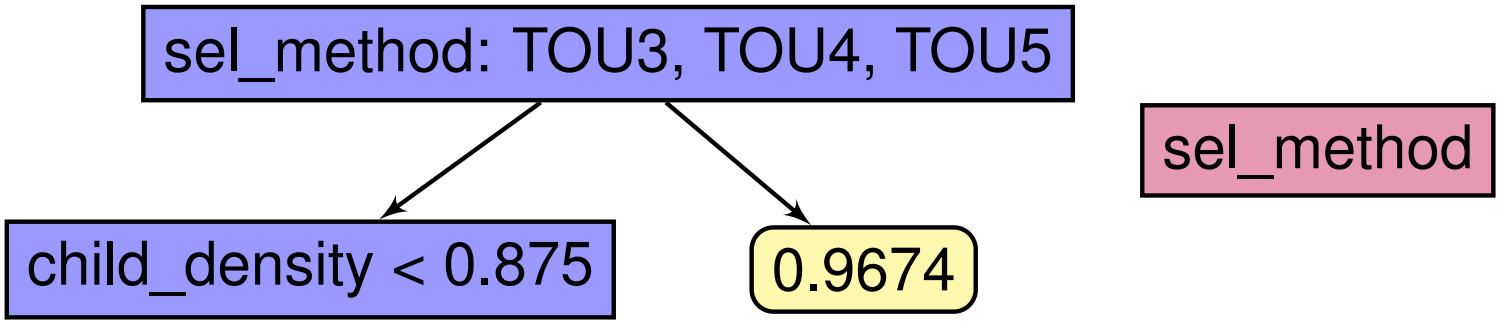


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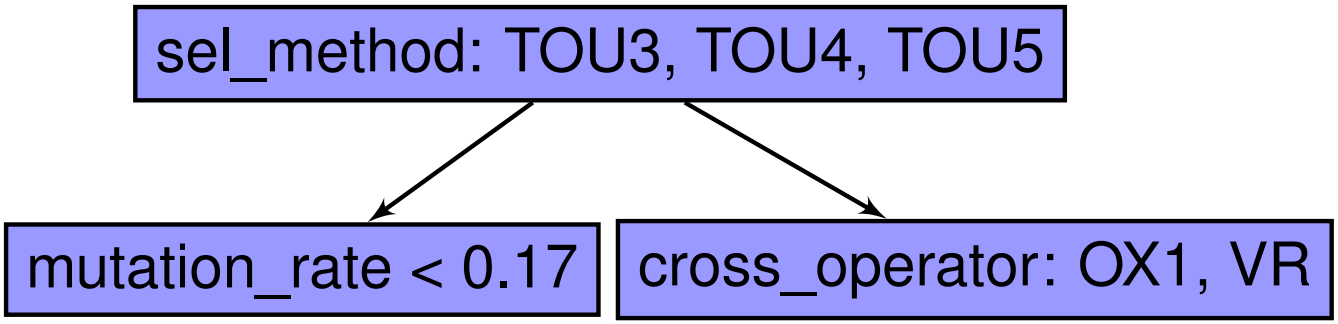

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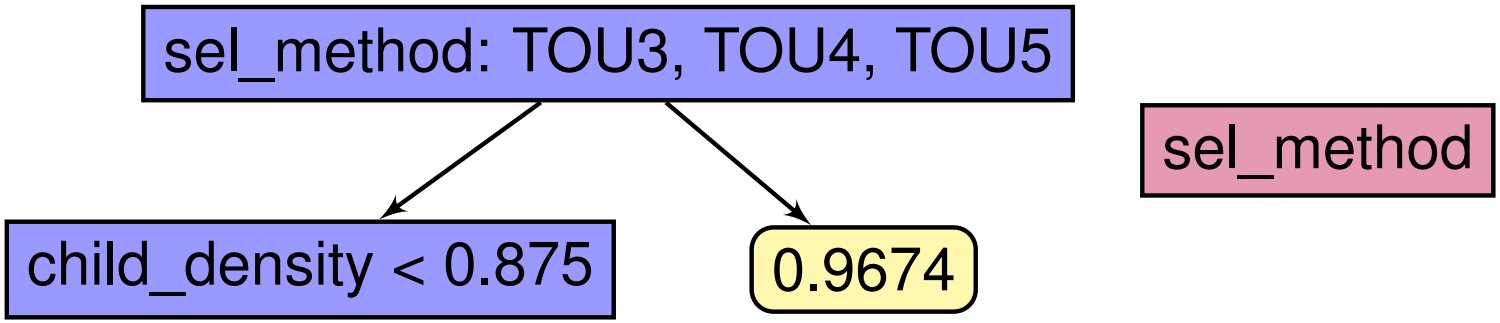


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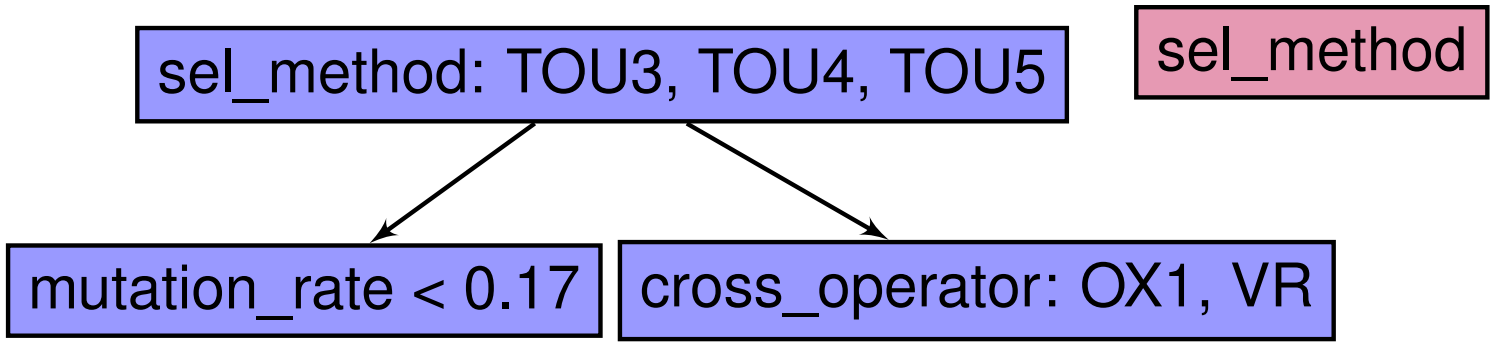

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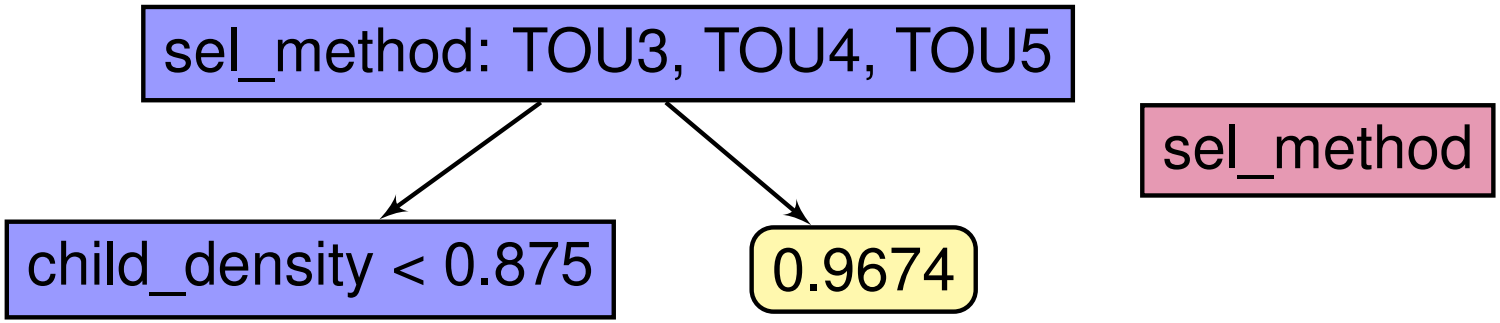


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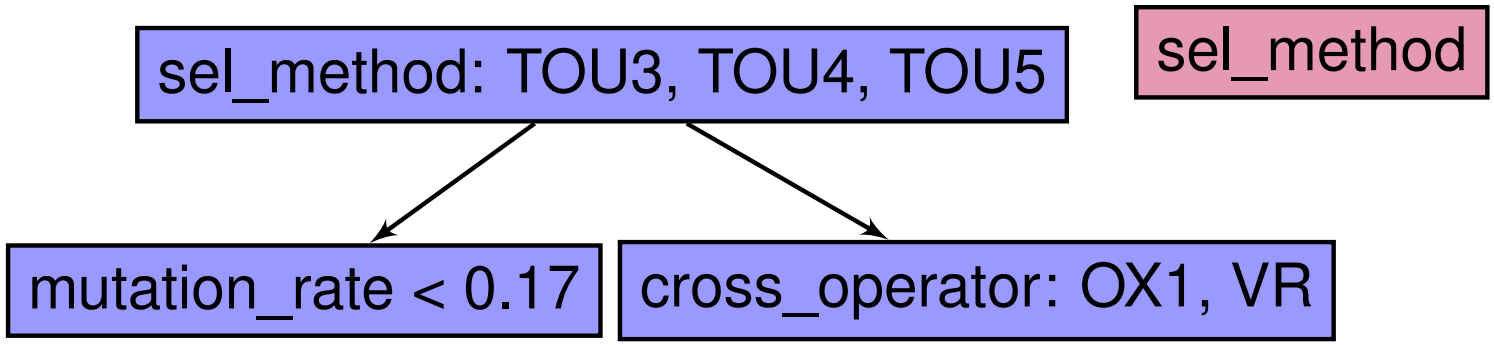


The sel_method variable is always the most important parameter

# Practical Suggestions: Use Tree Models

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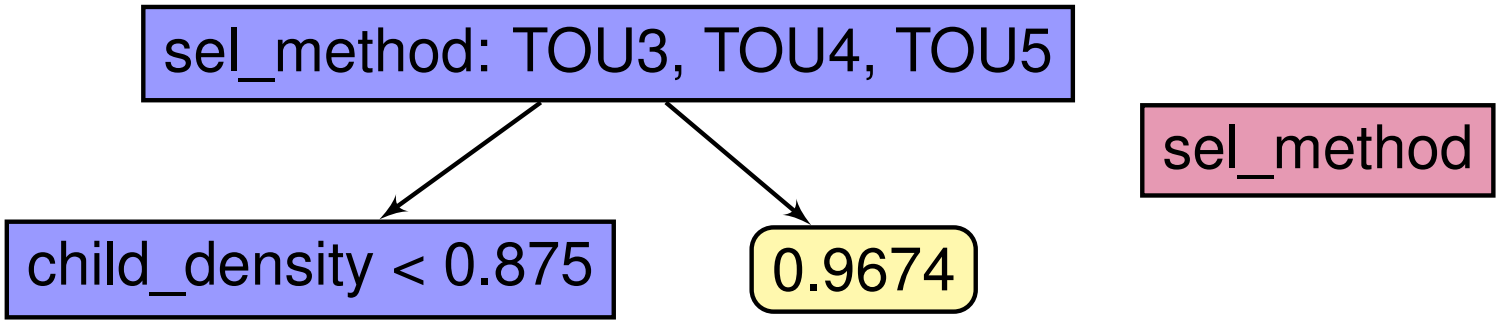


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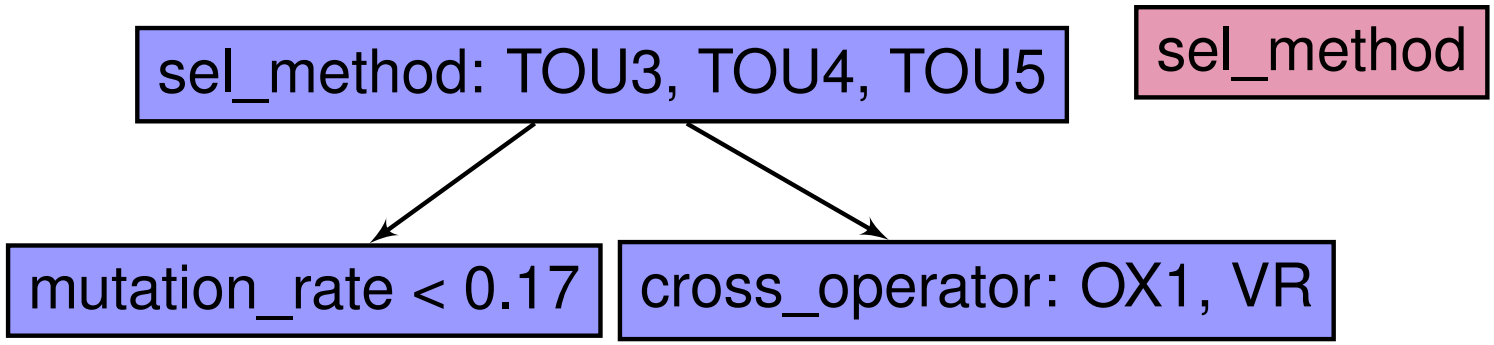


Importance of sel_method holds for all case study applications

# Practical Suggestions: Use Tree Models

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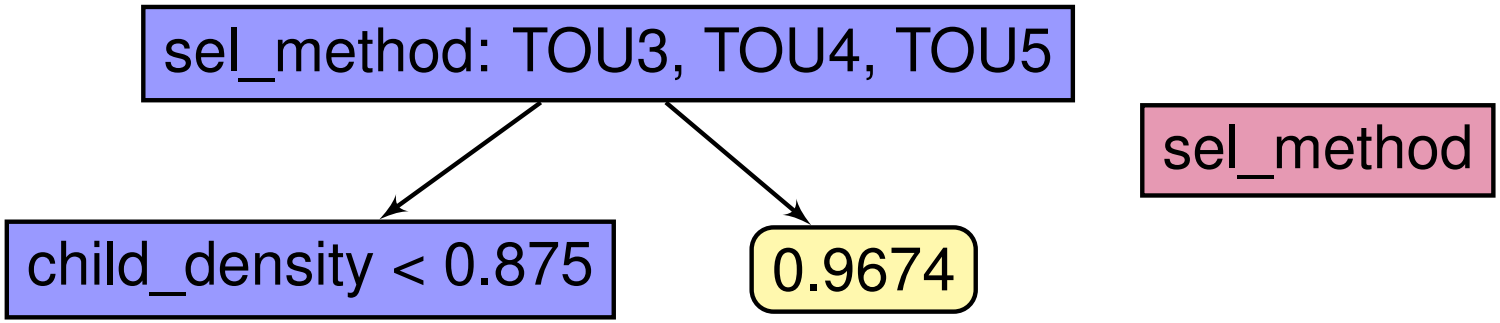


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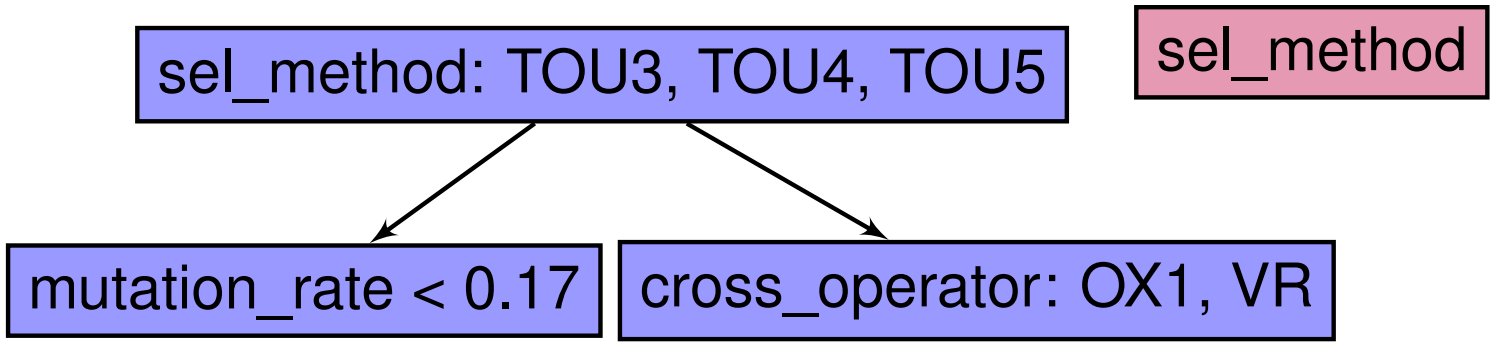


How does the selection method impact efficiency and effectiveness?

# Practical Suggestions: Use Tree Models

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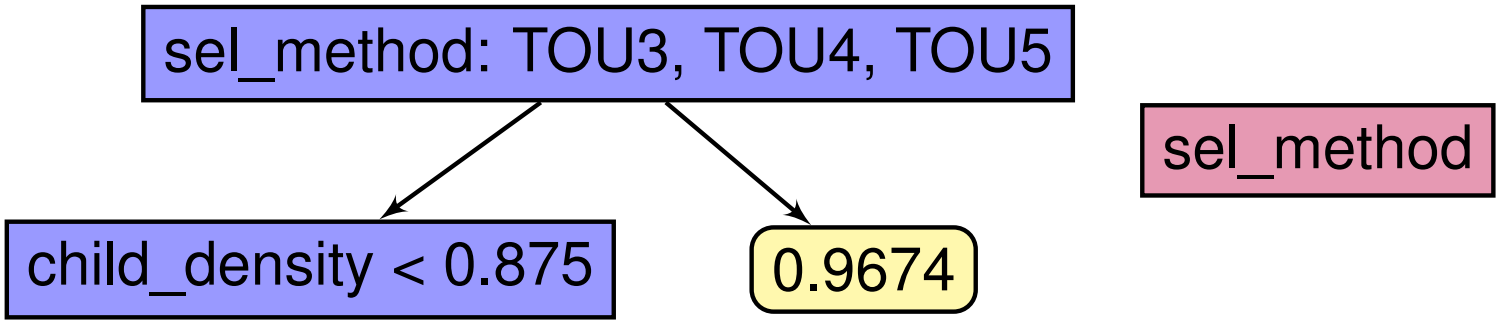


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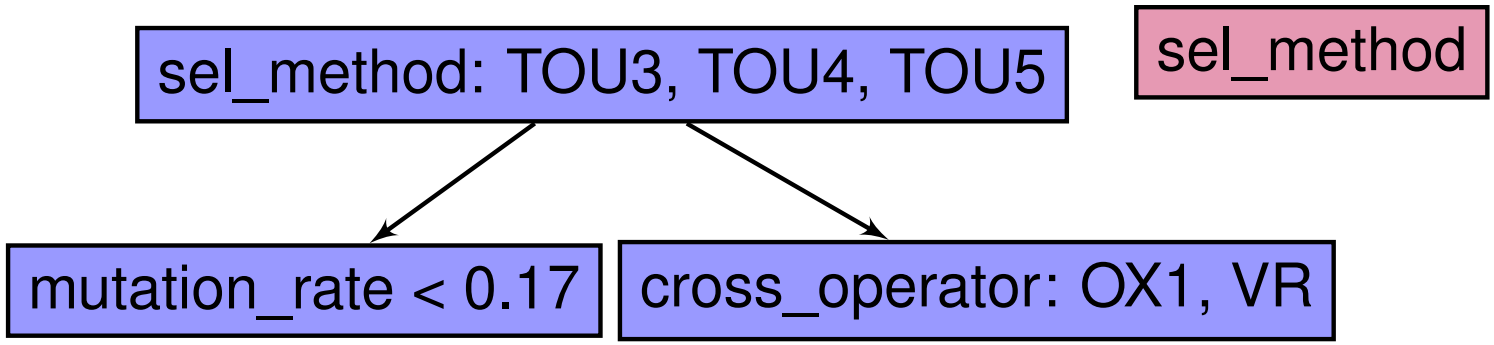
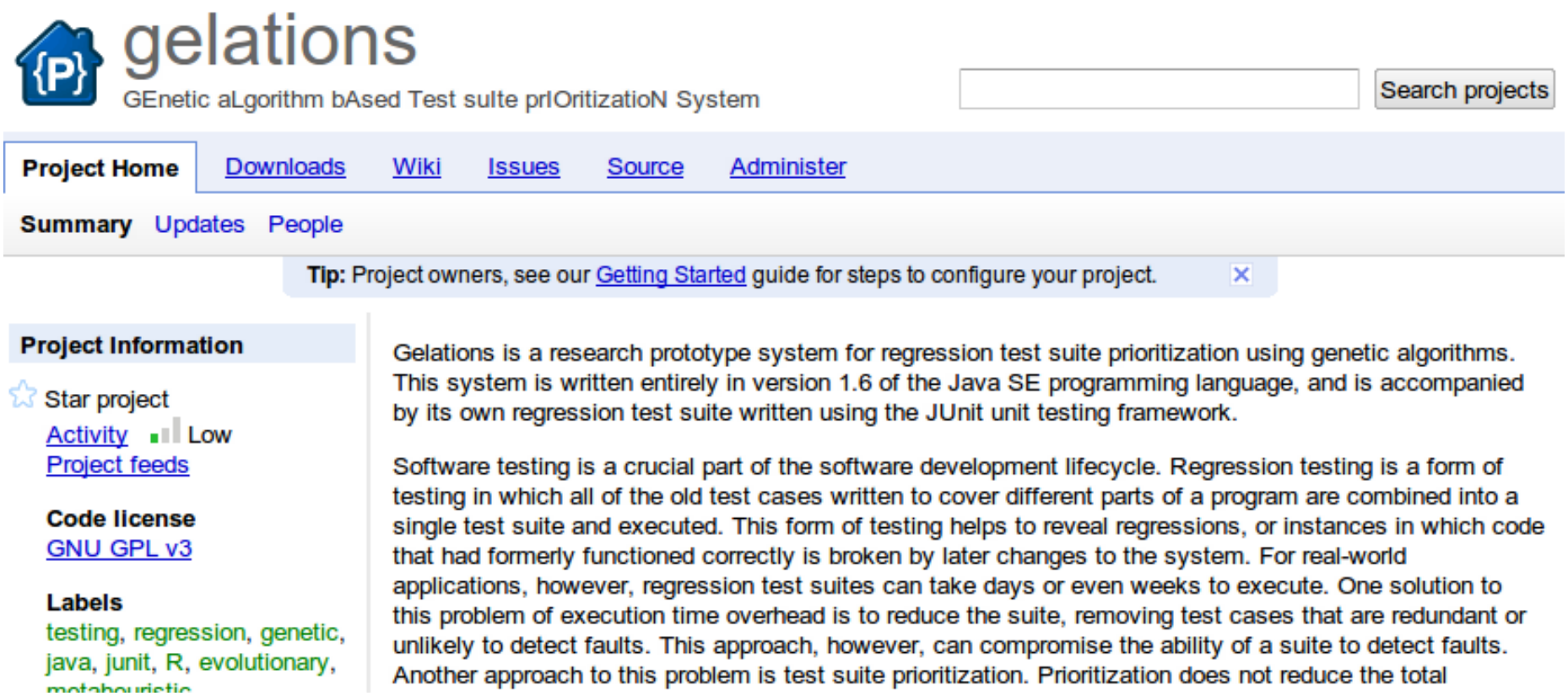



For More Details, Please See Conrad et al. [22]

# Practical Suggestions: Use Open Source



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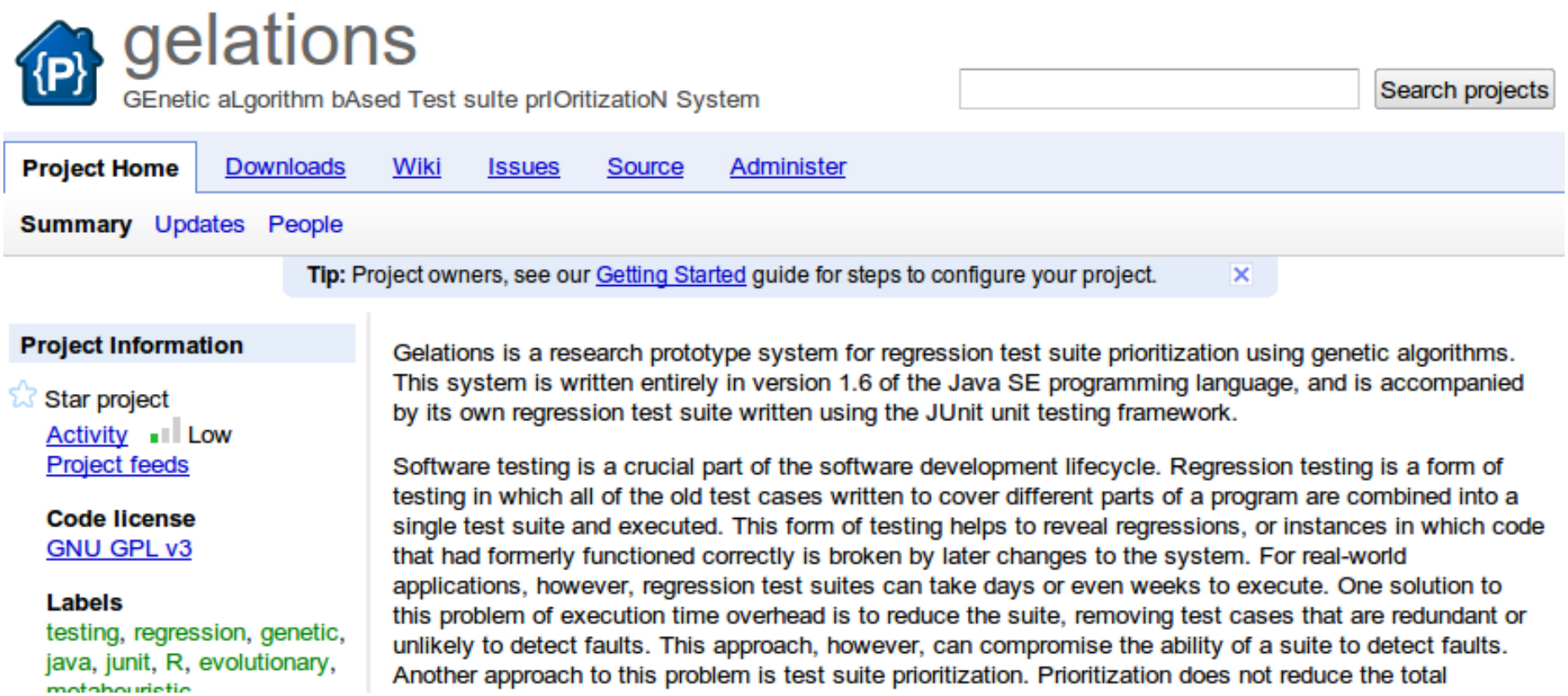


Gelations is a Genetic Algorithm-Based Test Suite Prioritizer

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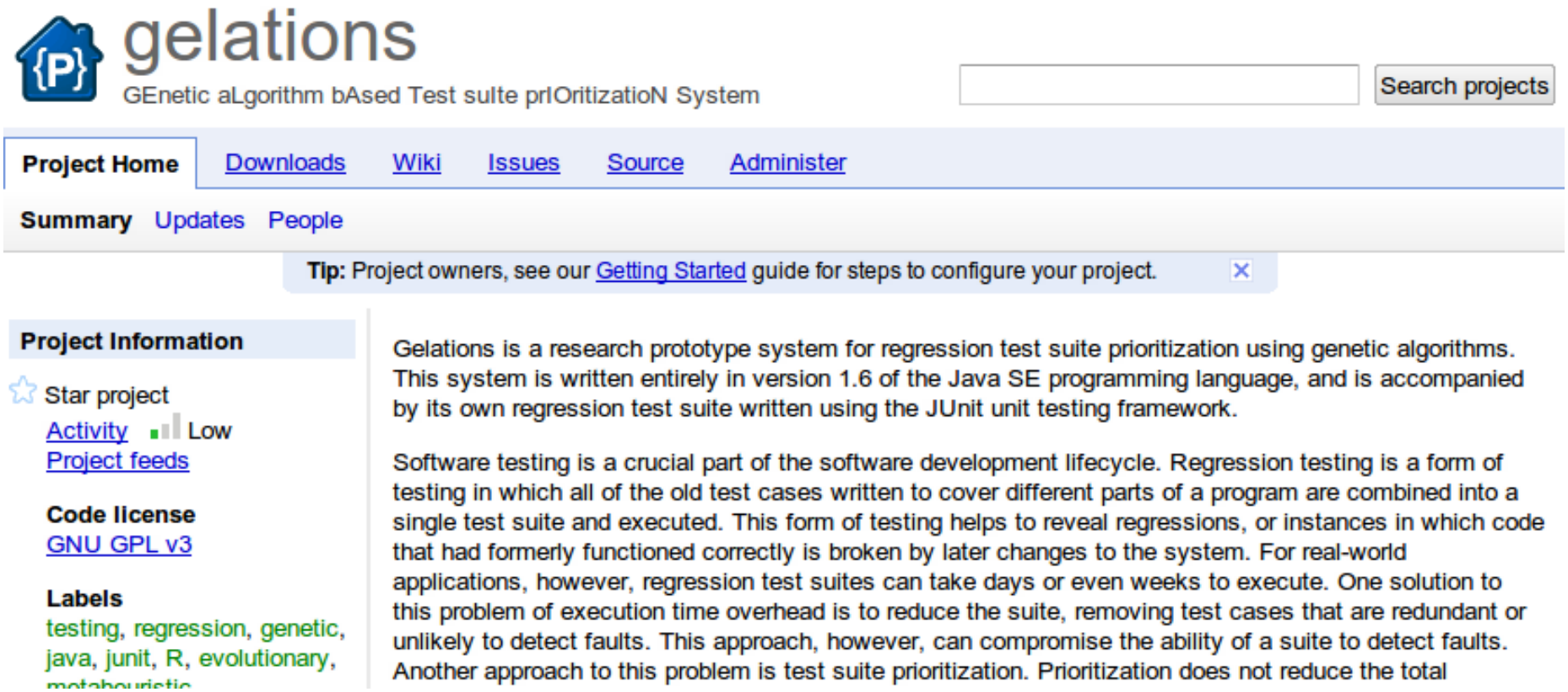
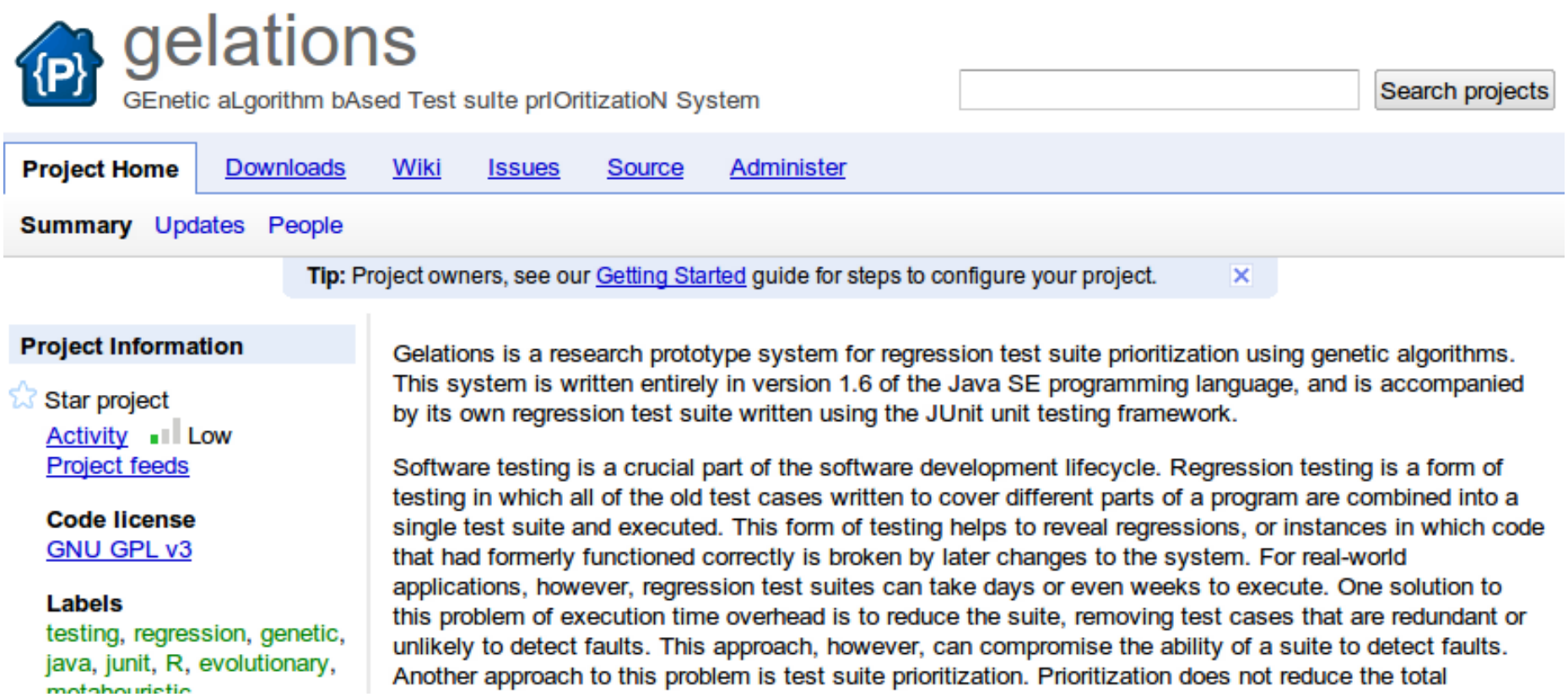



Visit `http://gelations.googlecode.com/` for More Details

# Practical Suggestions: Use Open Source




Visit `http://raise.googlecode.com/` for Greedy Algorithms

# Conclusions and Future Work

The Potential Way Forward May Seem *Daunting*

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Richard Hamming

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Share *One* Item With Your Next Paper

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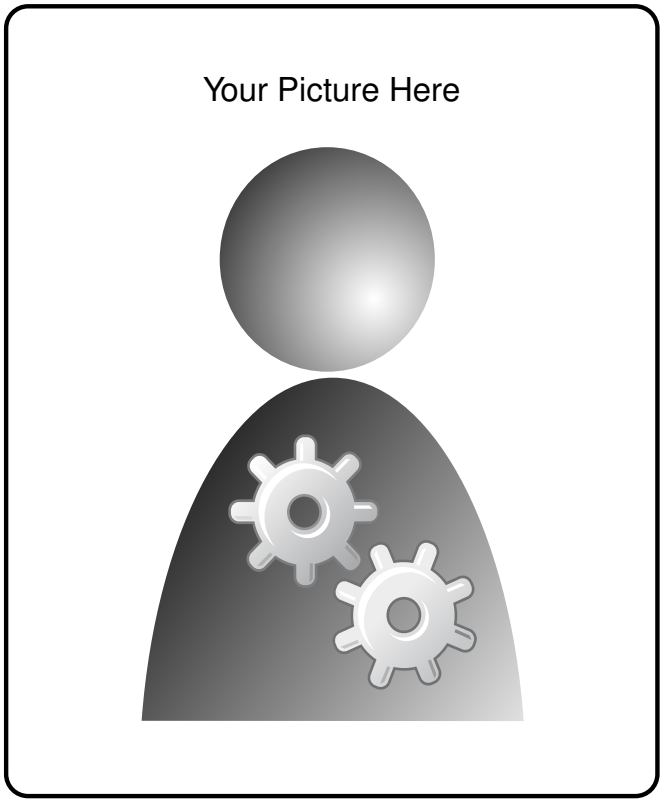


Leader of the Regression Testing Community

Your Help is Welcomed and Appreciated!

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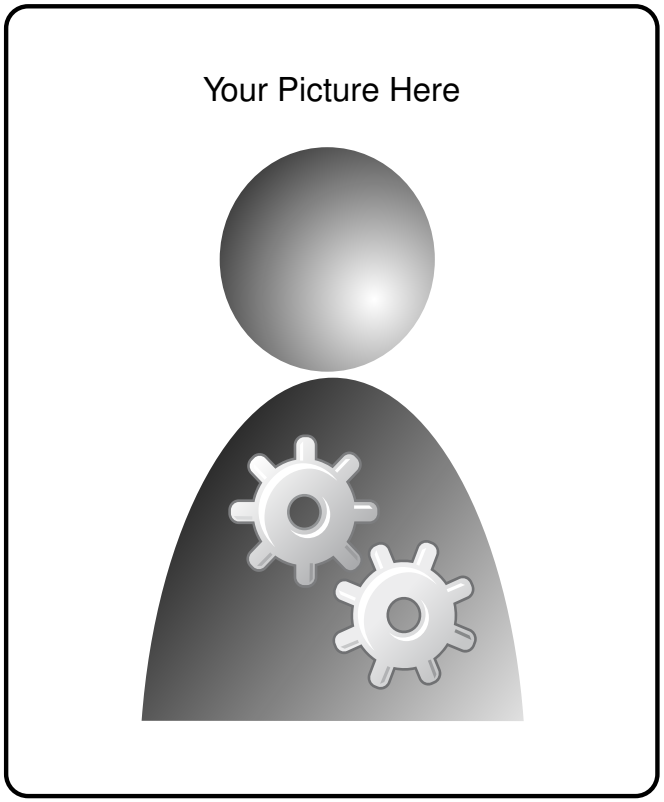


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Read the Paper and Contact Me with Comments

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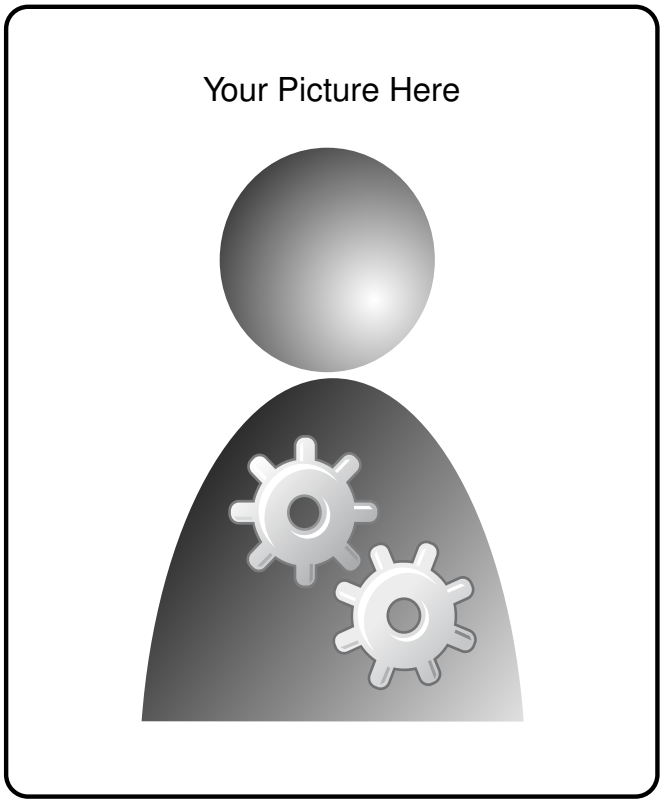


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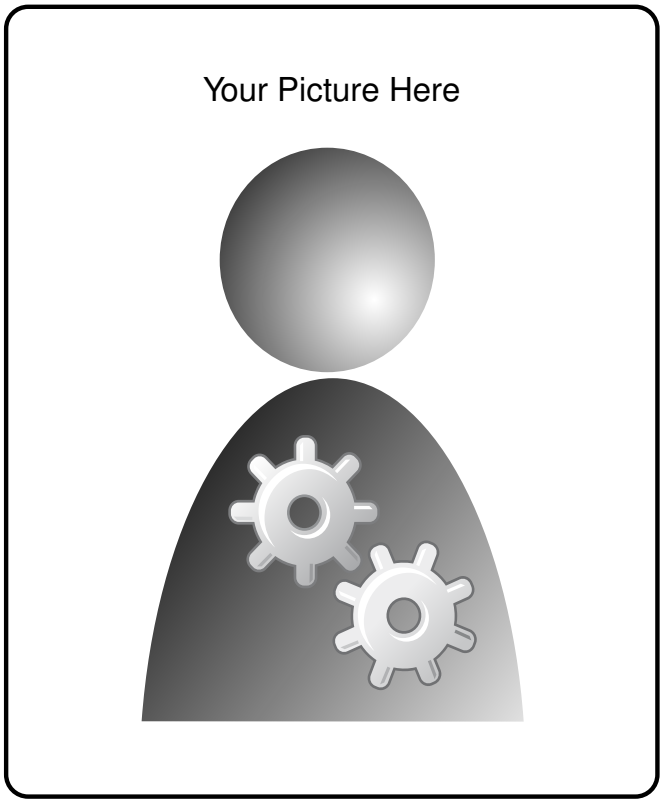
**Future Work**:
Complete Case Study of Reproducible Research in Regression Testing

- ✓ Data Sets
- ✓ Tools
- ✓ Visualizations

# Conclusions and Future Work

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**Acknowledgments**:

- ✓ Neil Elliott
- ✓ Jonathan Kauffman
- ✓ Molly Mattis
- ✓ Zachary Williams

provided feedback on drafts of the paper