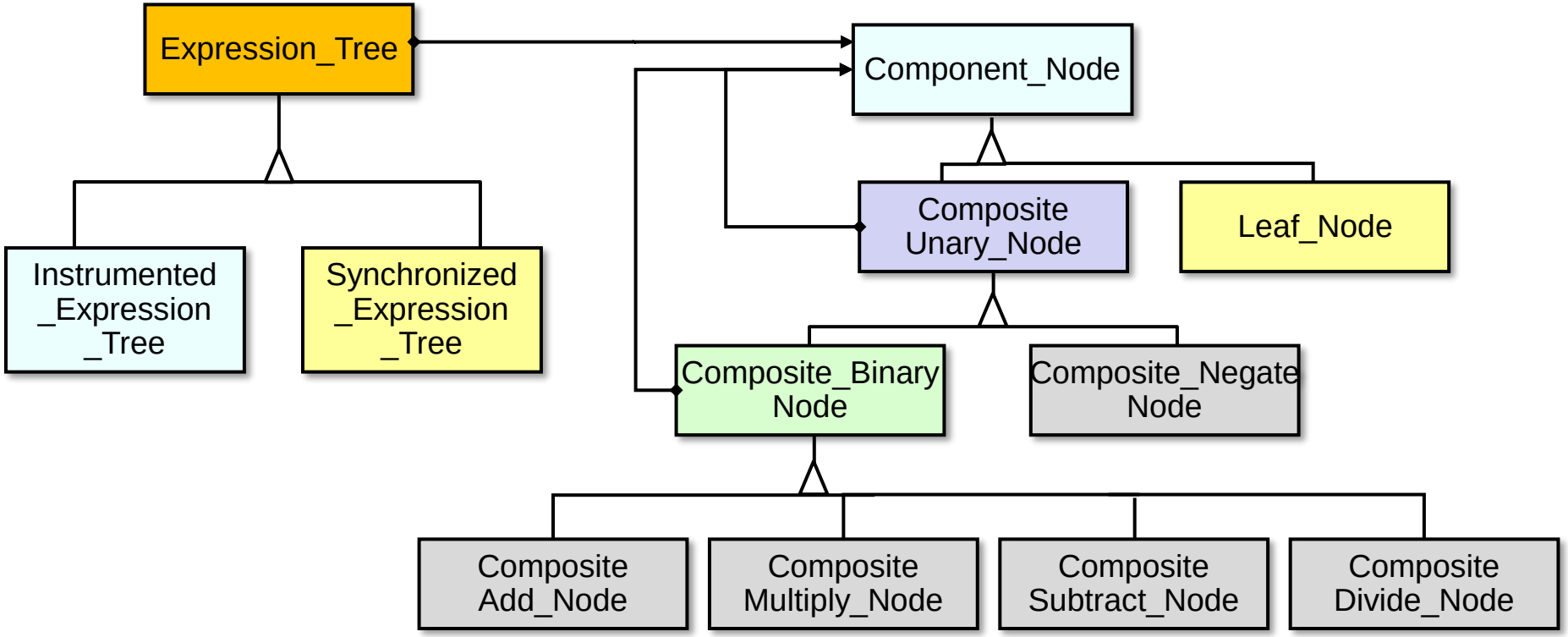
The Bridge Pattern

Motivating Example

Douglas C. Schmidt

Learning Objectives in This Lesson

- Recognize how the *Bridge* pattern can be applied to make the expression tree structure easier to access & evolve transparently.



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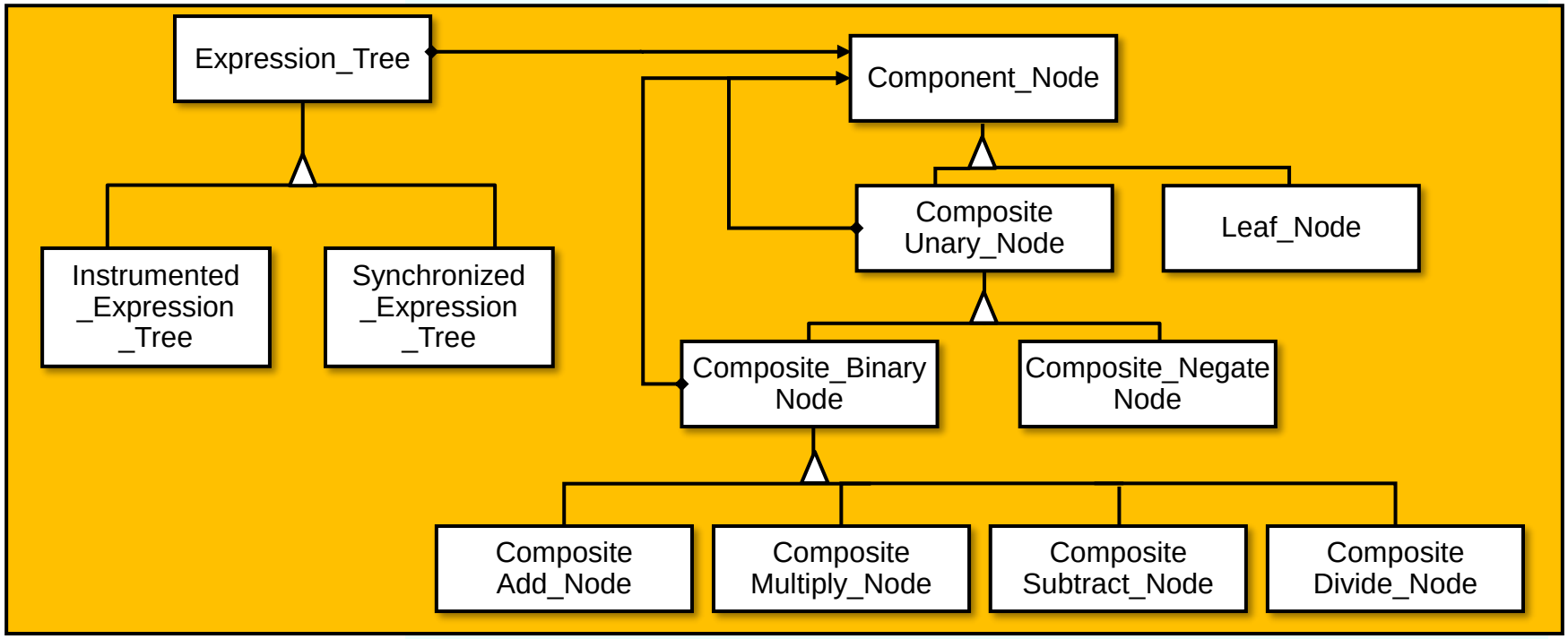
Motivating the Need for the Bridge Pattern in the Expression Tree App

A Pattern for Binding One of Many Variations

***Purpose**: Decouple the expression tree programming API from its behavior & implementation to enable transparent extensibility.*



Bridge minimizes coupling between clients, abstractions, & implementations.

Context: OO Expression Tree Processing App

- The app needs to run in a range of design-time & runtime environments

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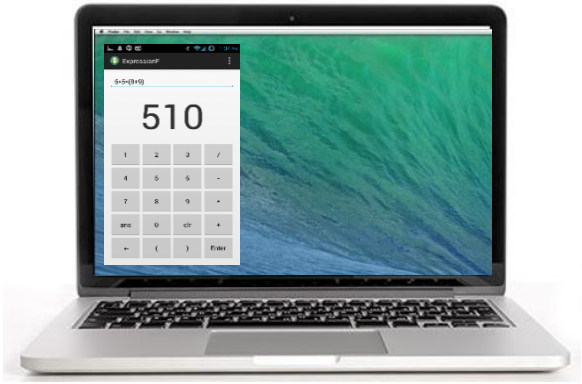
  - Mobile devices with limited memory & processing power



Context: OO Expression Tree Processing App

- The app needs to run in a range of design-time & runtime environments, e.g.,
  - Mobile devices with limited memory & processing power
  - Laptops & desktops with more abundant resources

Problem: Minimizing Impact of Variability

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Component_Node node =
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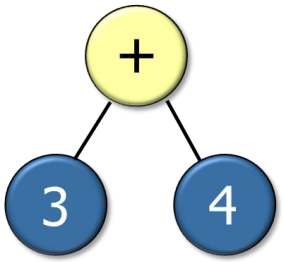

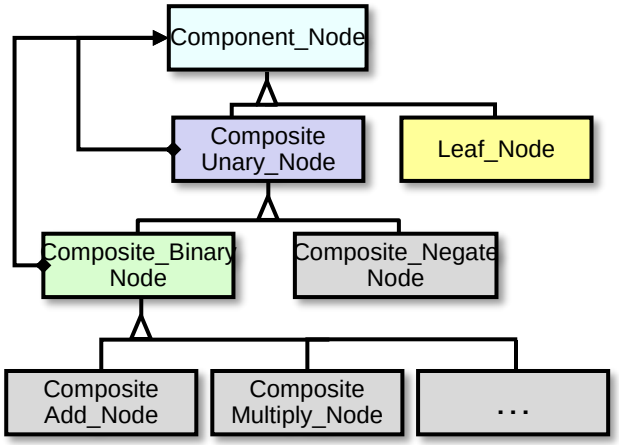

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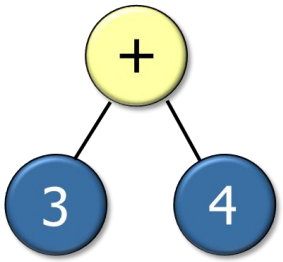

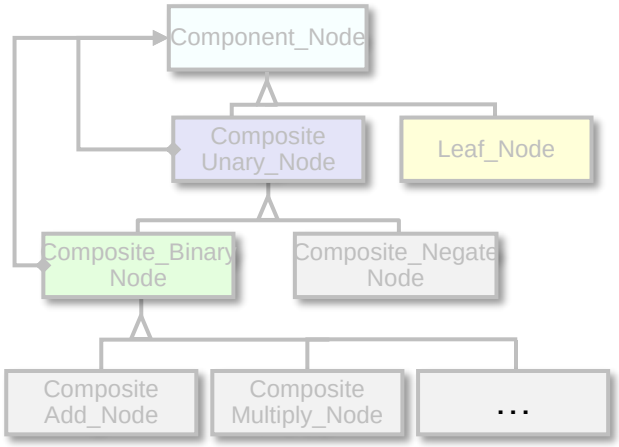

VS.

```
Component_Node node =
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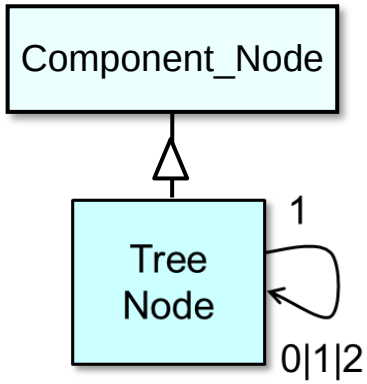

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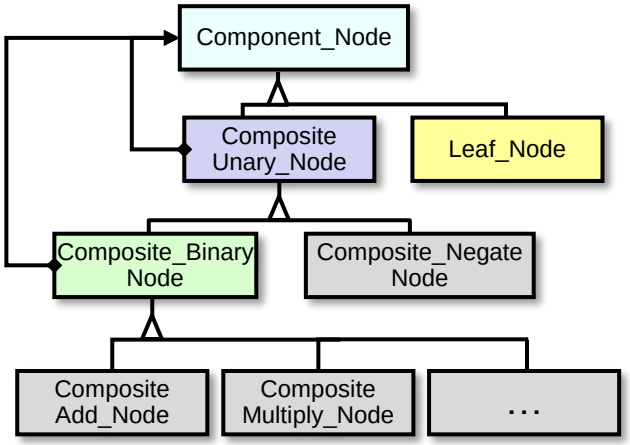
Different implementations have different time/space trade-offs

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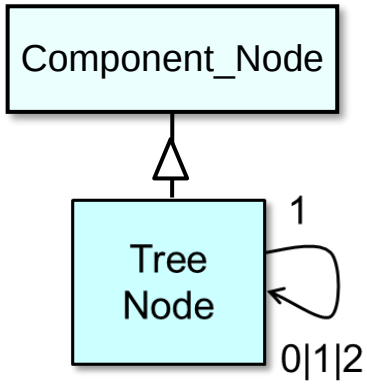

We should be able to change implementations without breaking client code.

Problem: Minimizing Impact of Variability

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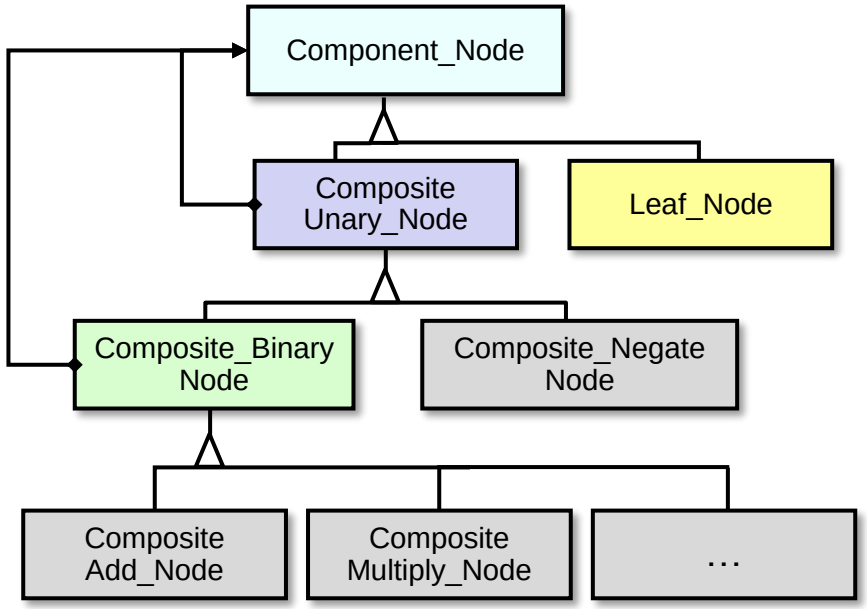
  - Hard to change services transparently



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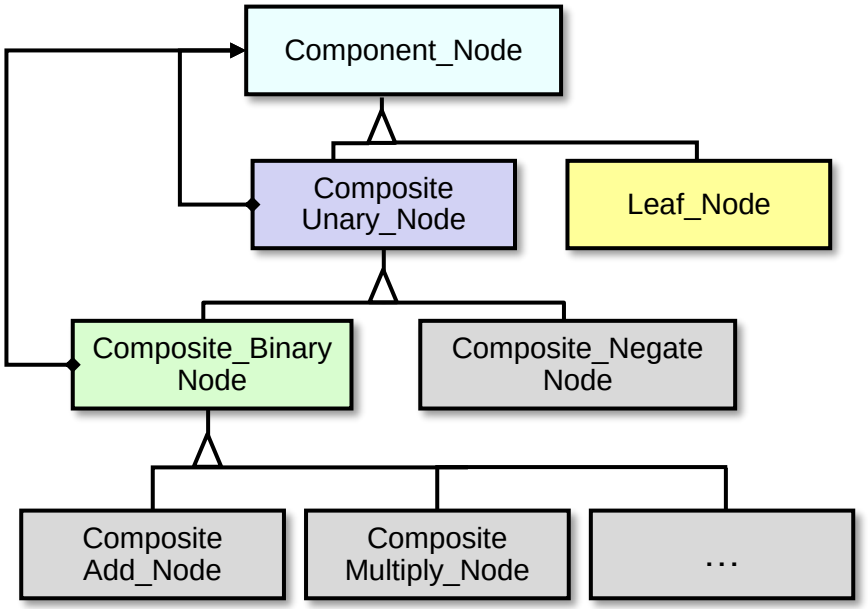

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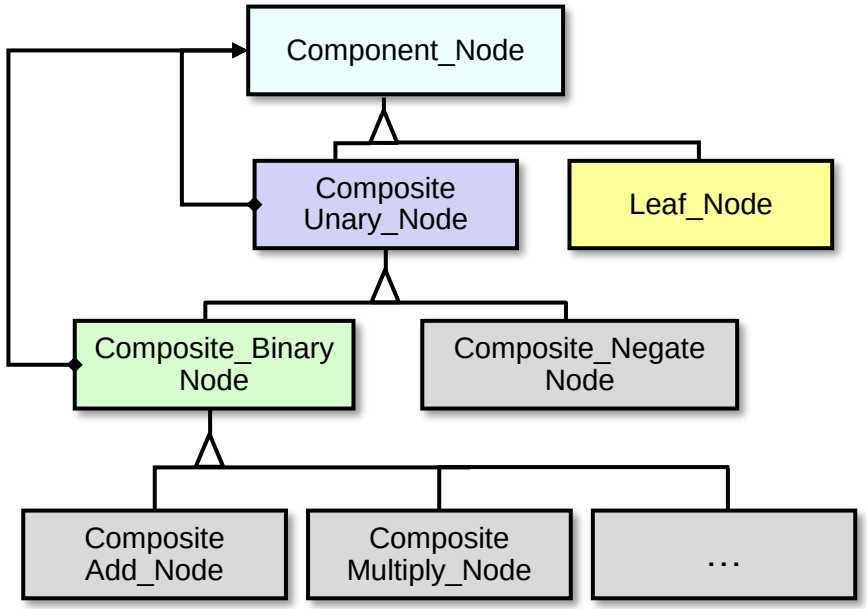

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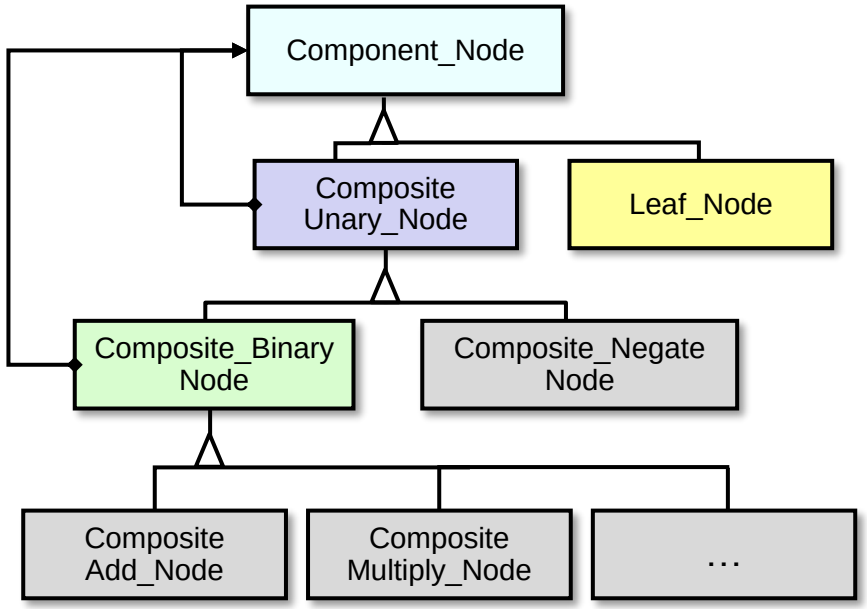

We should be able to enhance the service without breaking its implementation.

Solution: Separate Abstraction & Implementation

- Encapsulate variability behind a stable API that creates separate class hierarchies for an abstraction

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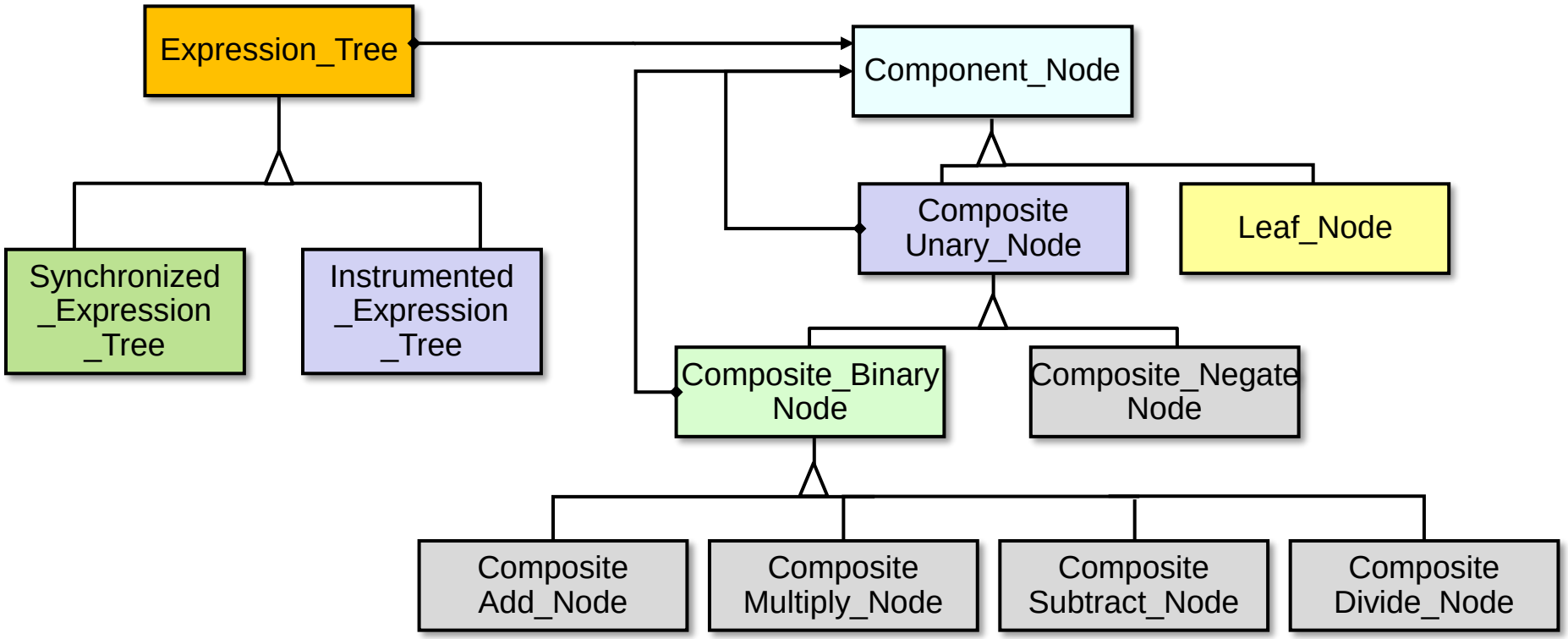
- Encapsulate variability behind a stable API that creates separate class hierarchies for an abstraction & its implementations.



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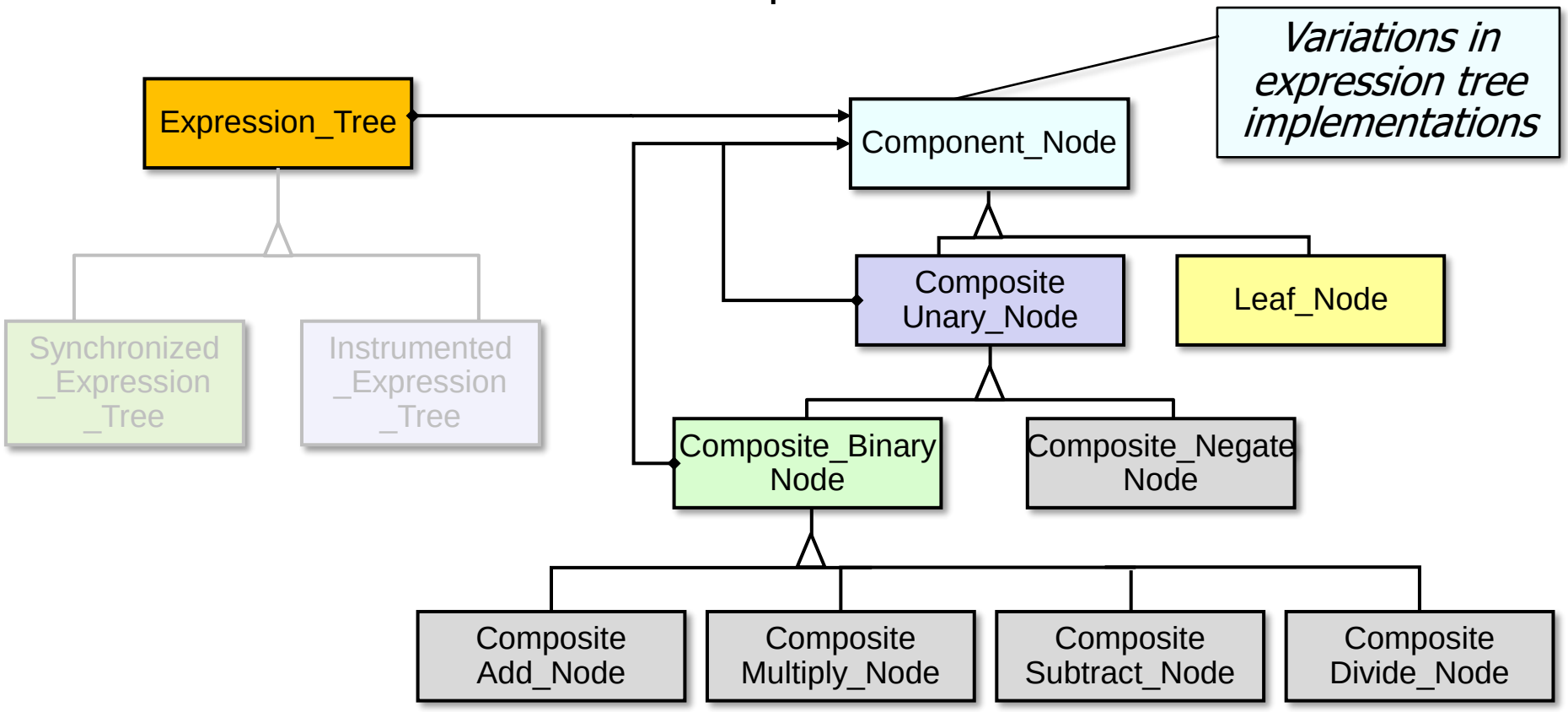

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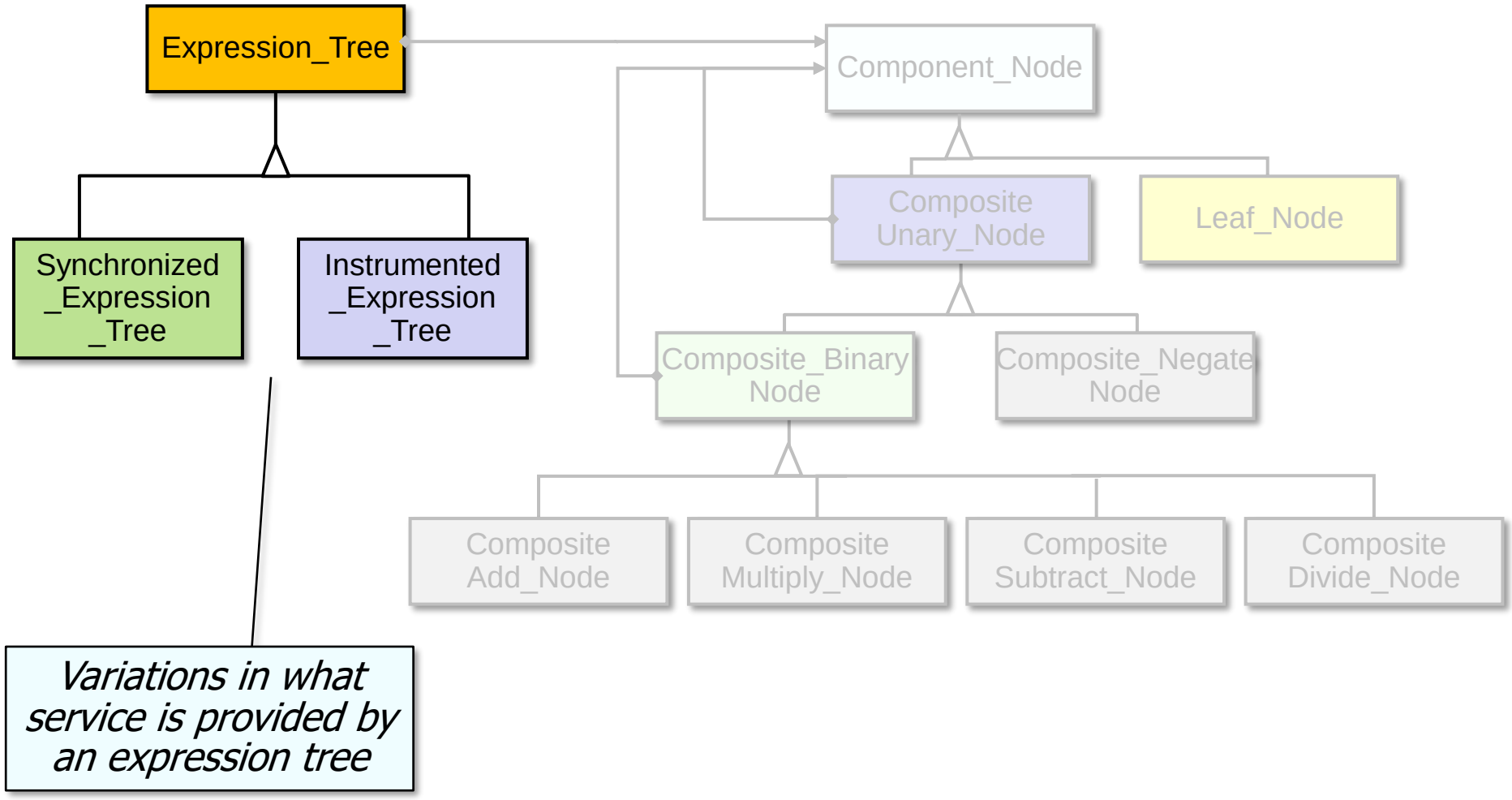
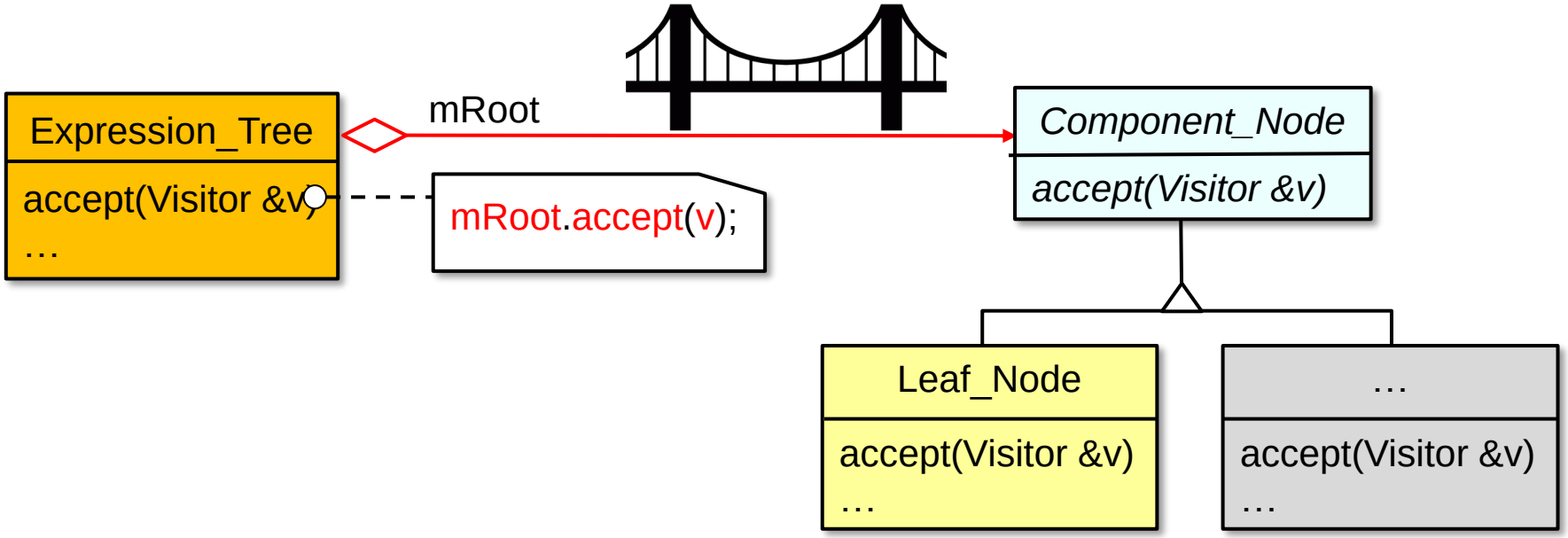


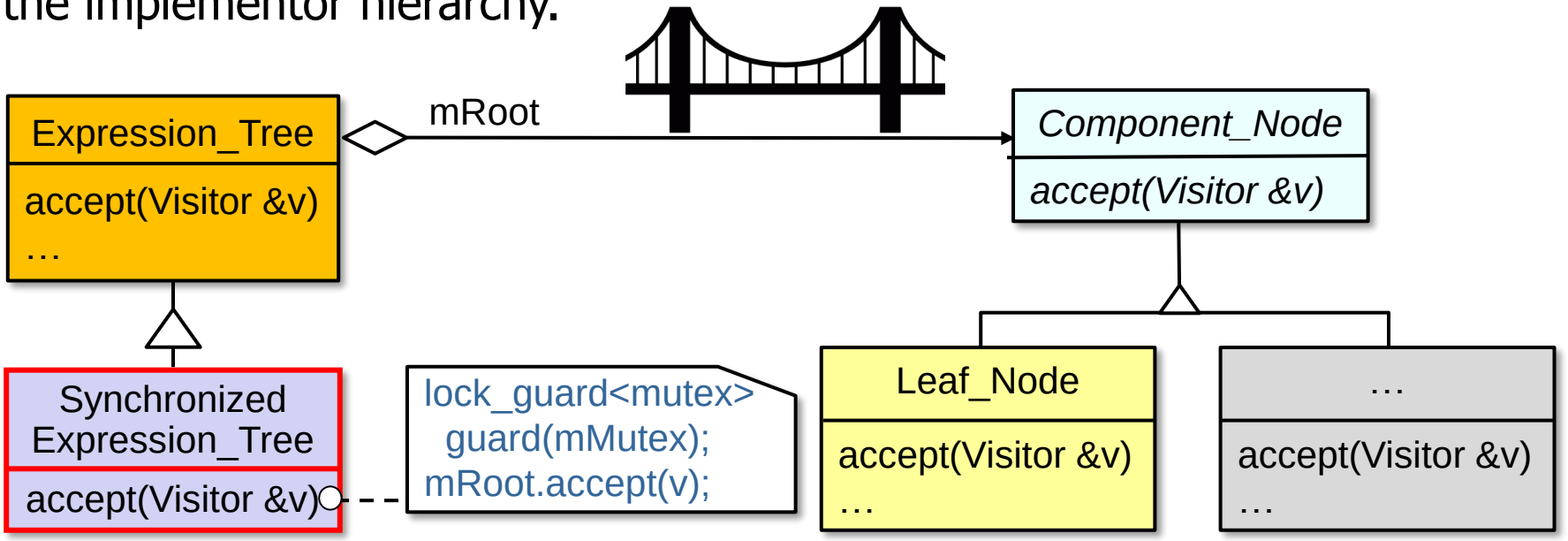
Solution: Separate Abstraction & Implementation

- Encapsulate variability behind a stable API that creates separate class hierarchies for an abstraction & its implementations.
  - Client calls to the abstraction are forwarded to the corresponding implementor subclass.



Solution: Separate Abstraction & Implementation

- Encapsulate variability behind a stable API that creates separate class hierarchies for an abstraction & its implementations.
  - Client calls to the abstraction are forwarded to the corresponding implementor subclass.
  - Subclass the abstraction class to enable different services without affecting the implementor hierarchy.



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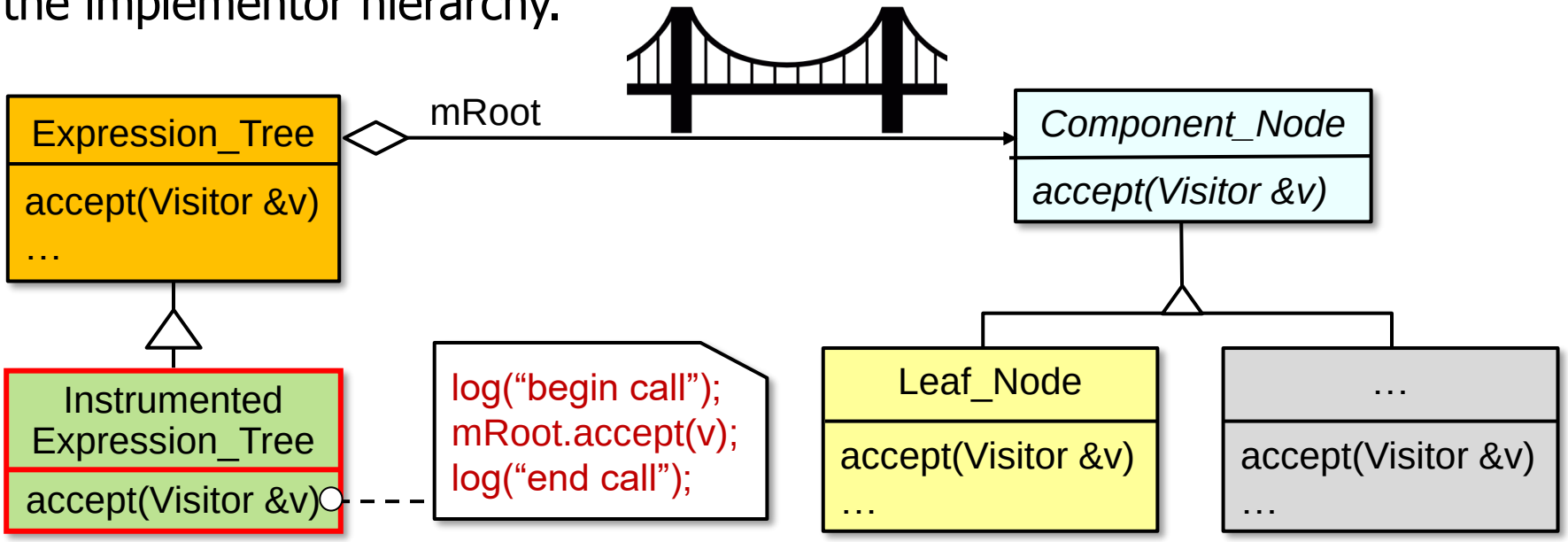

Expression_Tree Class Overview

- Defines an abstraction that shields clients from implementation details of expression tree that may change at design-time or runtime

Class methods

```
                Expression_Tree(Component_Node *root)
           bool is_null()
            int item()
Expression_Tree left()
Expression_Tree right()
           void accept(Visitor &visitor)
       iterator begin(const string &traversal_order)
       iterator end(const string &traversal_order)
```

See upcoming lessons on *Factory Method*, *Iterator*, & *Visitor* patterns.

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Pass in the root of the implementor hierarchy

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Forward to implementor hierarchy

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Plays essential role in the *Iterator* & *Visitor* patterns.

See upcoming lessons on "*The Iterator Pattern*" & "*The Visitor Pattern*."

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Factory methods creates iterators

See upcoming lessons on *Factory Method*, *Iterator*, & *Strategy* patterns.

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- **Commonality**: provides a common interface for expression tree operations
- **Variability**: component nodes will vary depending on user input expressions; iterator behavior can vary; & expression tree itself can vary