Automatic Performance Optimization with PerfExpert

Leo Fialho, Ashay Rane and Jim Browne

Agenda

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Introduction

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Steps for Performance Optimization

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- Metrics definition and performance measurement

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- Analysis, diagnosis and identification of bottlenecks

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Challenges of Automatic Performance Optimization

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Challenges of Automatic Performance Optimization

- Programmers are really inventive

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- The execution environment is quite complex

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- Programmers are really inventive
- The execution environment is quite complex
- Compilers usually do only static source code analysis

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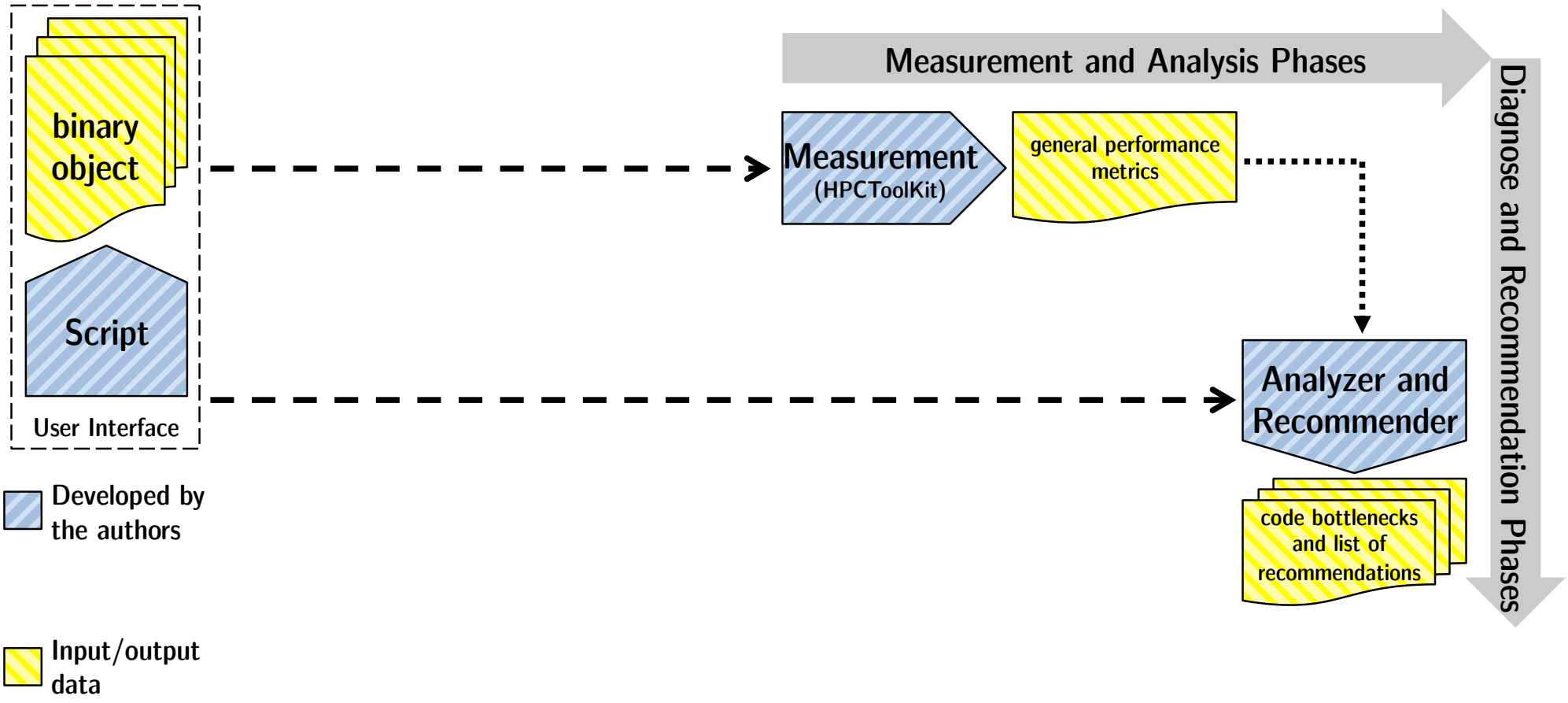
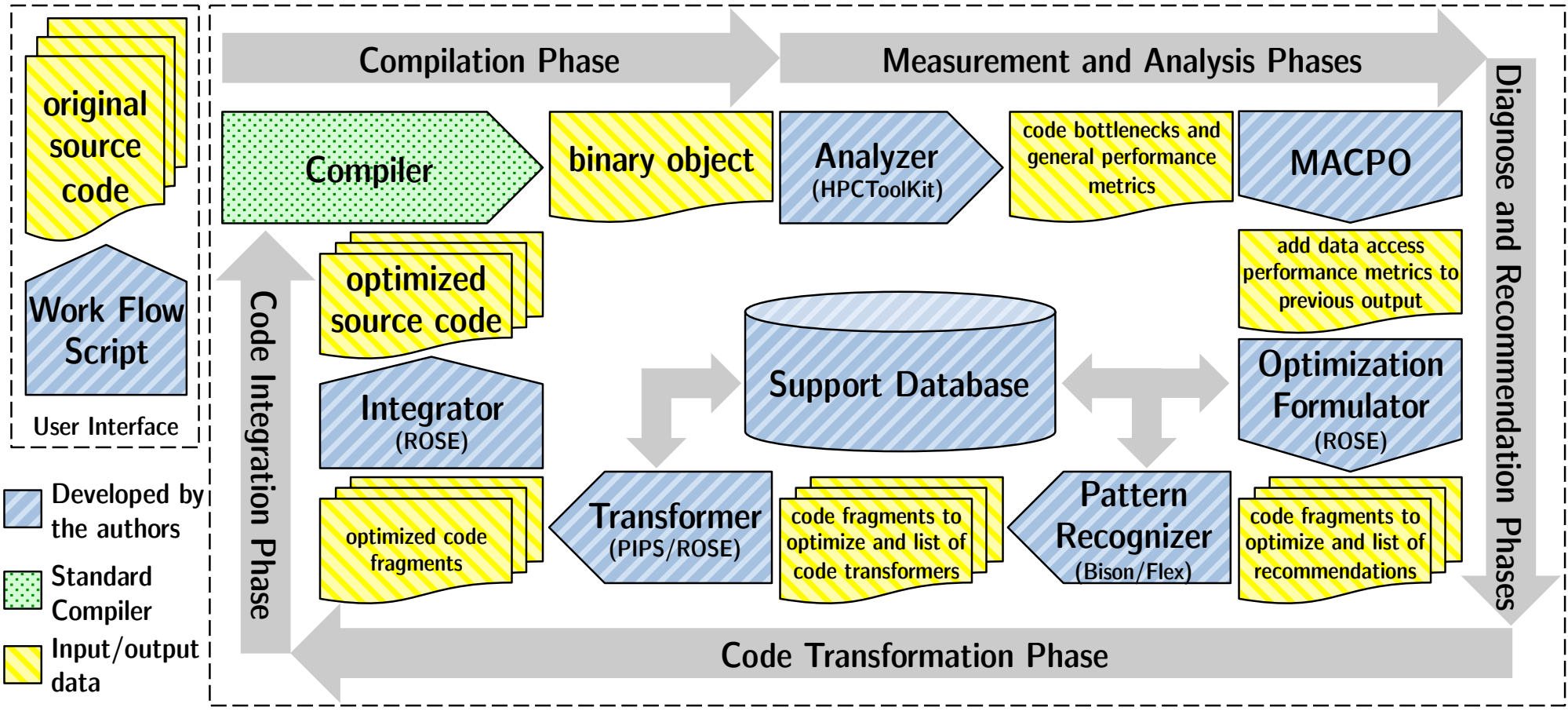
Current Version: The Big Picture



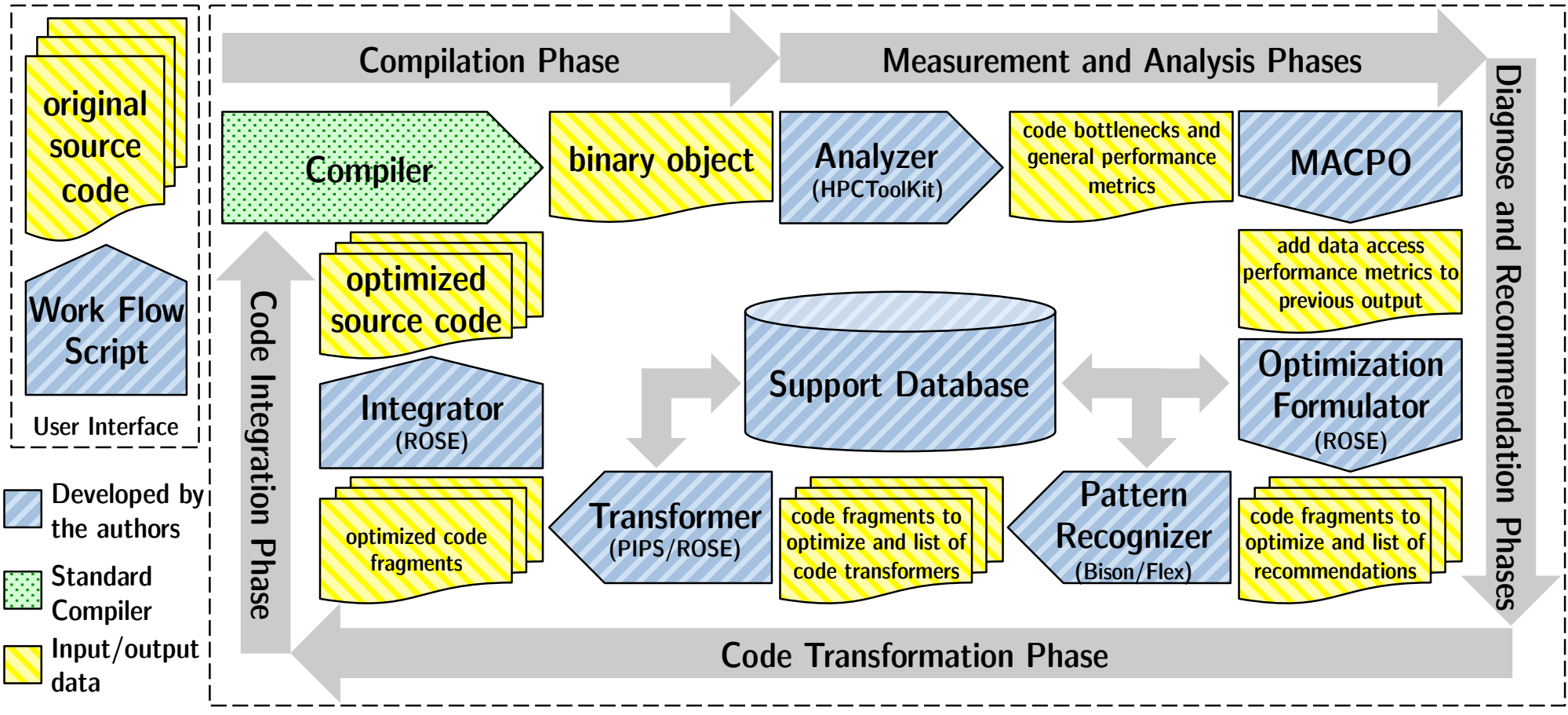
New Version: The Big Picture



New Version: Short Demo

Short demo

New Version: Work Flow Script



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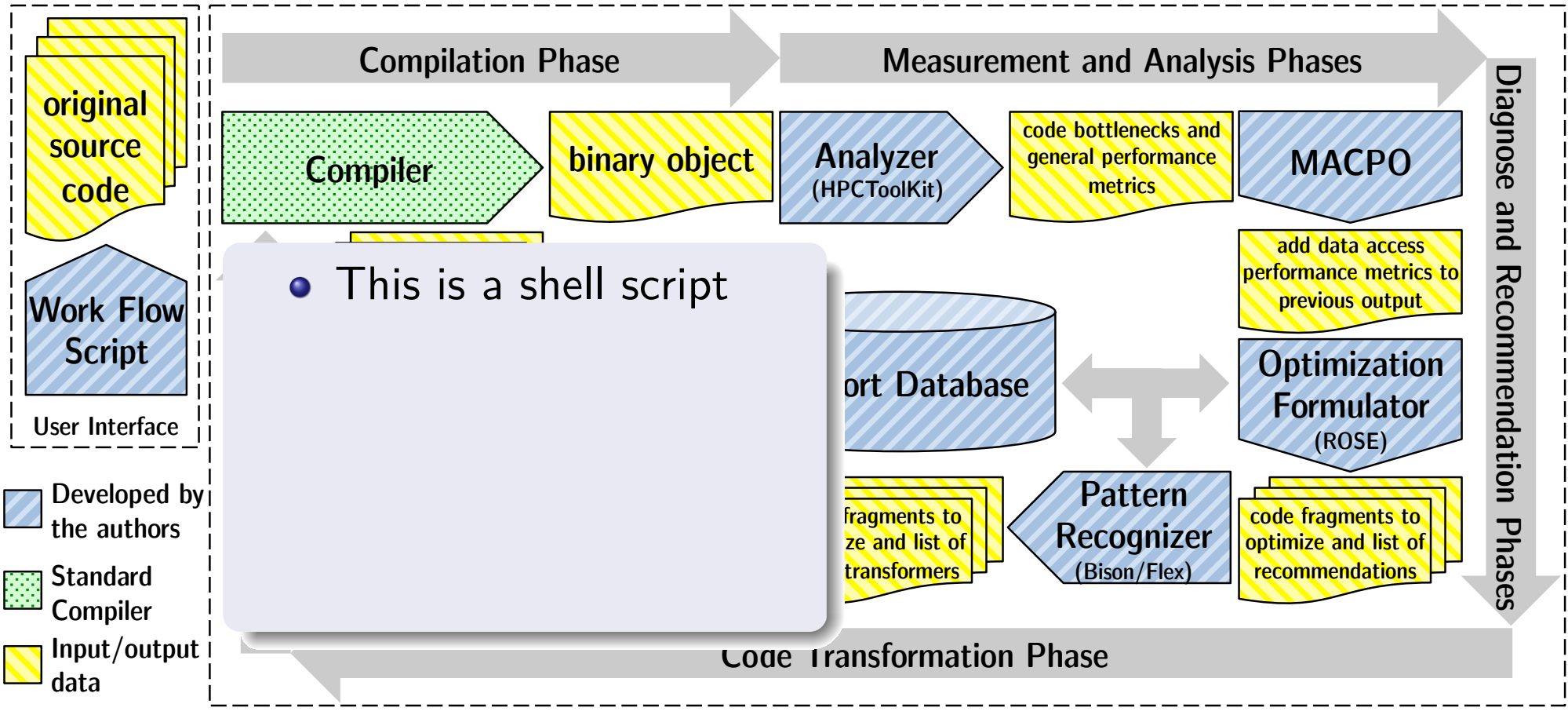

- This is a shell script

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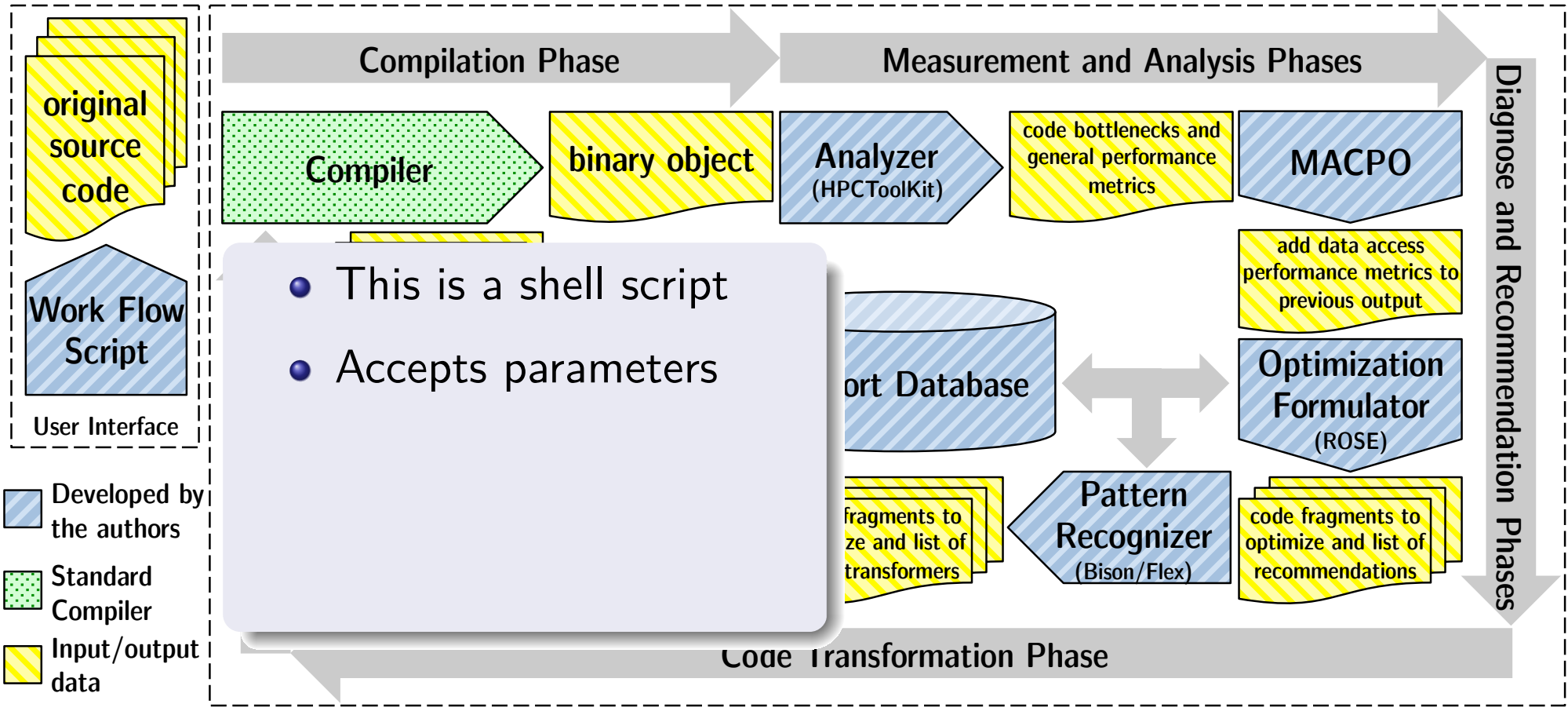

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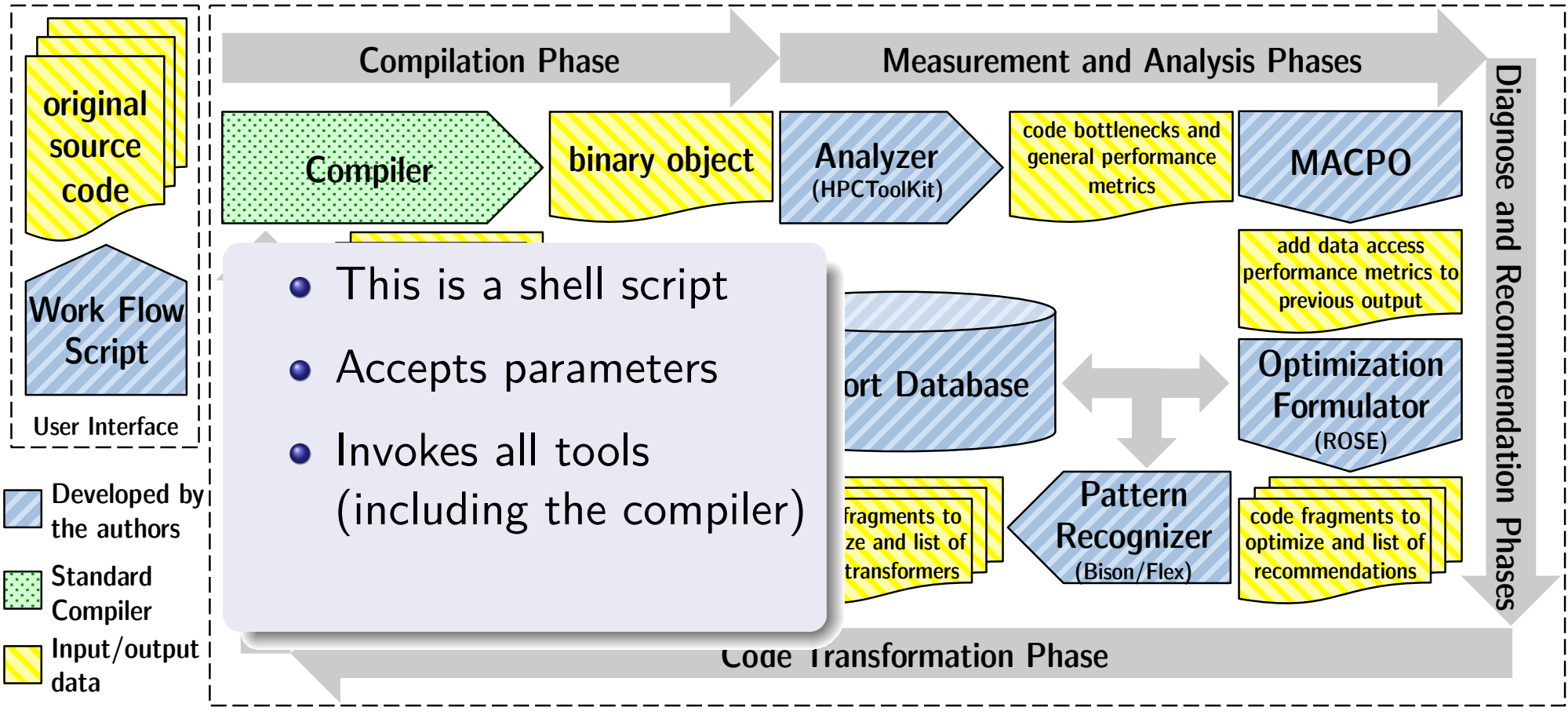

- This is a shell script
- Accepts parameters
- Invokes all tools (including the compiler)

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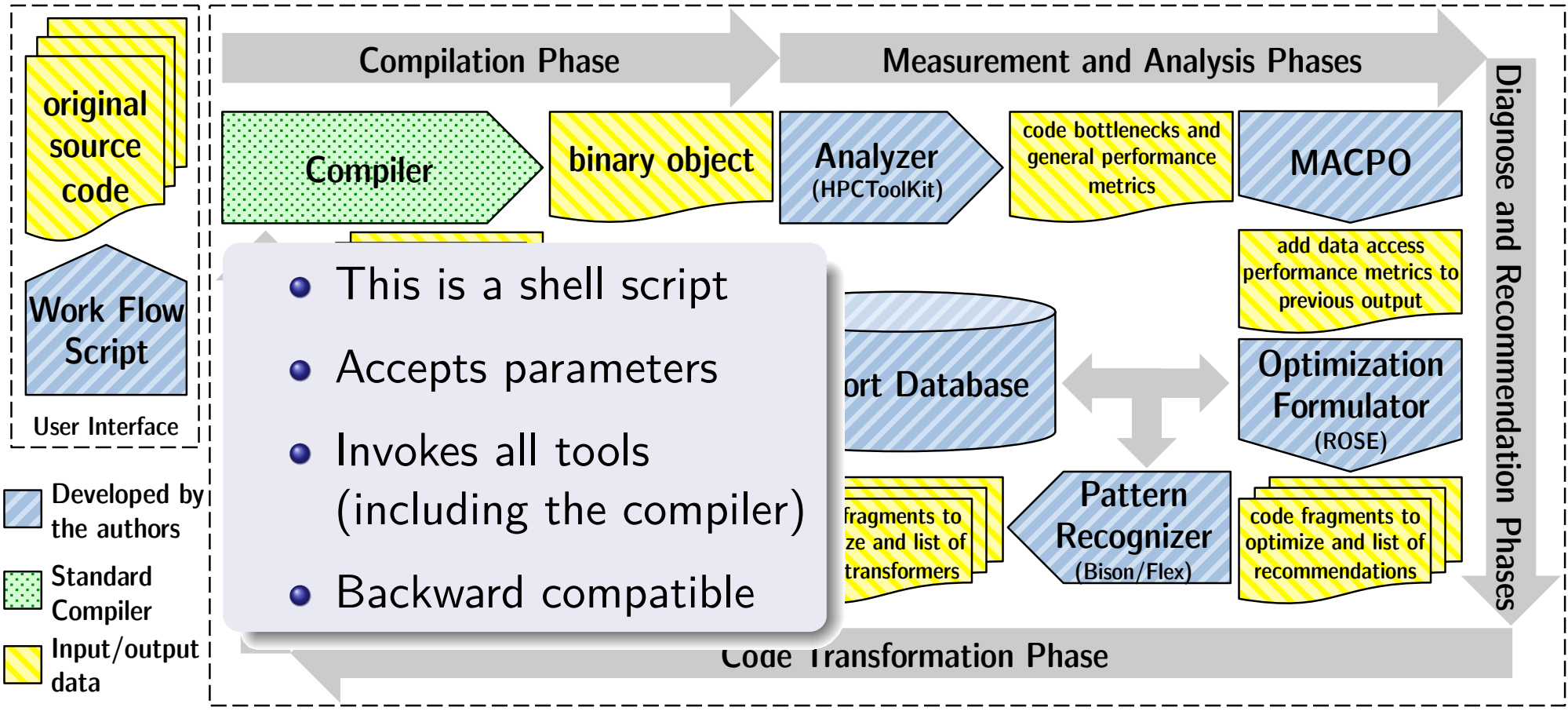
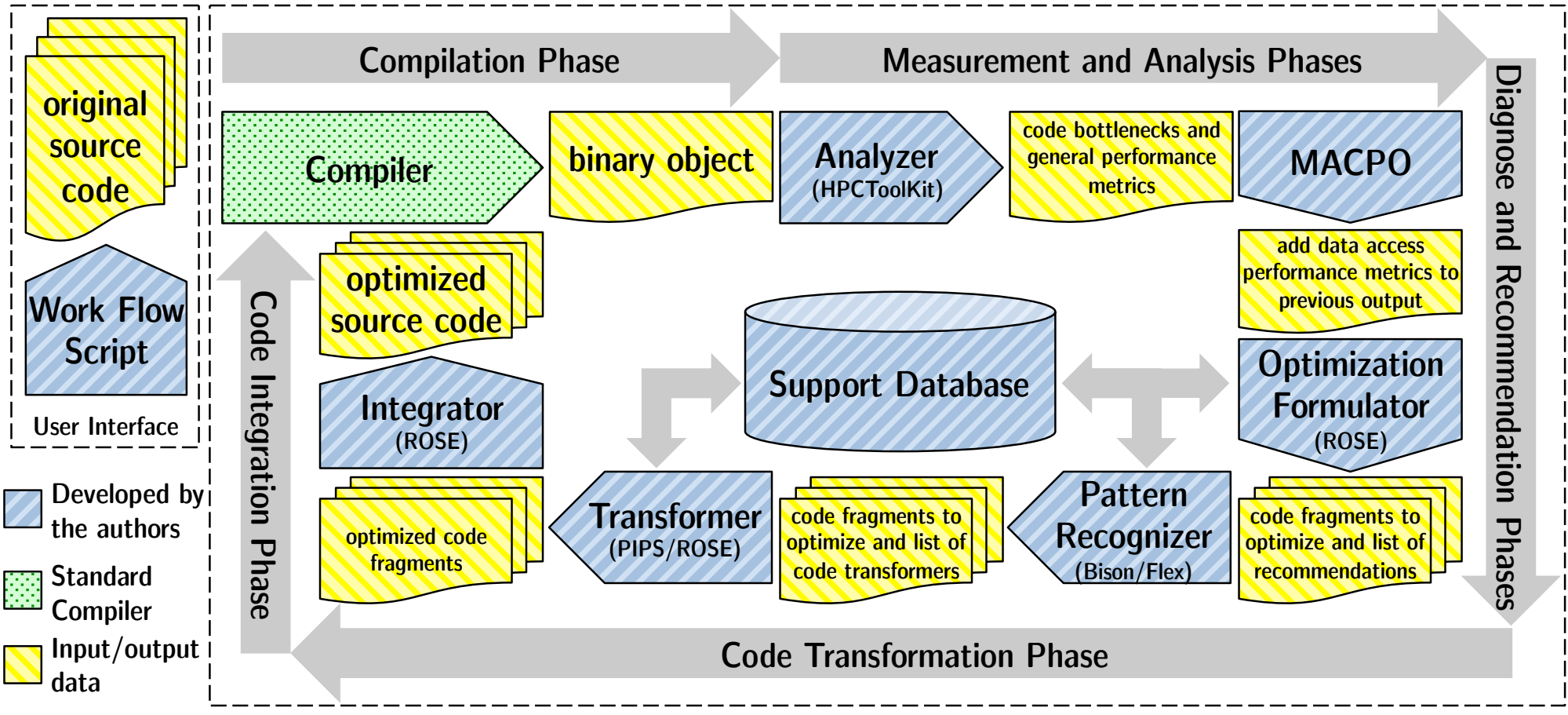


- This is a shell script
- Accepts parameters
- Invokes all tools (including the compiler)
- Backward compatible

New Version: Analyzer



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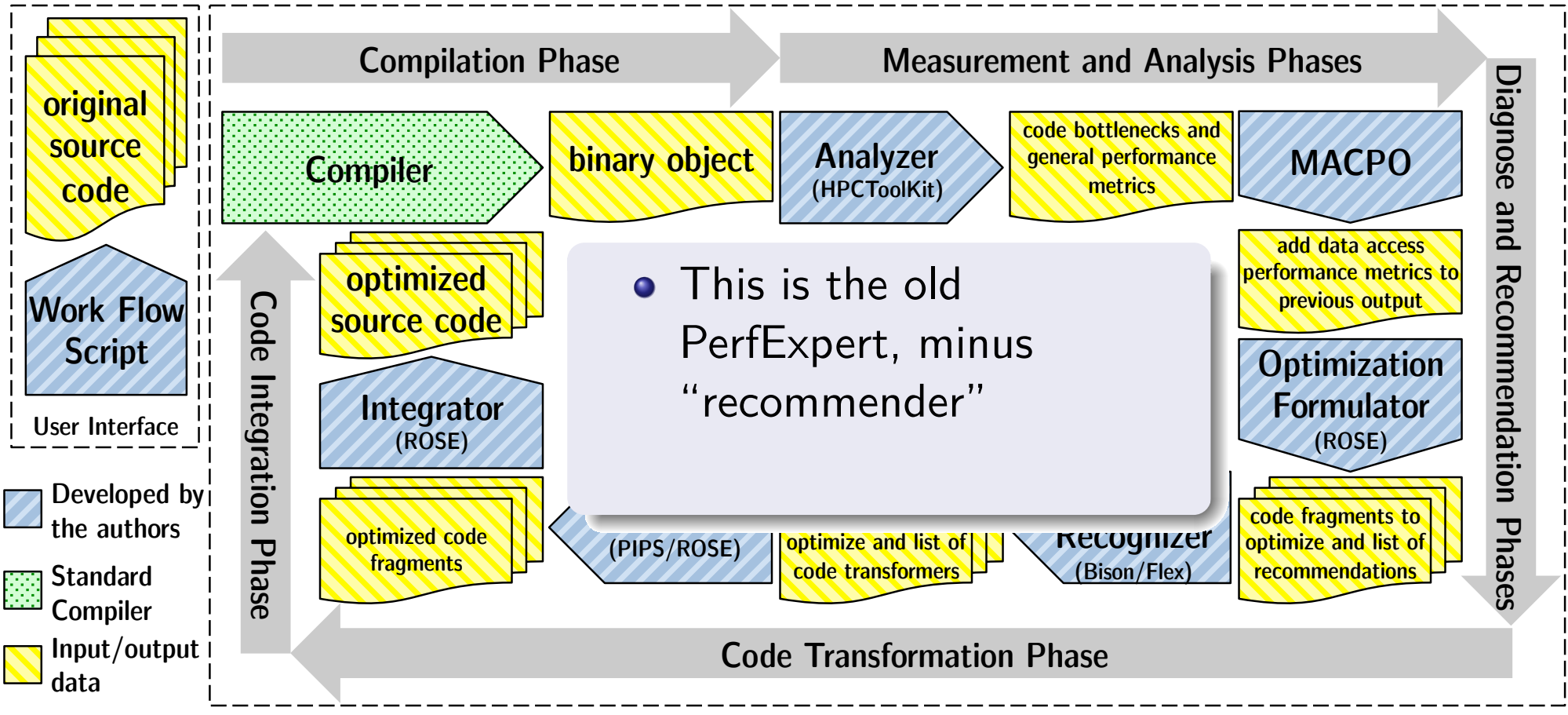

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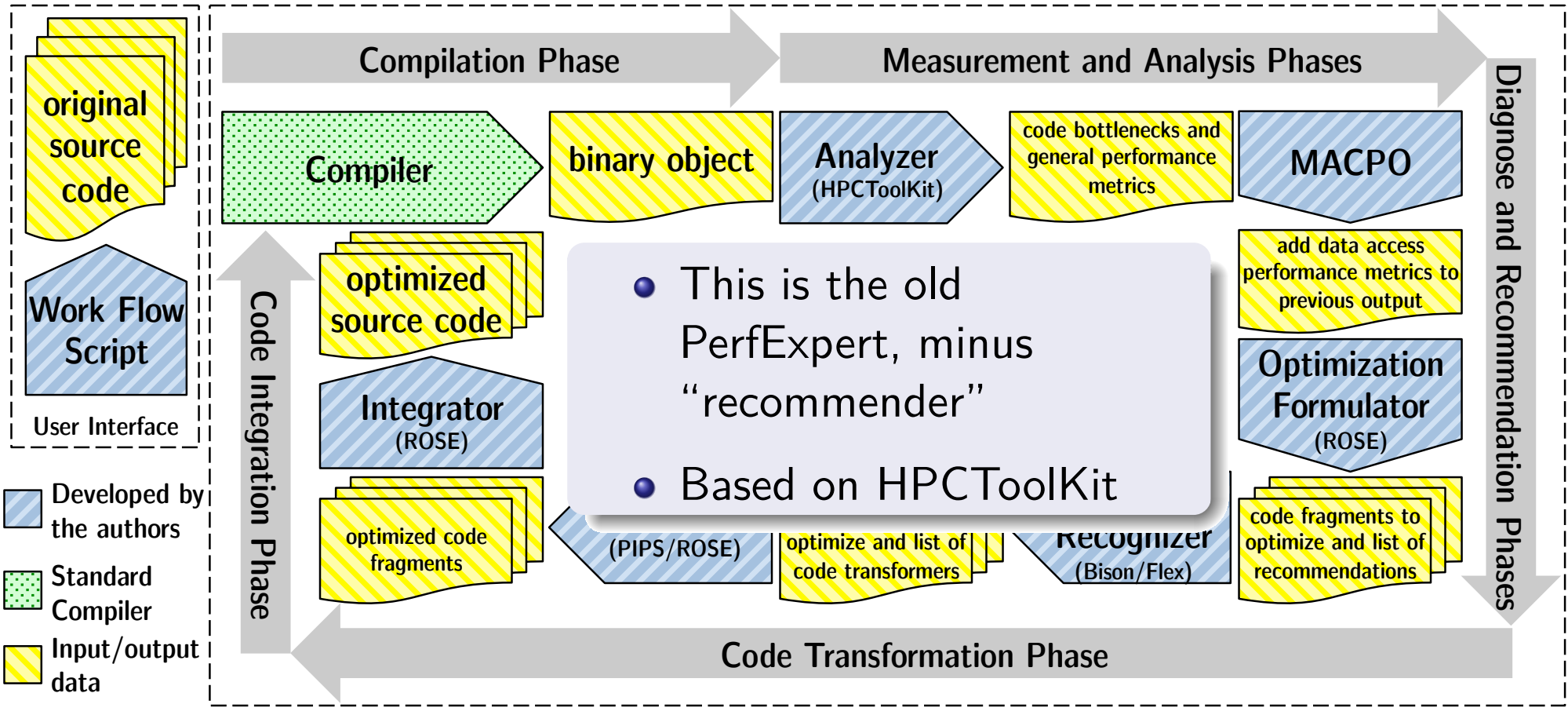
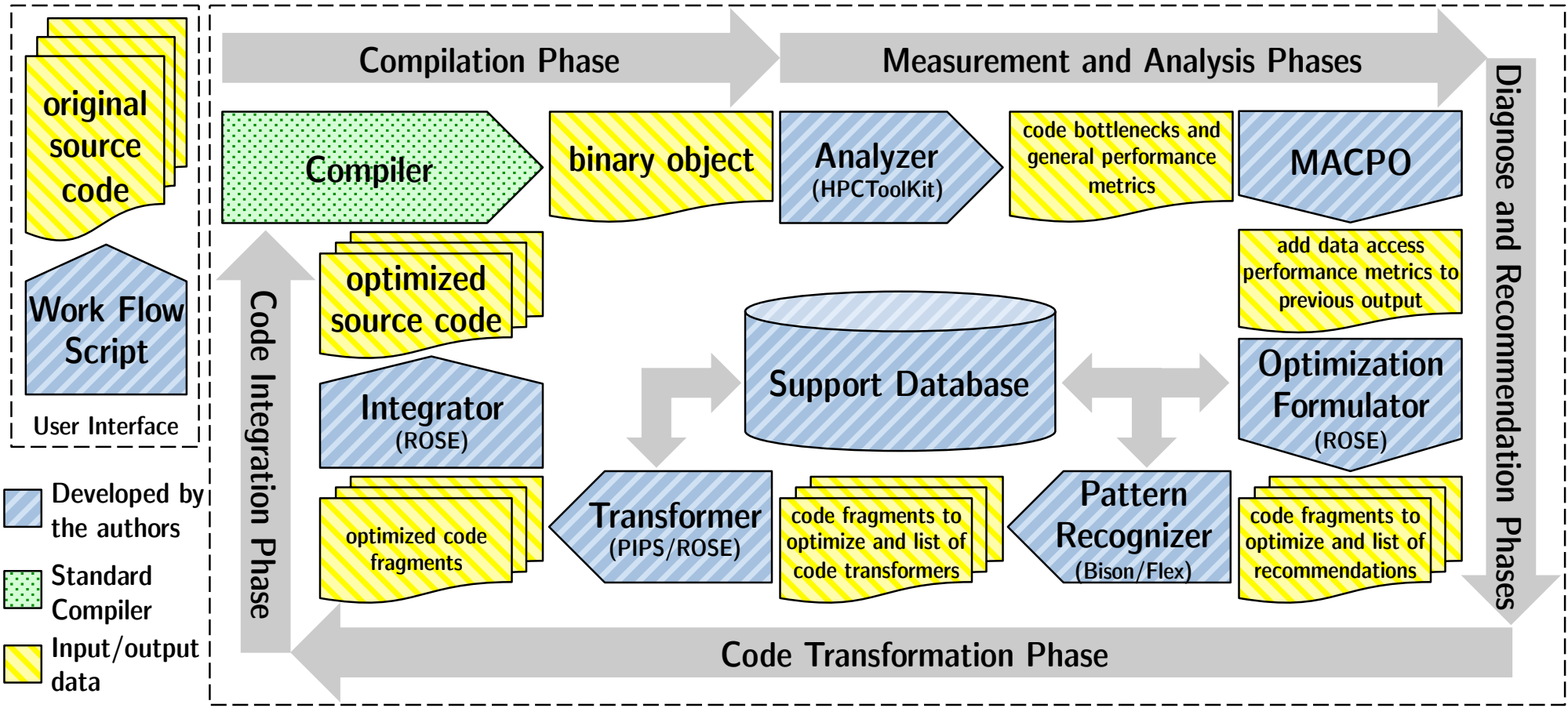


New Version: MACPO



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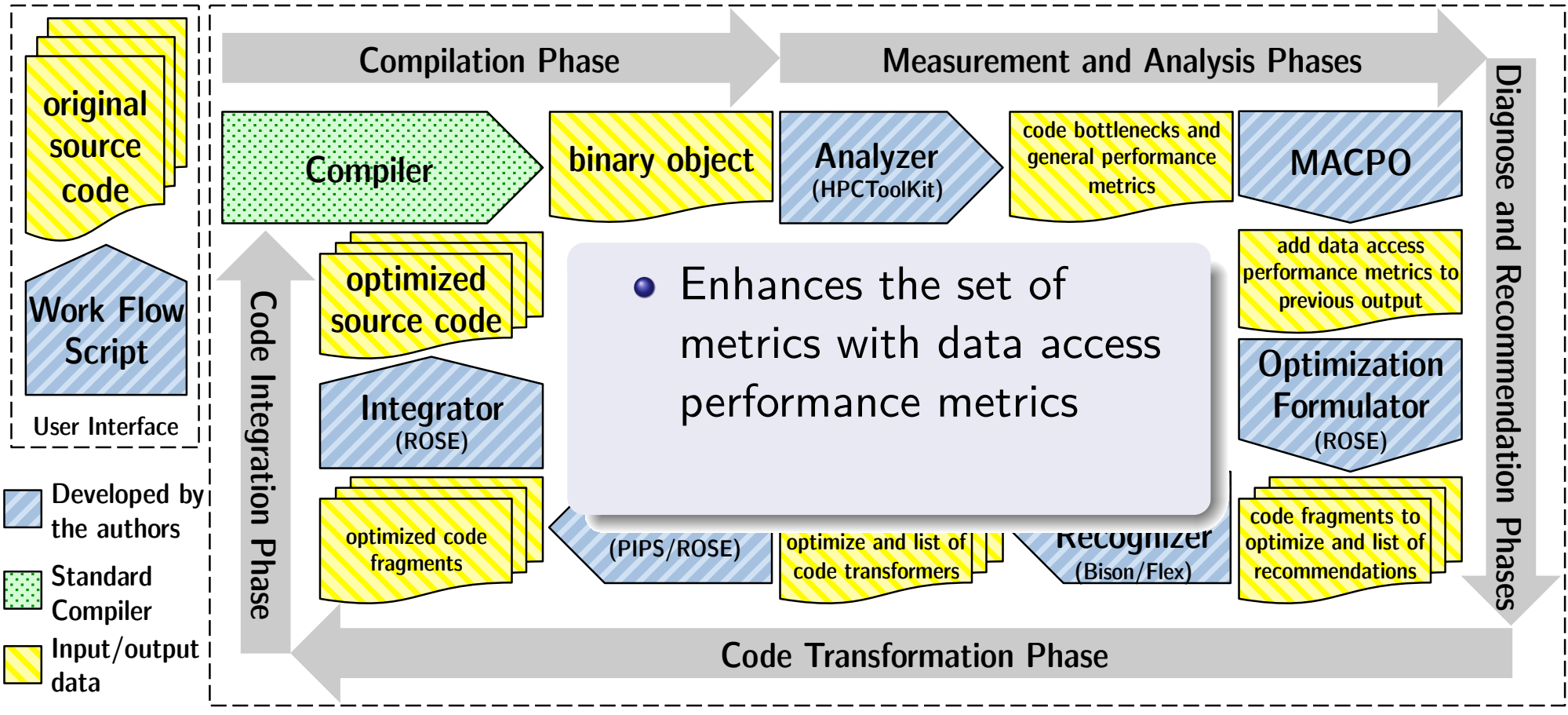

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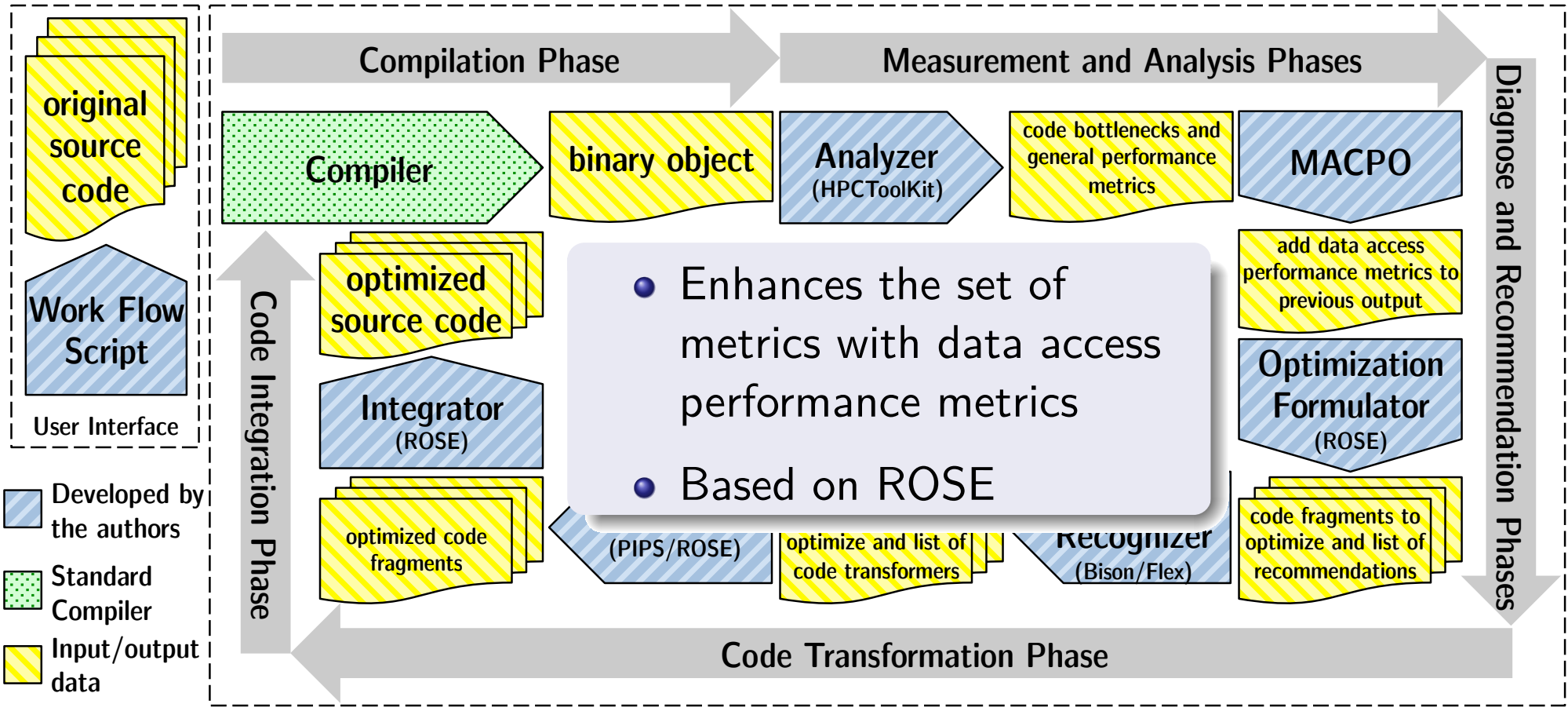
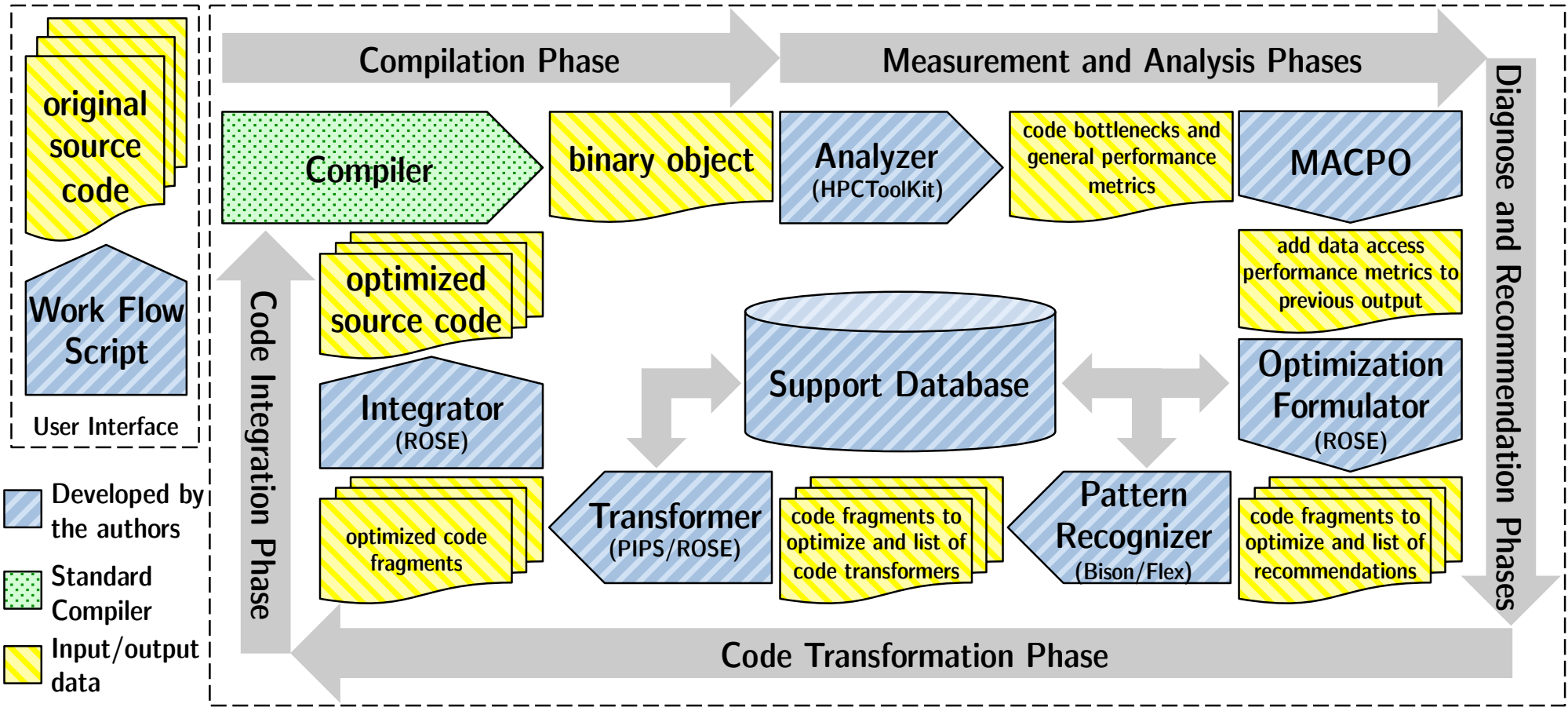


New Version: Optimization Formulator



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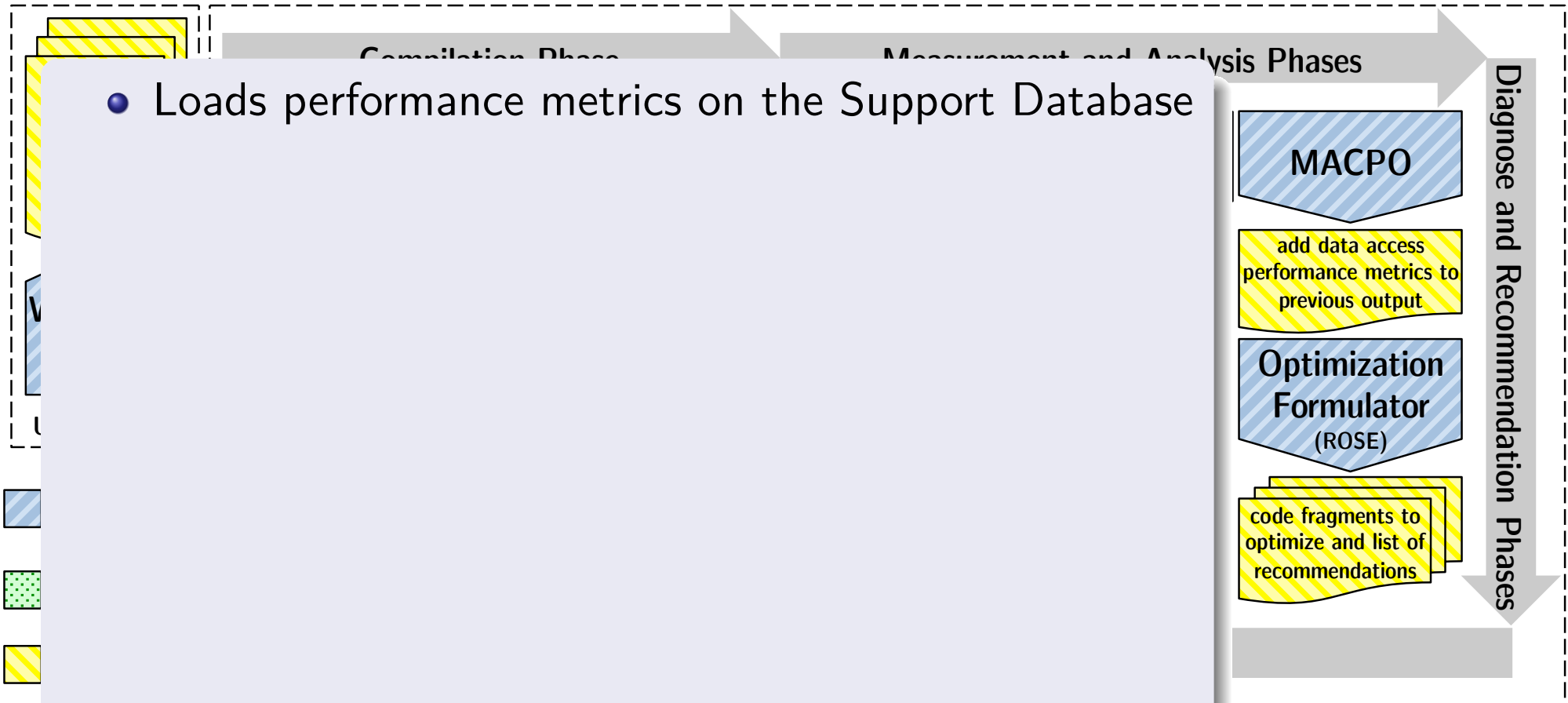

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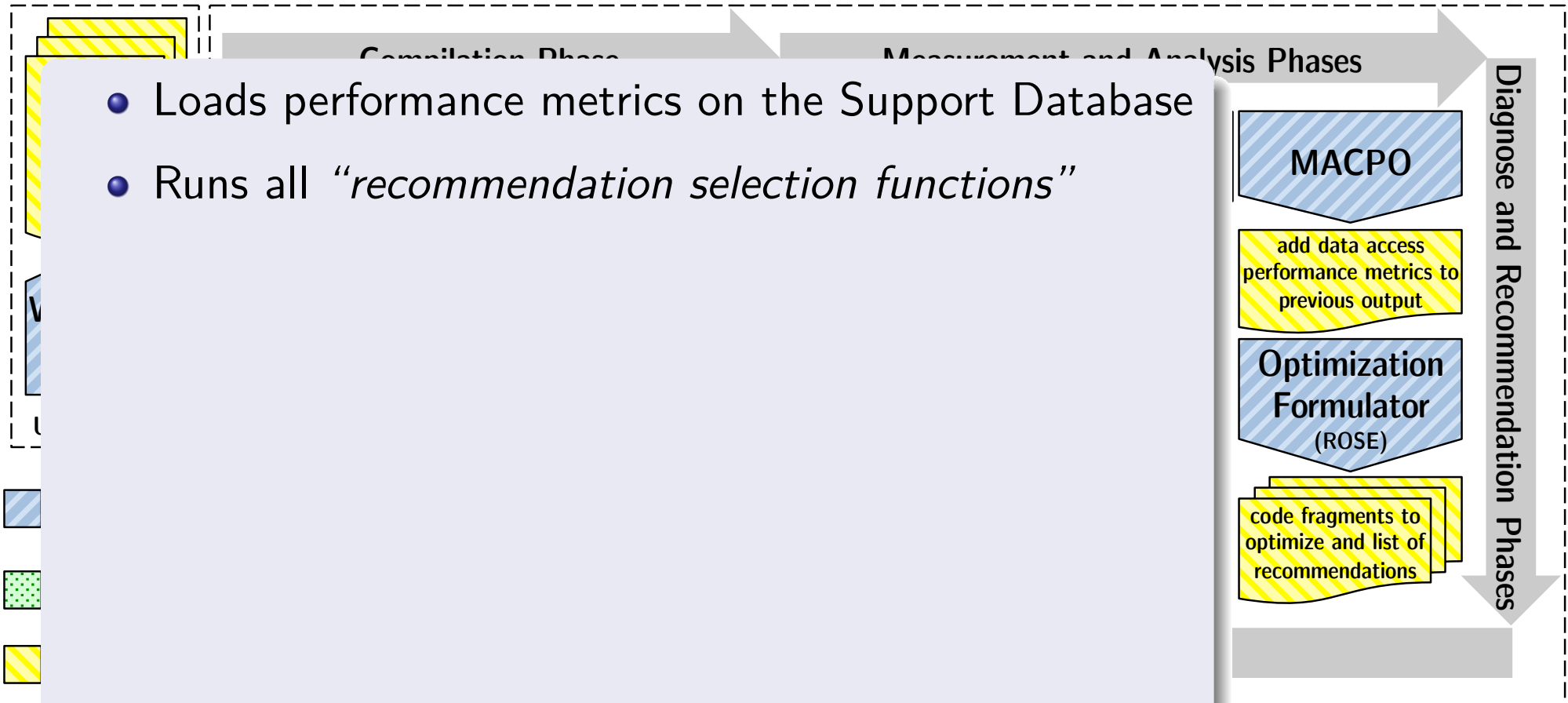
- Loads performance metrics on the Support Database
- Runs all *"recommendation selection functions"*



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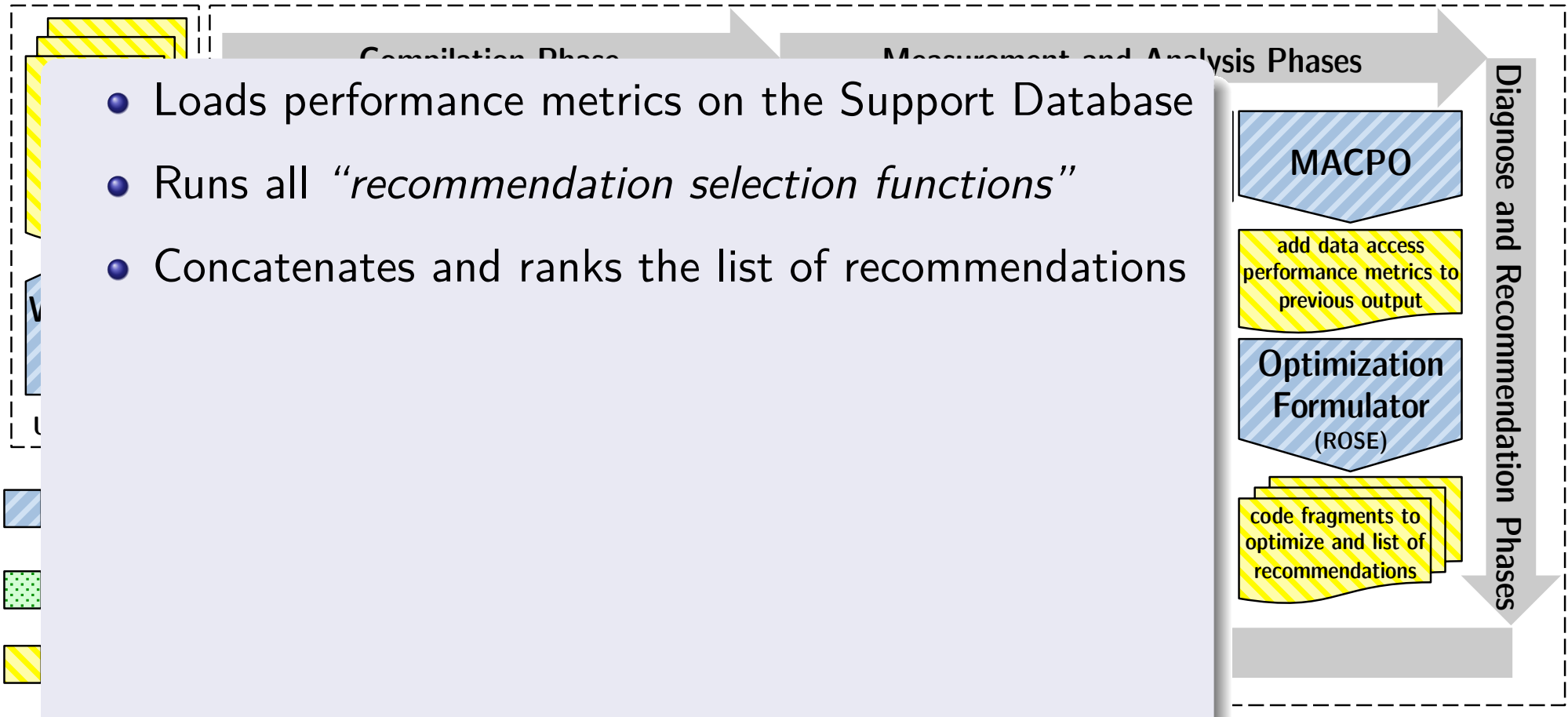

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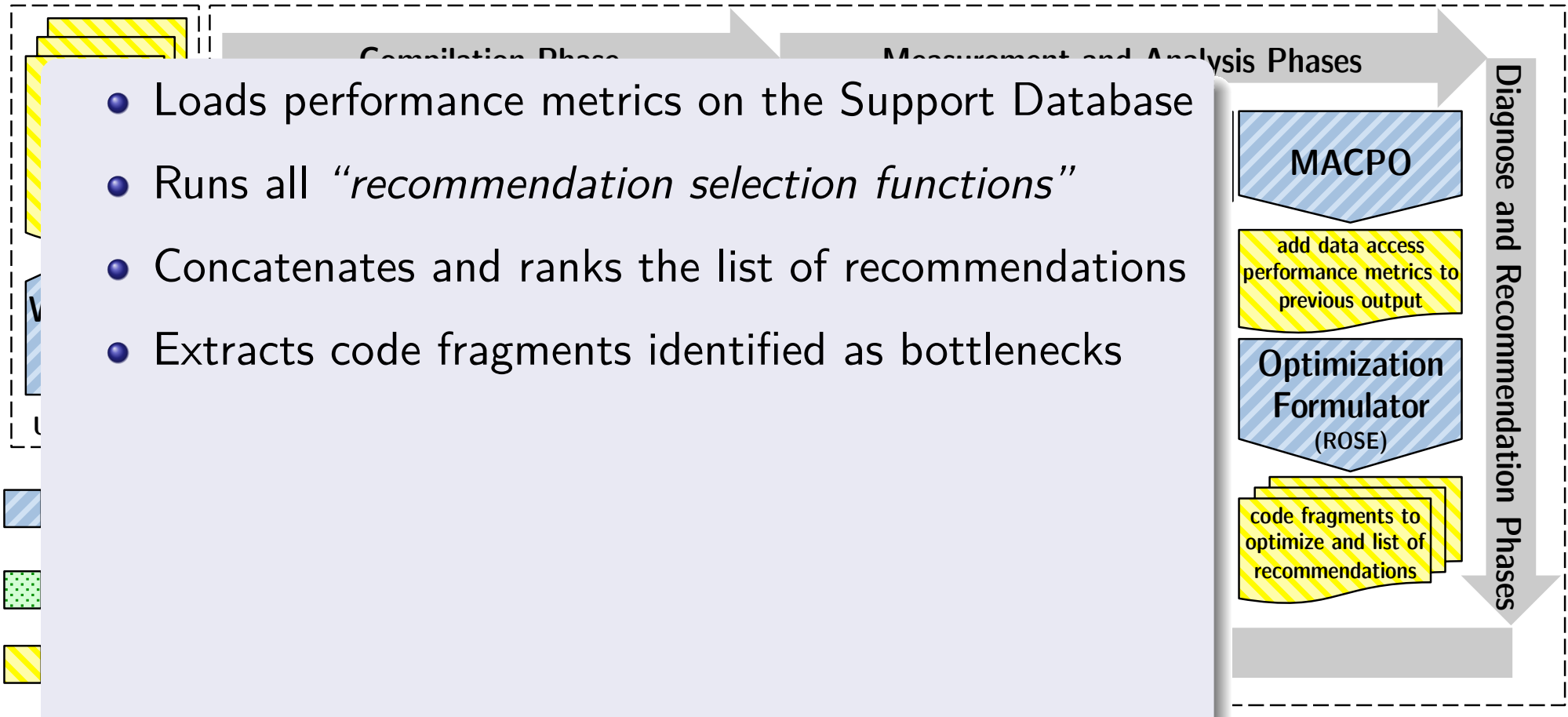

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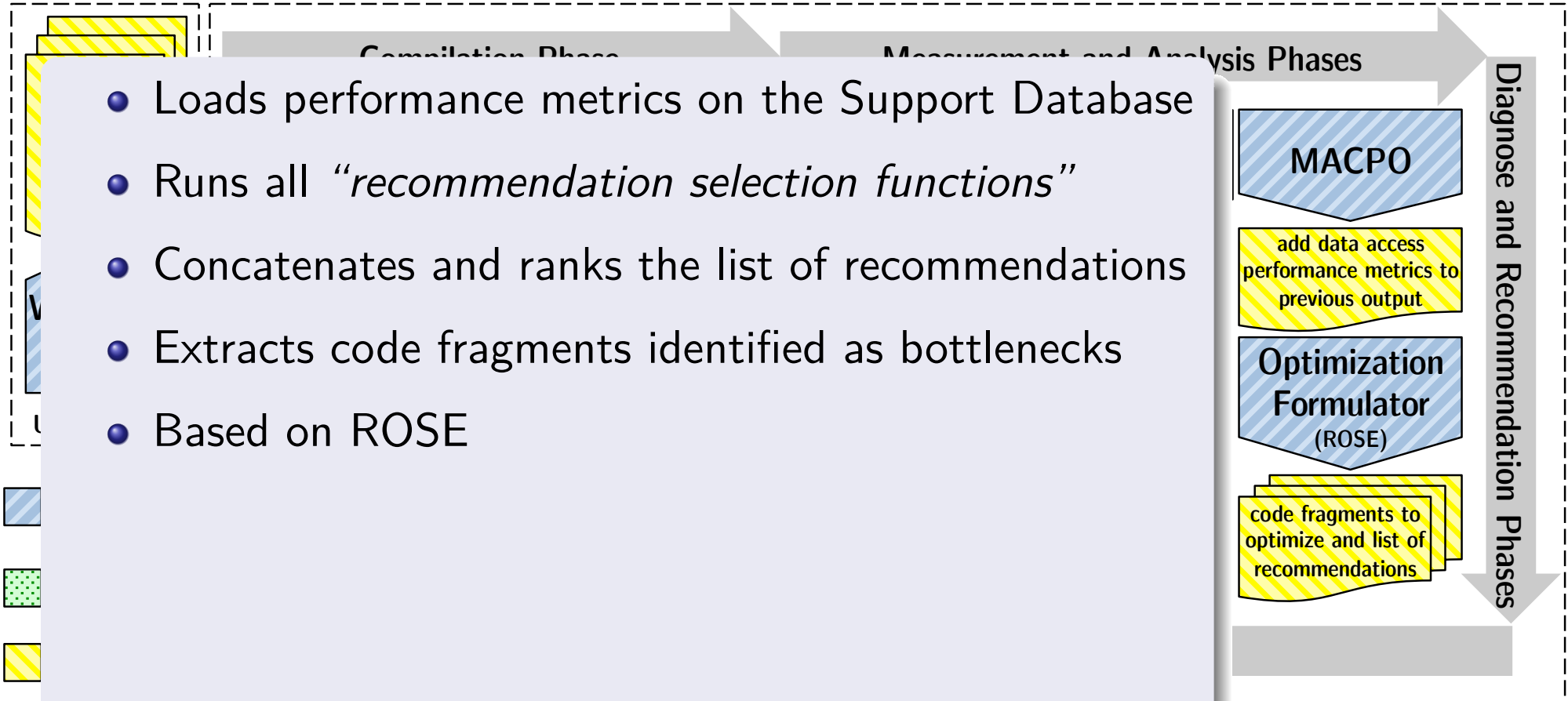
- Based on ROSE



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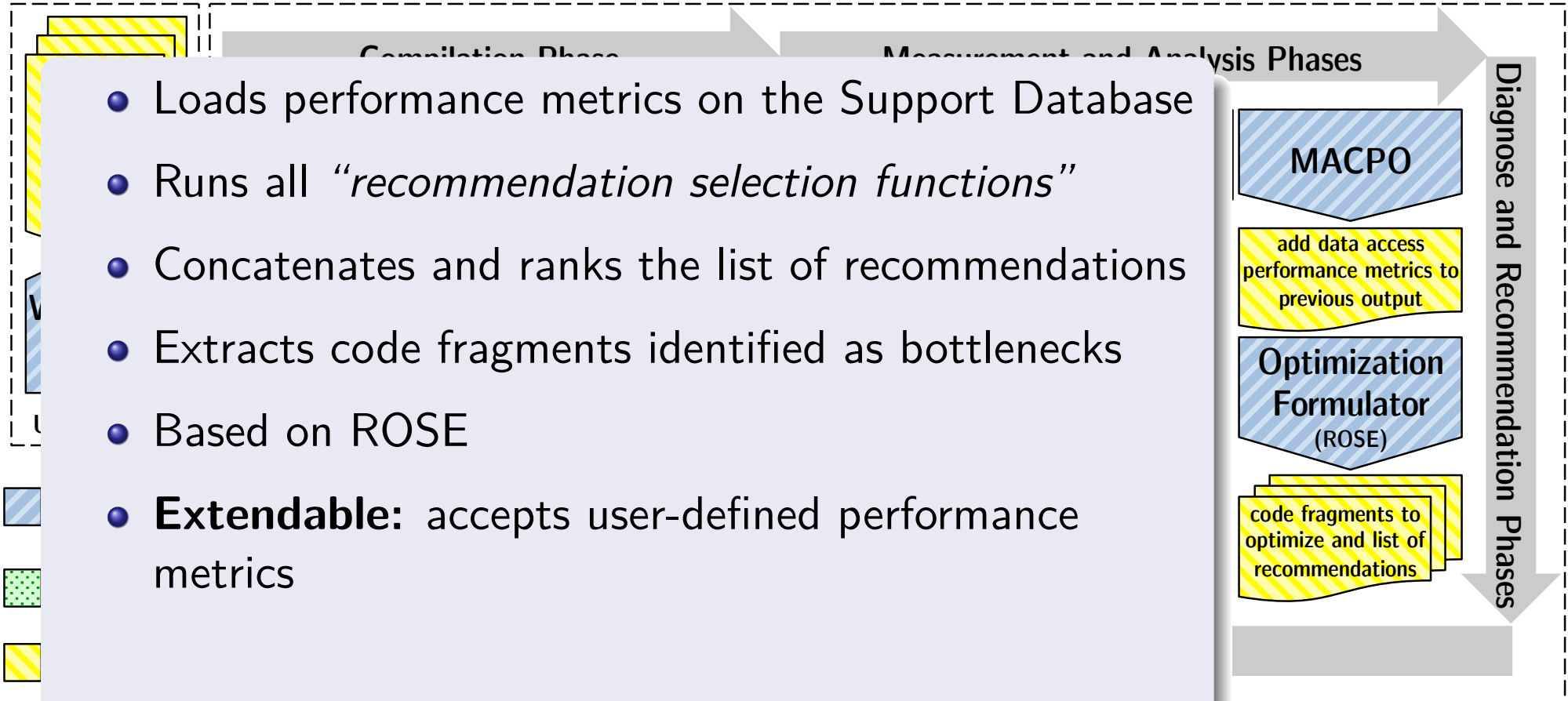

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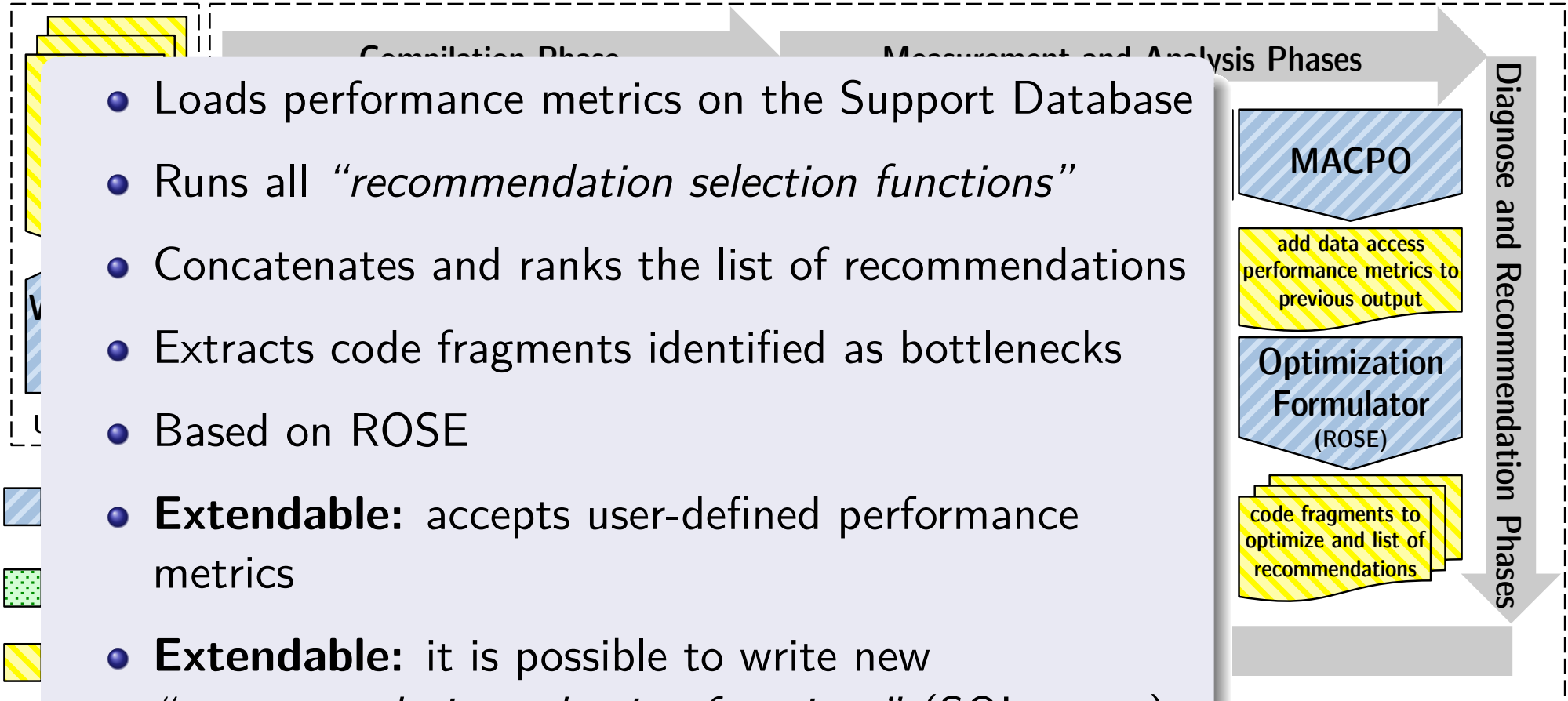

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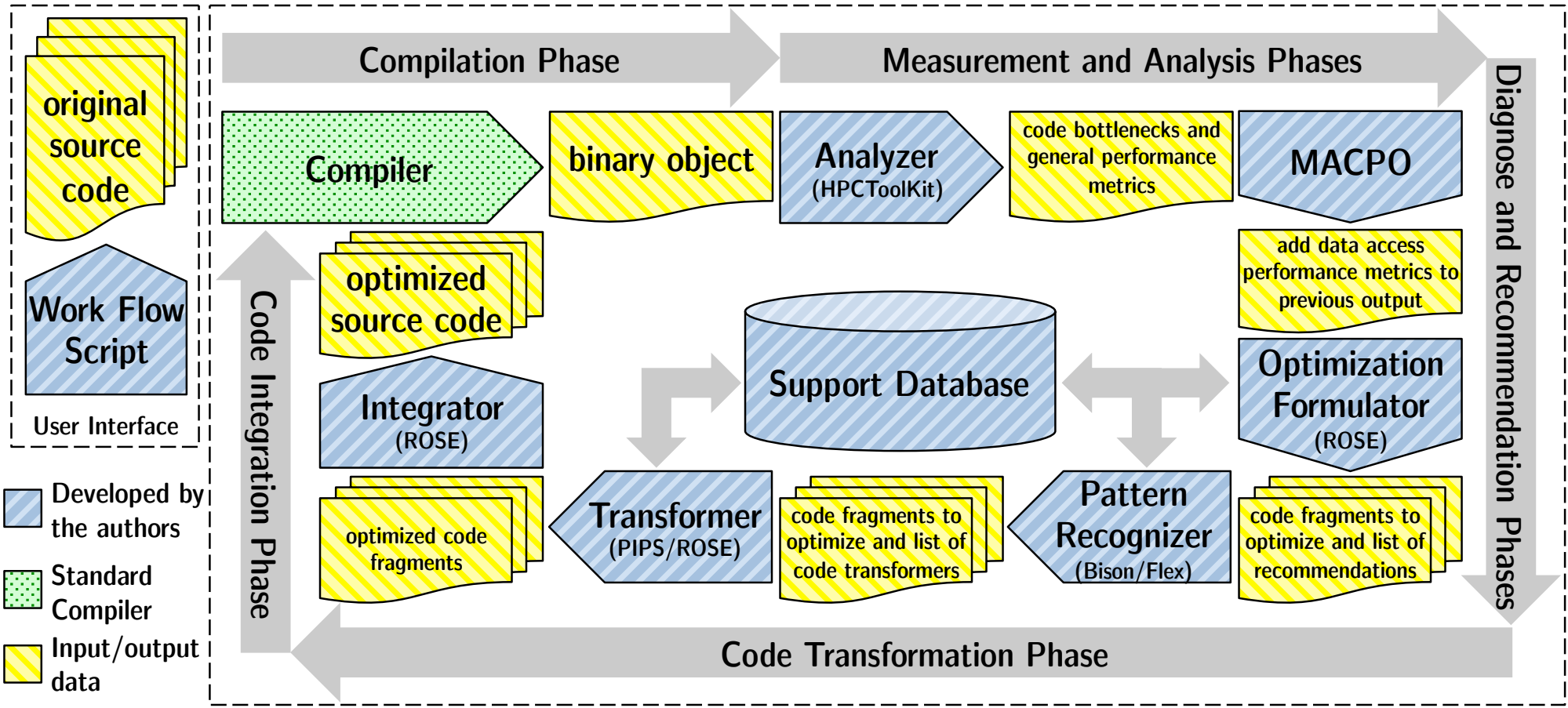
- **Extendable:** accepts user-defined performance metrics
- **Extendable:** it is possible to write new *"recommendation selection functions"* (SQL query)

New Version: Support Database



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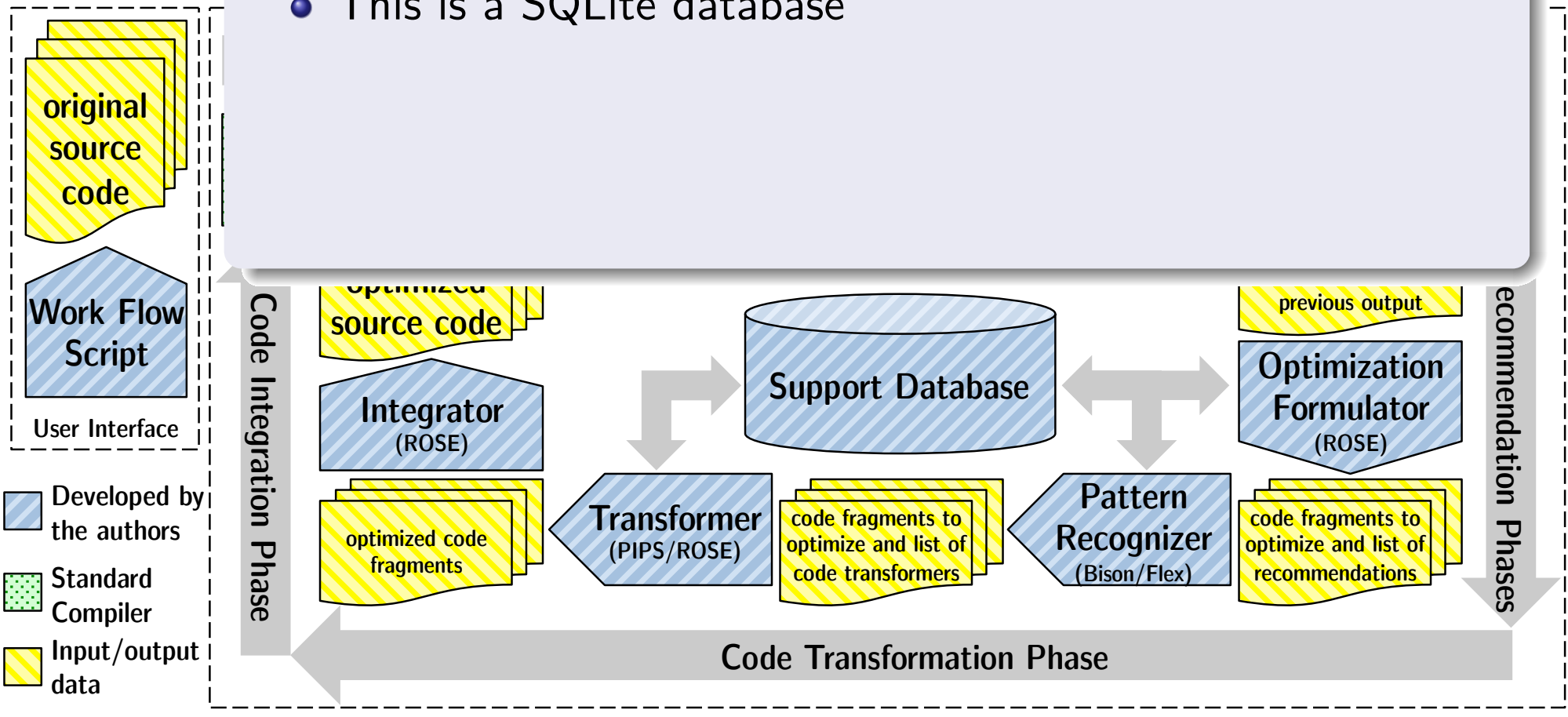
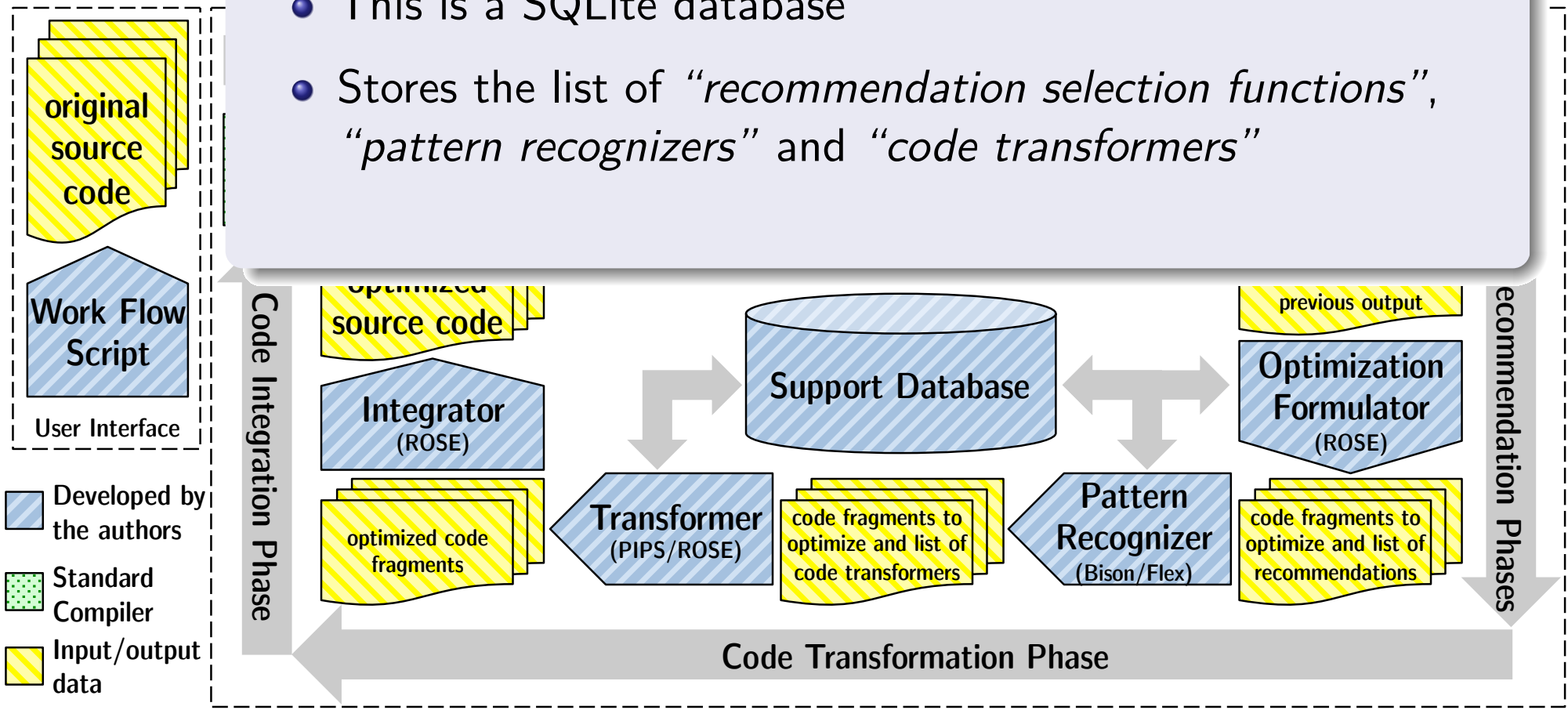


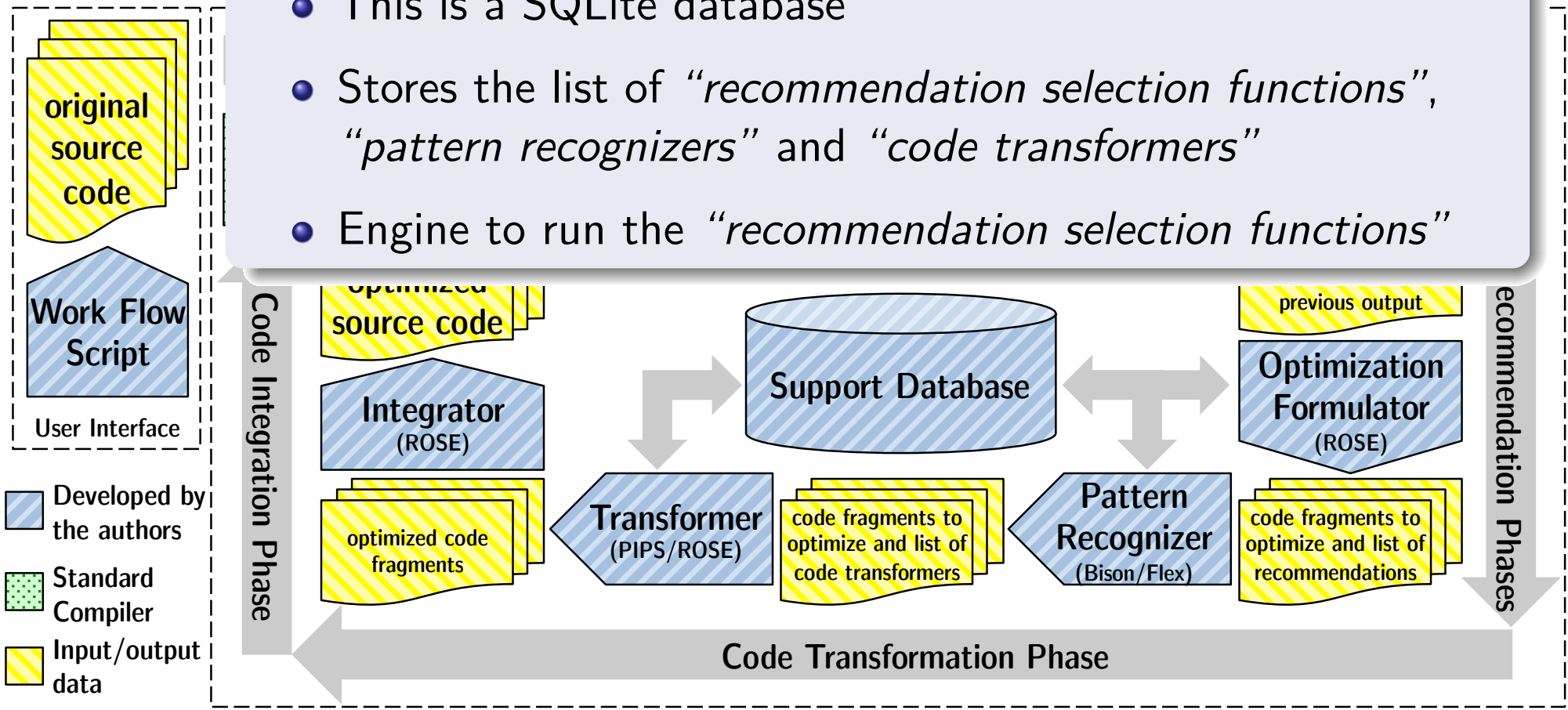
New Version: Support Database

- This is a SQLite database
- Stores the list of *"recommendation selection functions"*, *"pattern recognizers"* and *"code transformers"*



New Version: Support Database

- This is a SQLite database
- Stores the list of *"recommendation selection functions"*, *"pattern recognizers"* and *"code transformers"*
- Engine to run the *"recommendation selection functions"*



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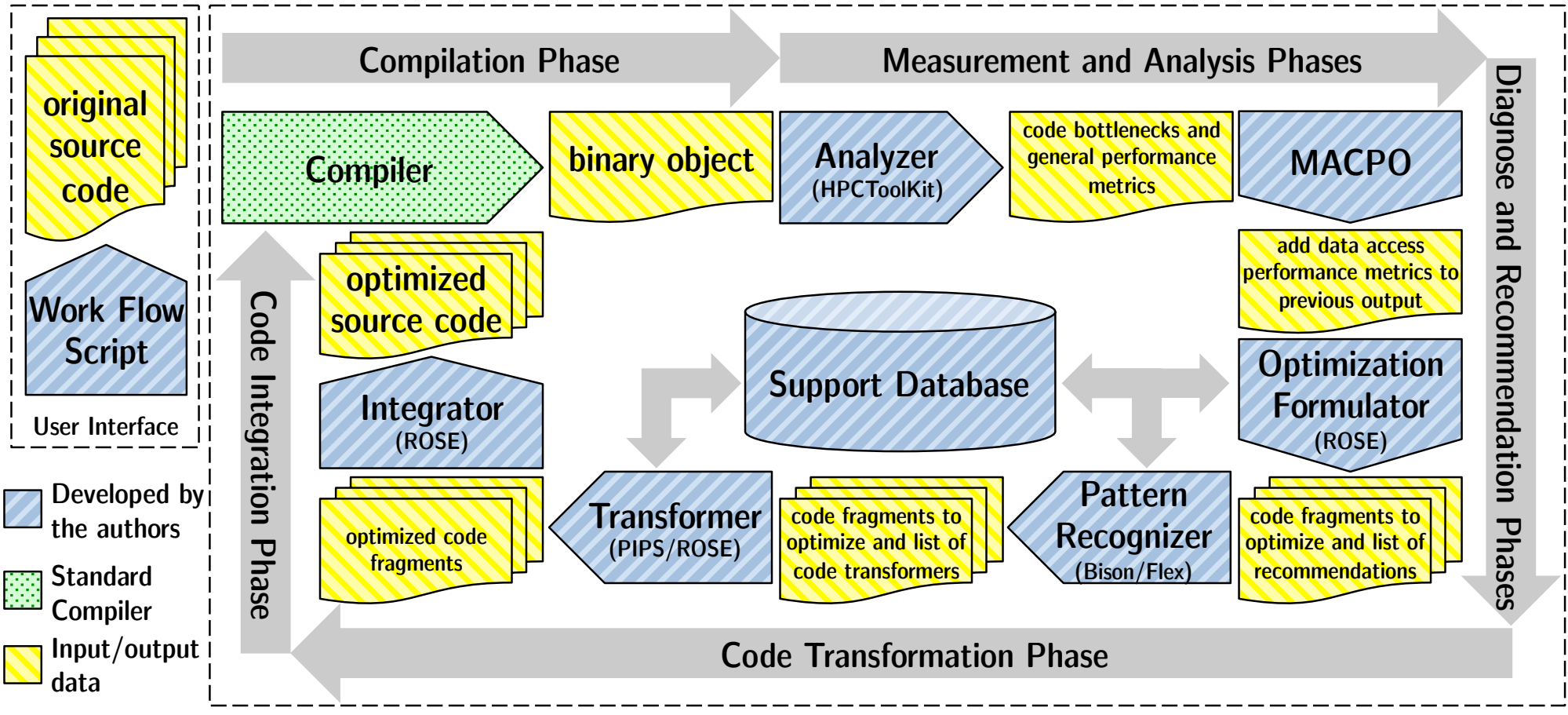

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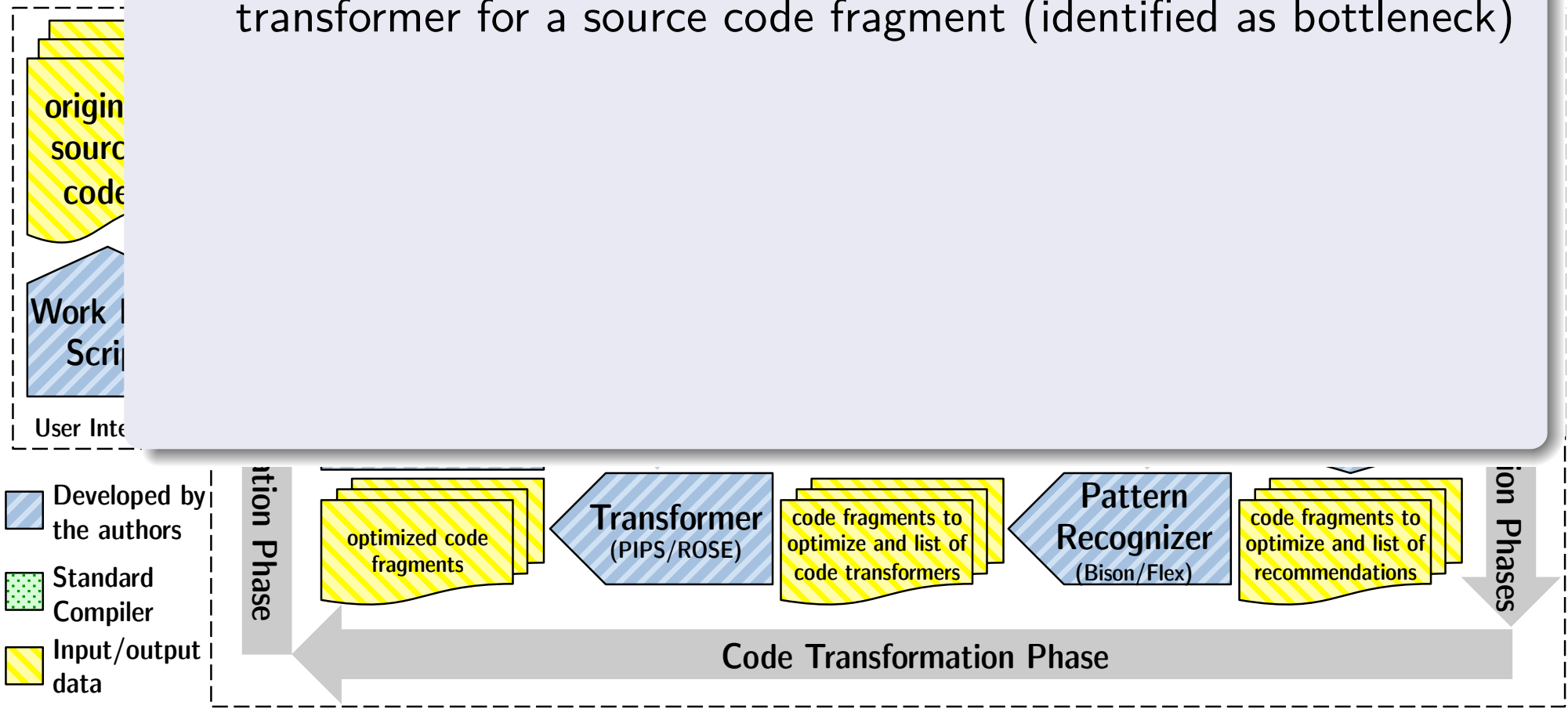
- Acts as a "filter" trying to find (match) the right code transformer for a source code fragment (identified as bottleneck)



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- Acts as a "filter" trying to find (match) the right code transformer for a source code fragment (identified as bottleneck)
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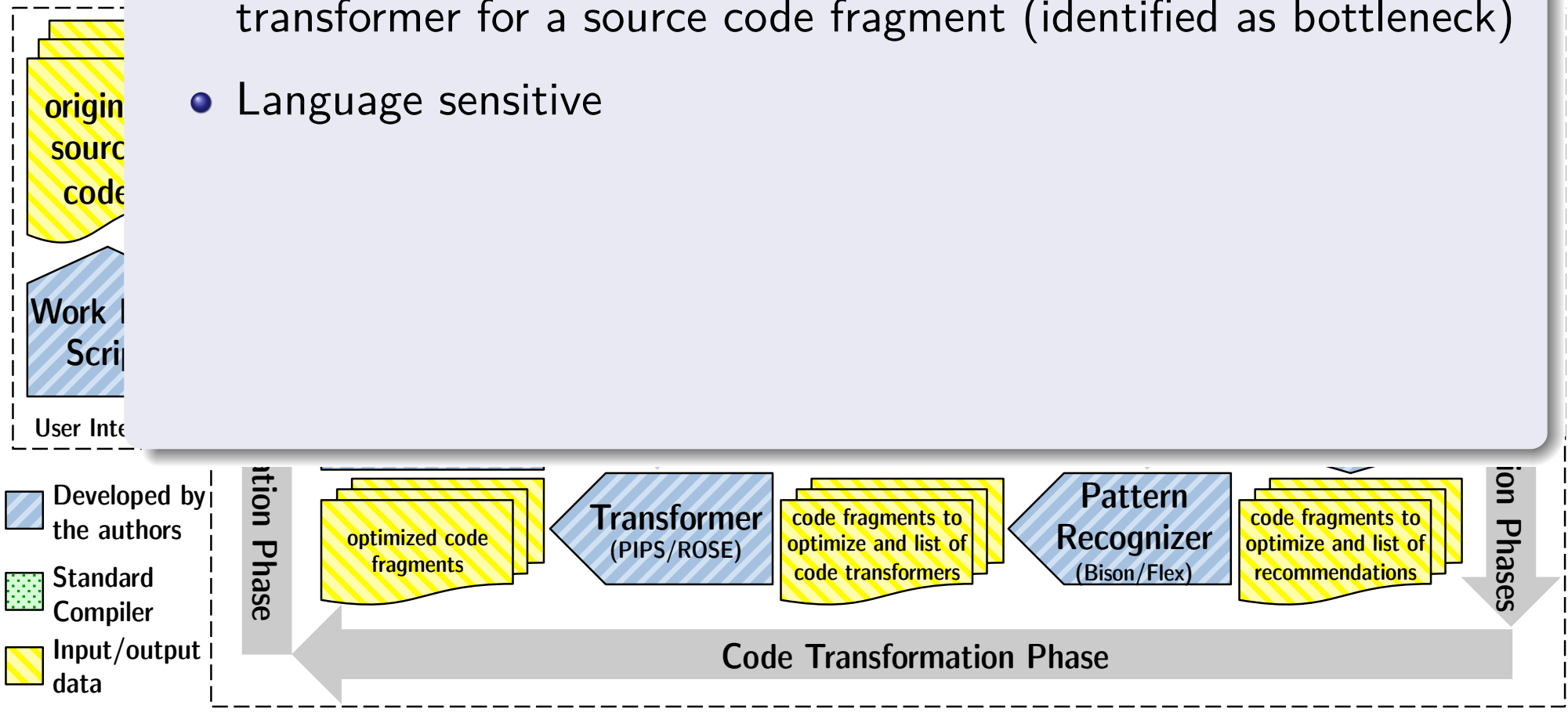

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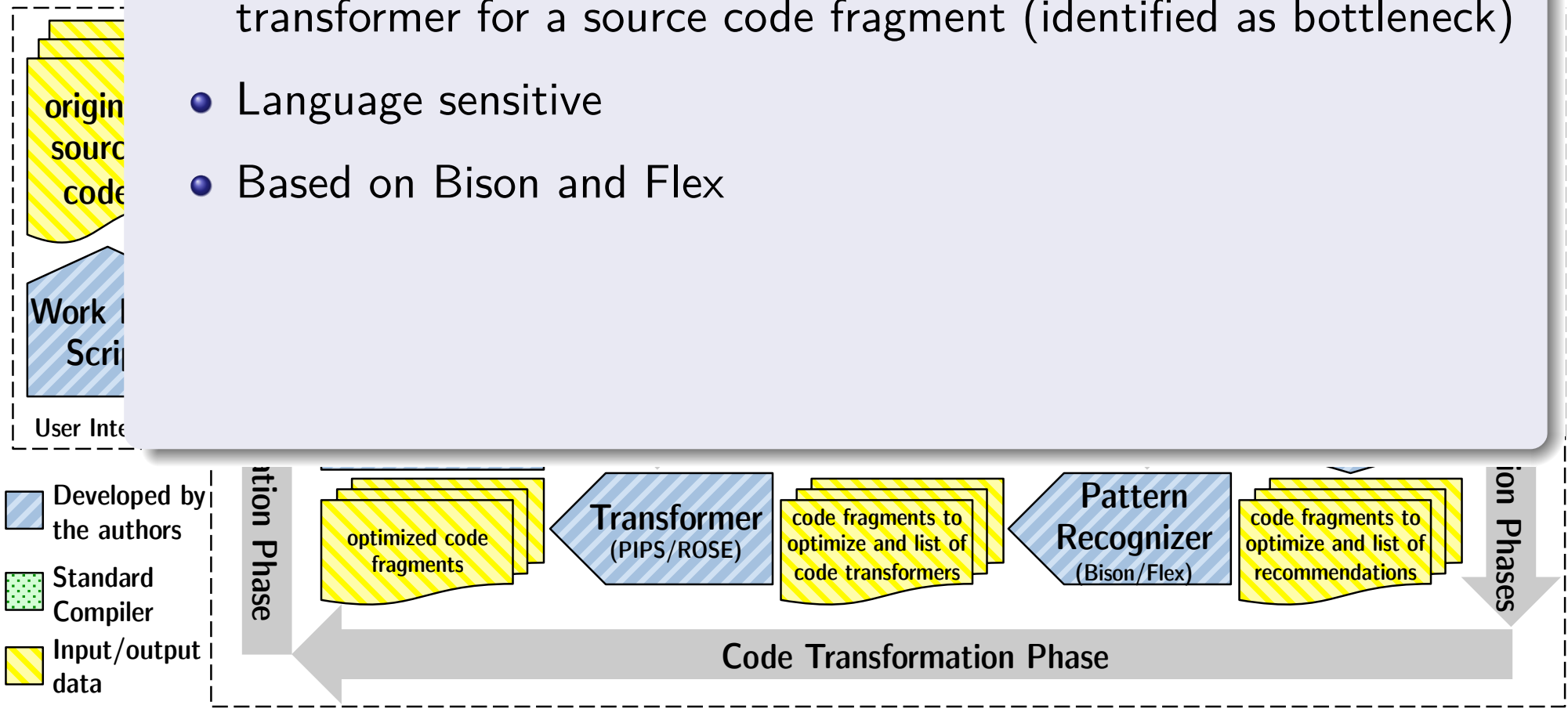
- Language sensitive
- Based on Bison and Flex



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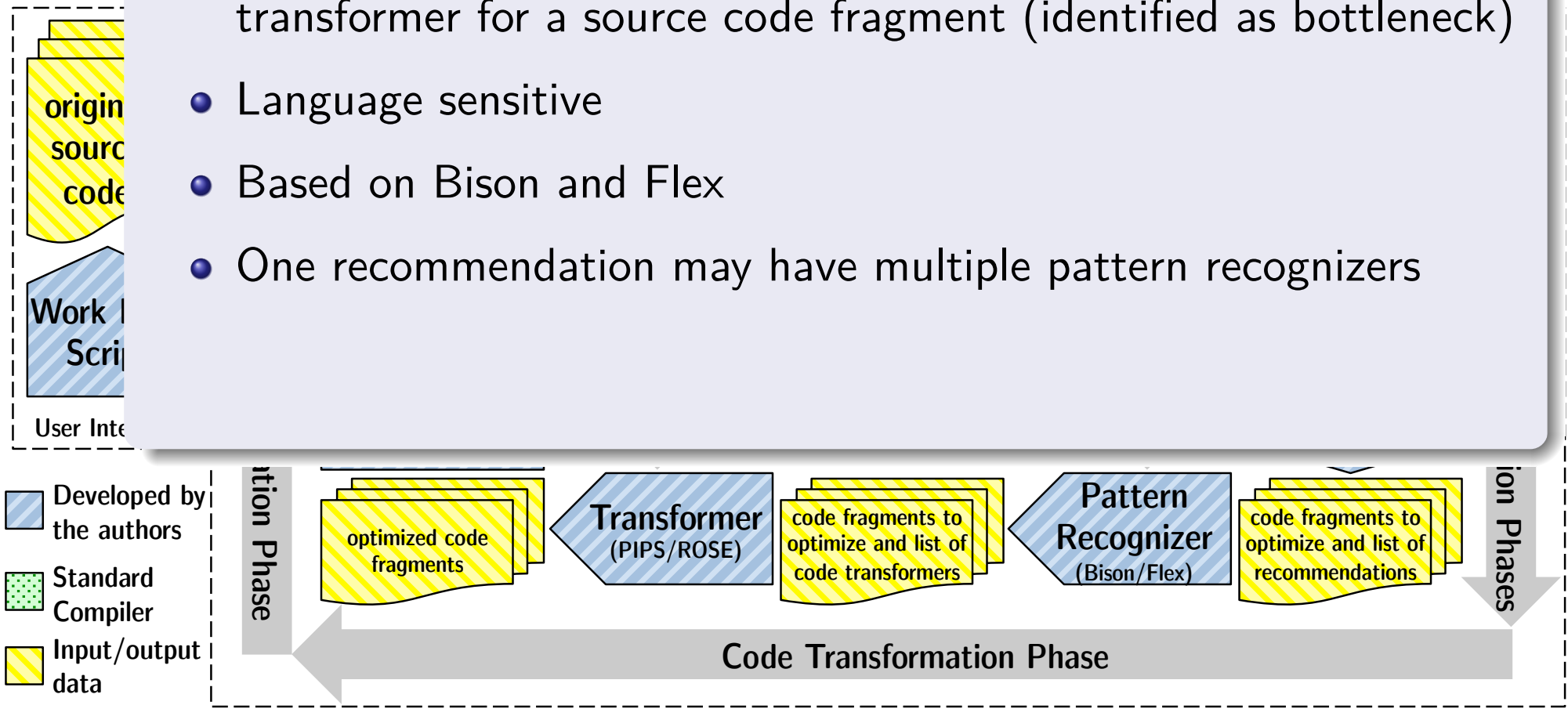

New Version: Pattern Recognizer

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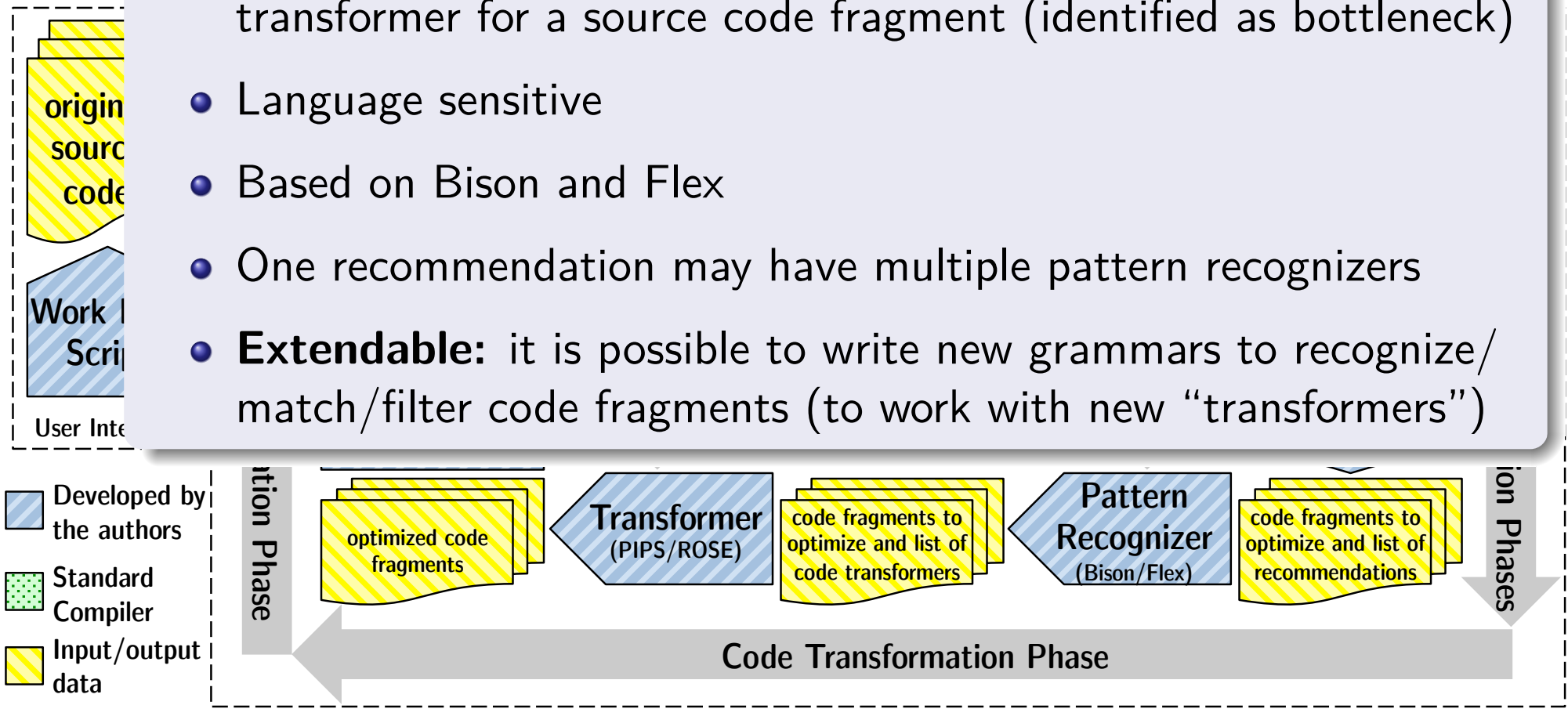
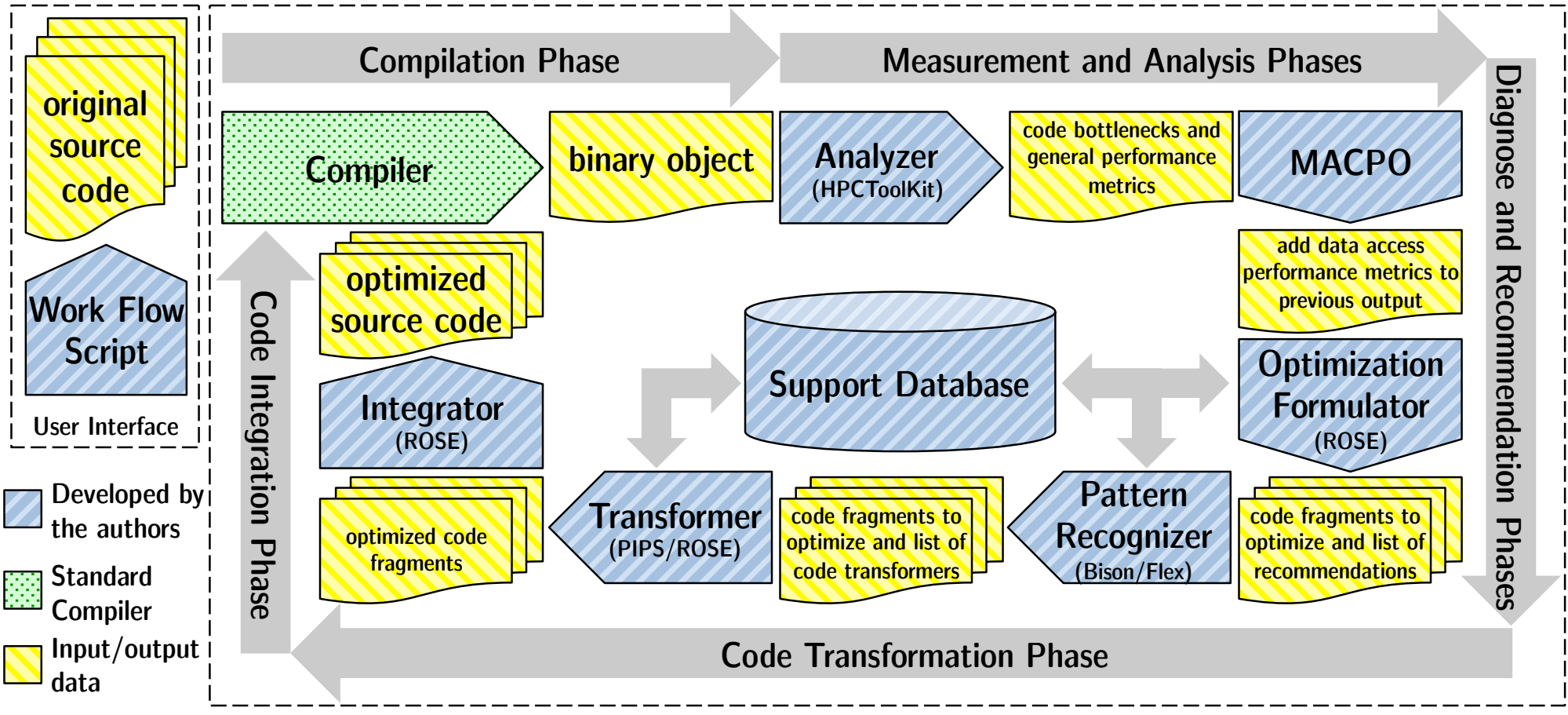
- Language sensitive
- Based on Bison and Flex
- One recommendation may have multiple pattern recognizers
- **Extendable:** it is possible to write new grammars to recognize/match/filter code fragments (to work with new "transformers")

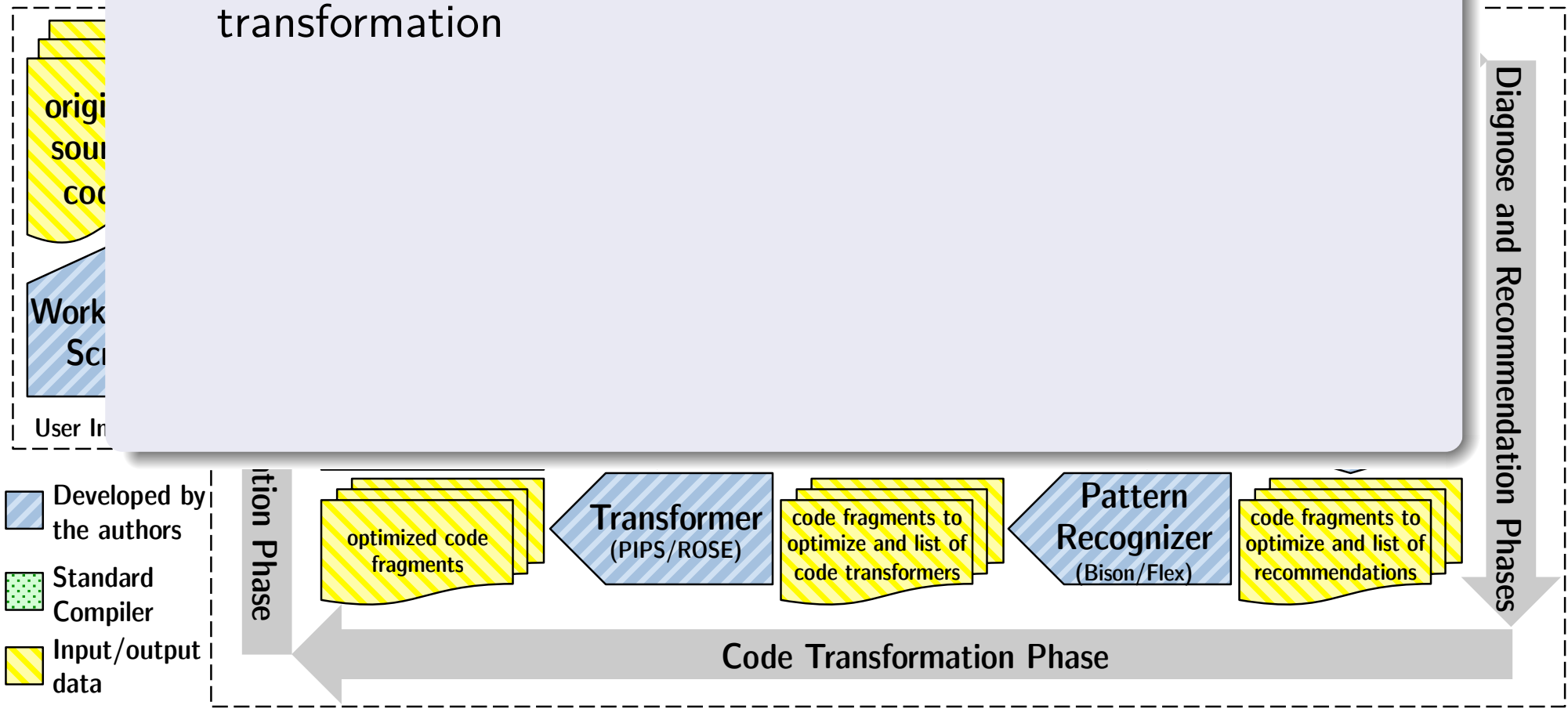


New Version: Transformer



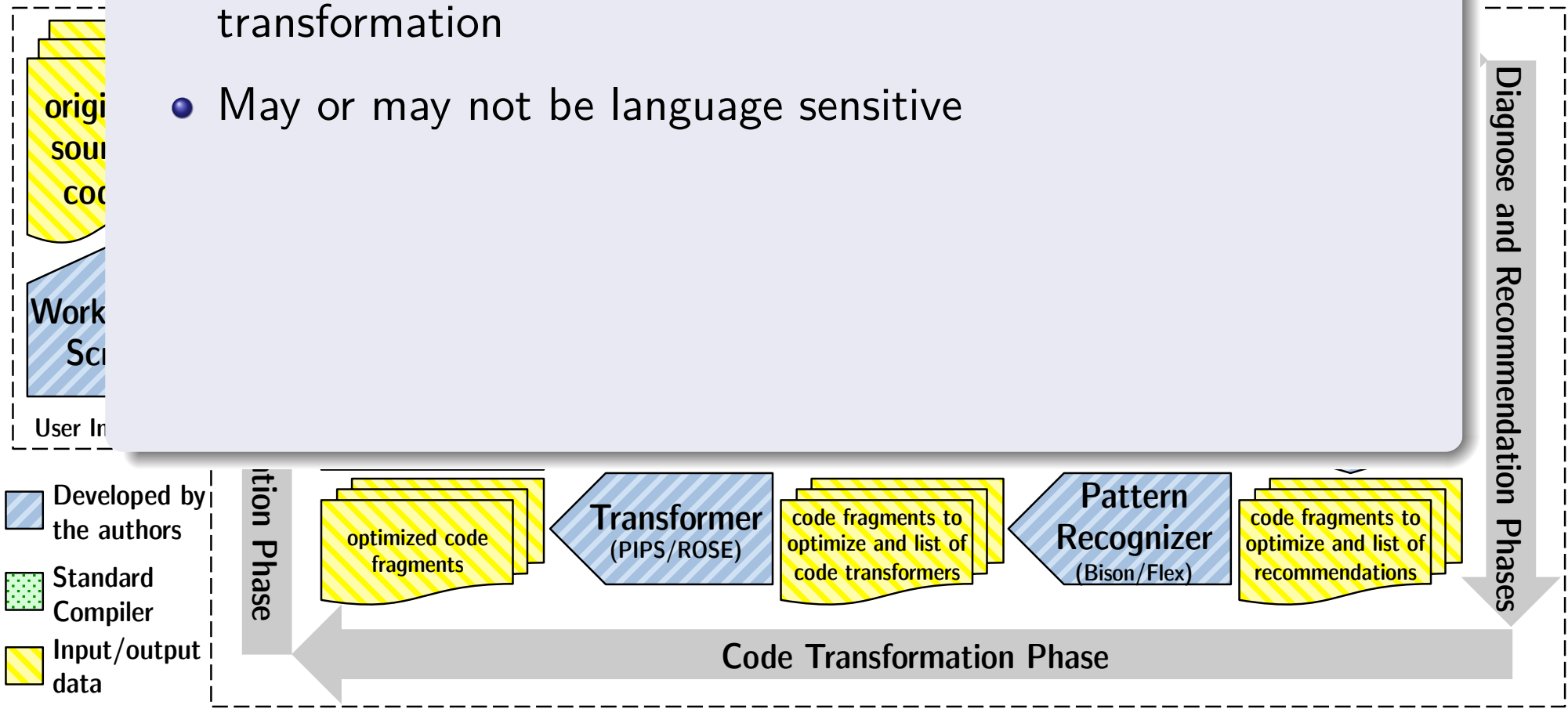
New Version: Transformer

- Implements the recommendation by applying source code transformation



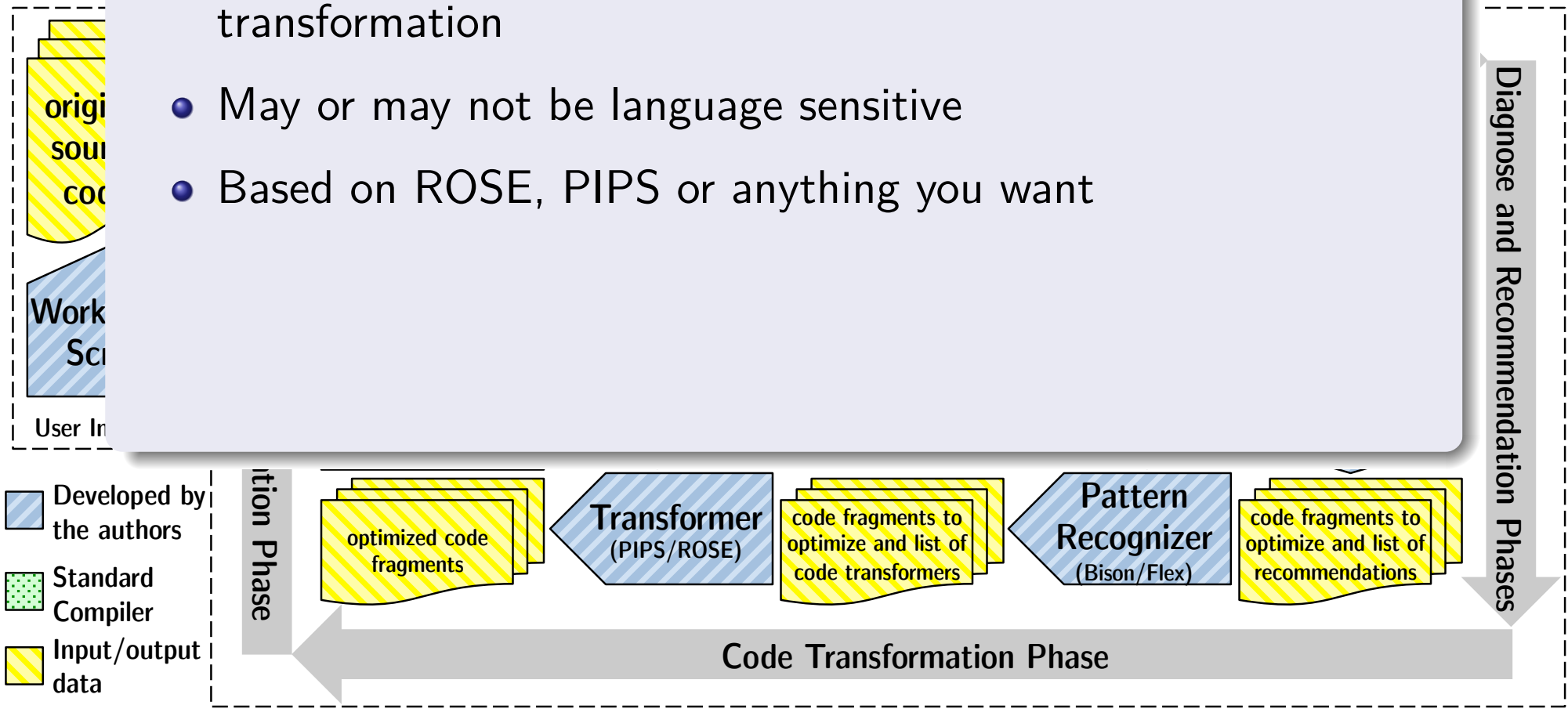
New Version: Transformer

- Implements the recommendation by applying source code transformation
- May or may not be language sensitive



New Version: Transformer

- Implements the recommendation by applying source code transformation
- May or may not be language sensitive
- Based on ROSE, PIPS or anything you want



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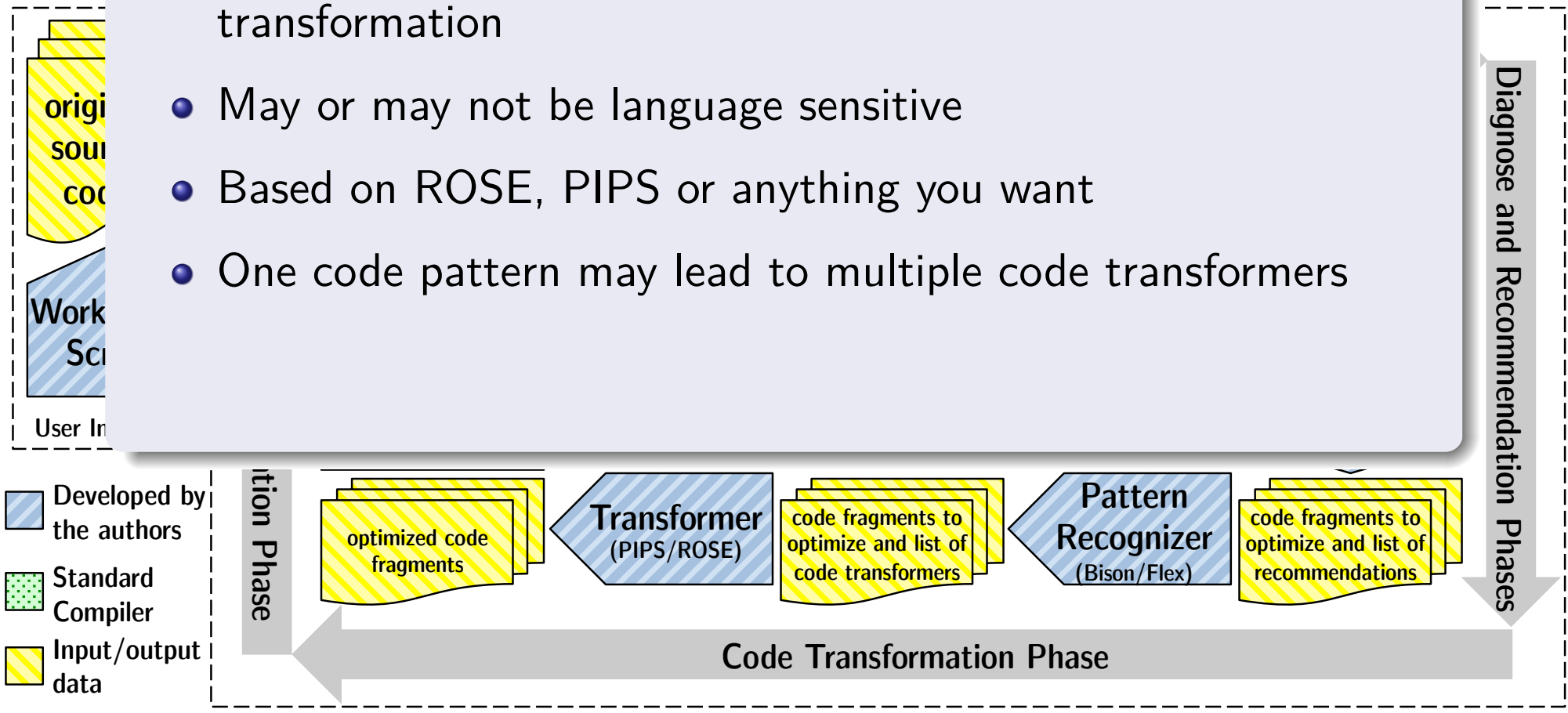
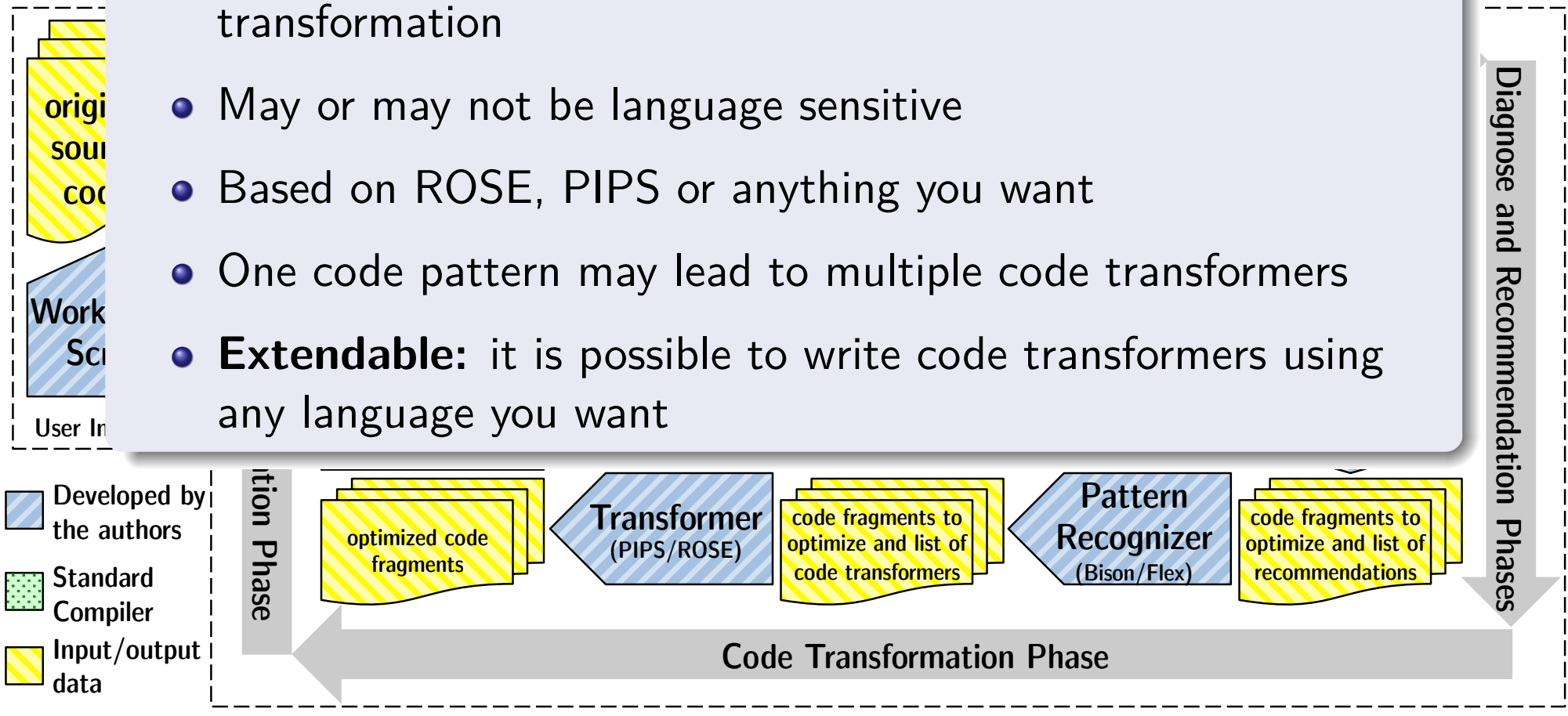
- One code pattern may lead to multiple code transformers



New Version: Transformer

- Implements the recommendation by applying source code transformation
- May or may not be language sensitive
- Based on ROSE, PIPS or anything you want
- One code pattern may lead to multiple code transformers
- **Extendable:** it is possible to write code transformers using any language you want



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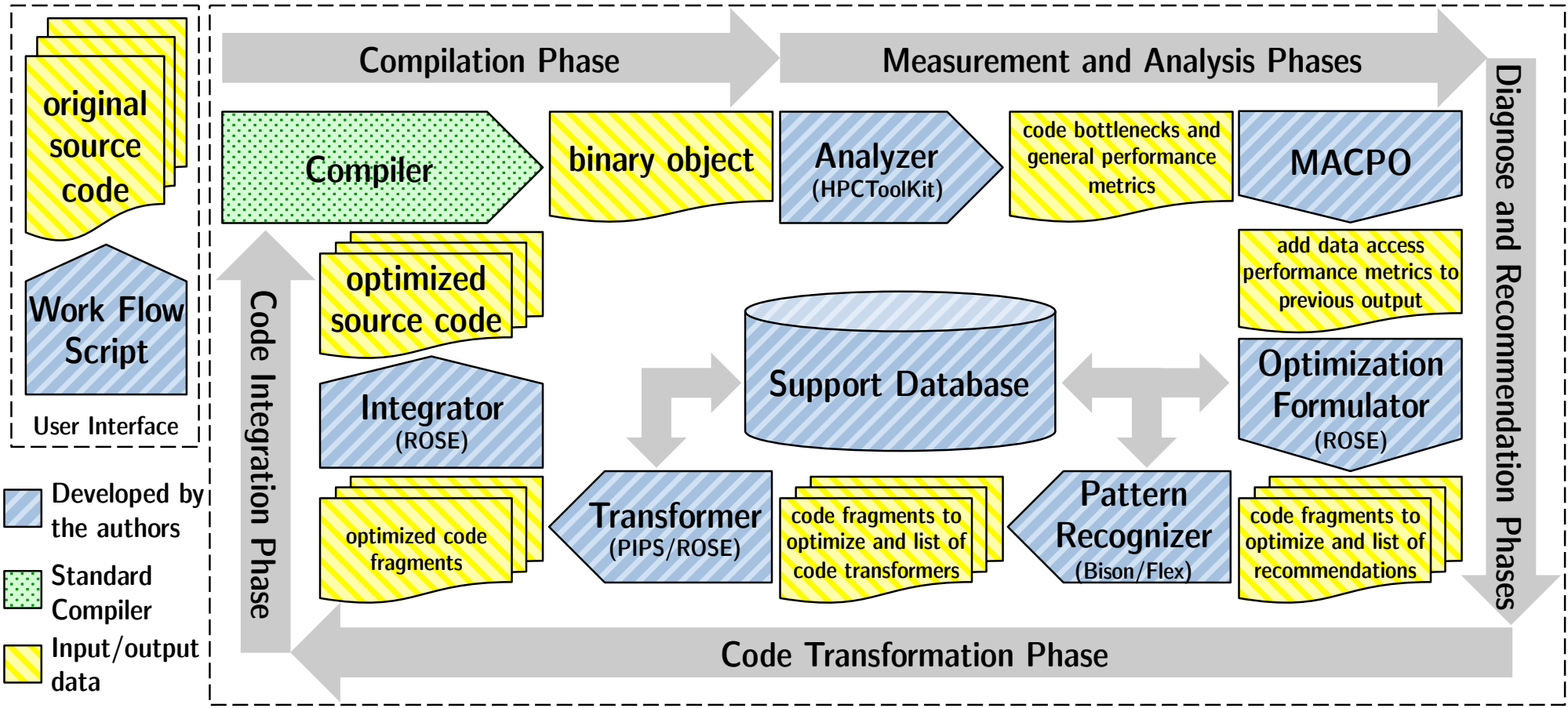

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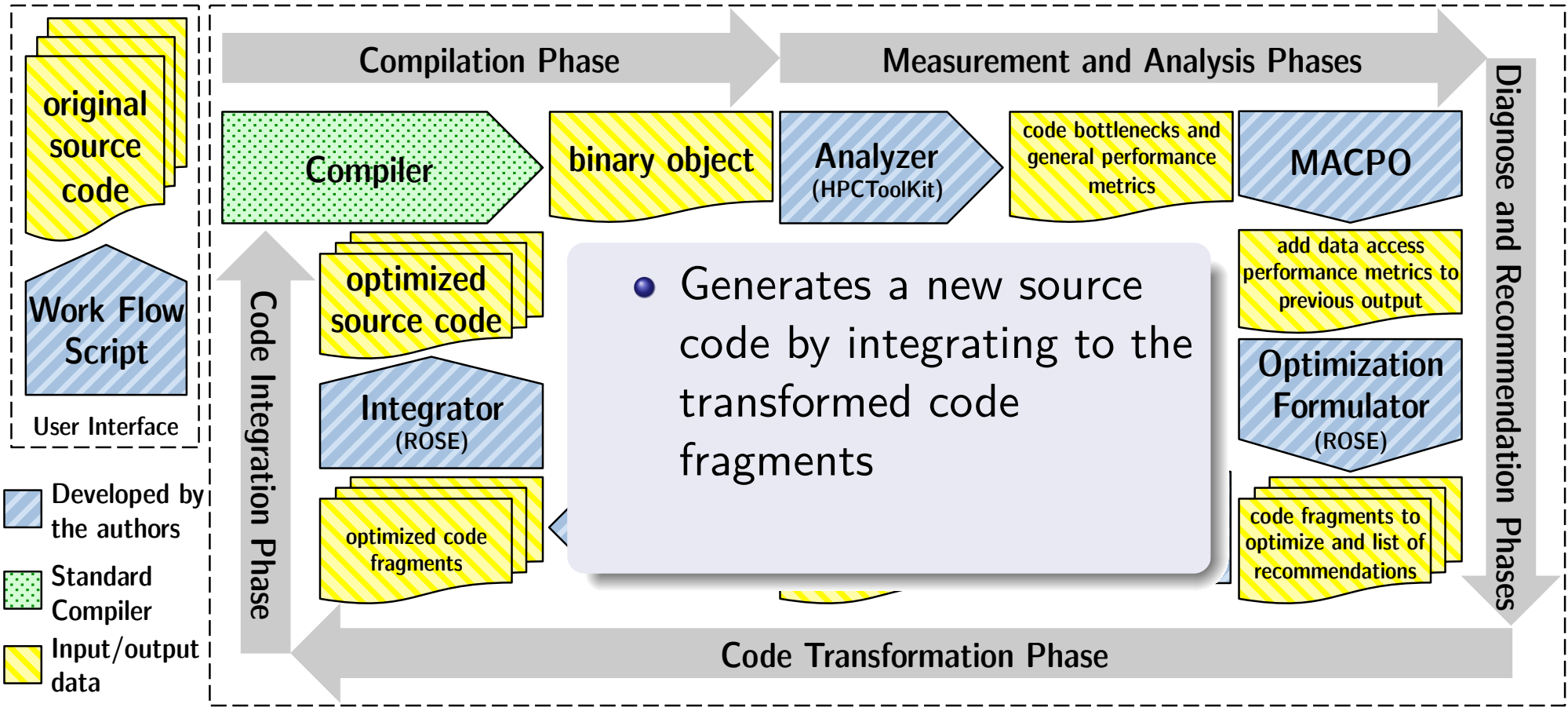
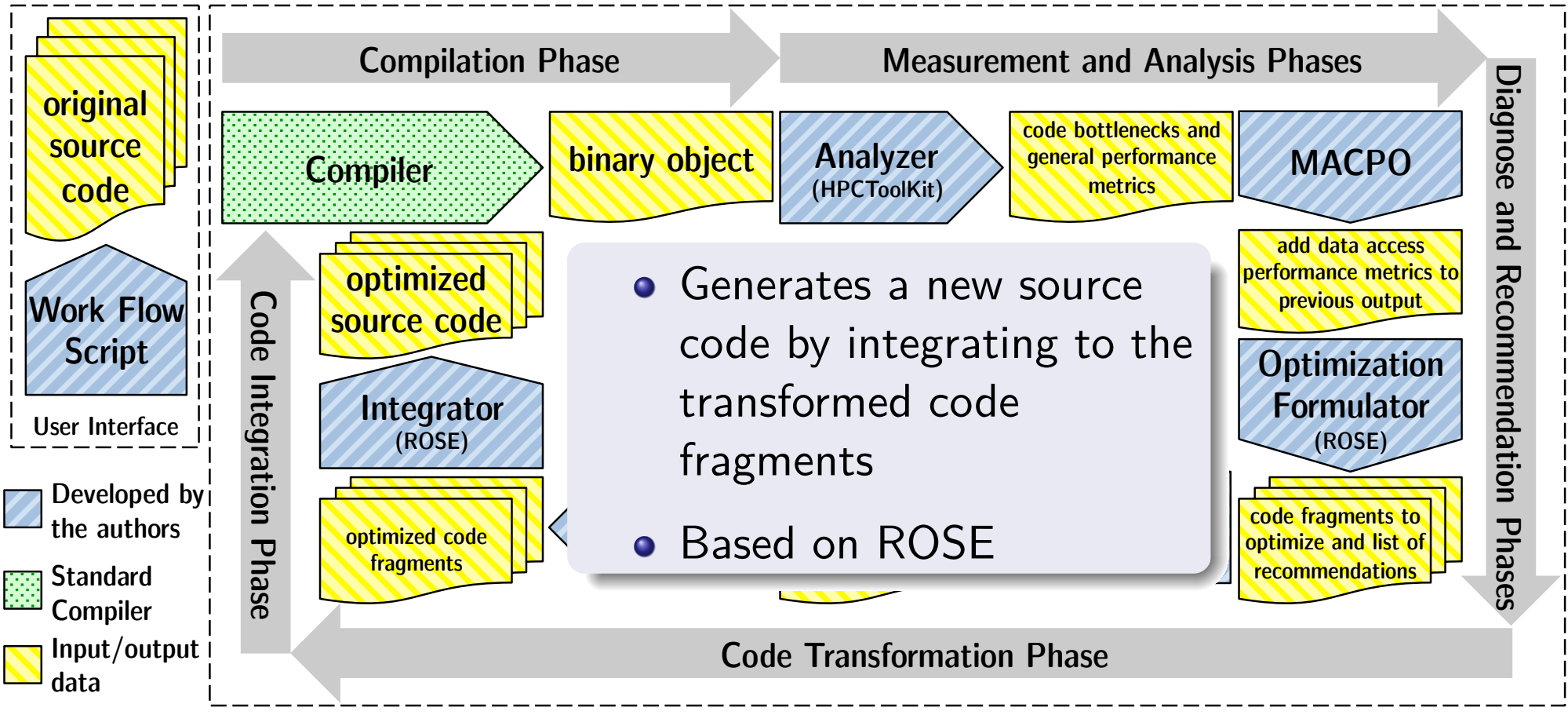


New Version: Integrator



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- Easy to use and lightweight!

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- Different from (most of) the available performance optimization tools, there is no "big code" (to increase in complexity until it become unusable or too hard to maintain)

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- Make the required packages installation process easier
- Add a test suite based on established benchmark codes
- Easy-to-use interface to manipulate the support database

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Thank You