Structural Pattern: Flyweight

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Coming Up

Describing the flyweight pattern

- Characters of a document
- Intrinsic and extrinsic state

Structure of the flyweight pattern

Variation: unshared concrete flyweight

Coming Up

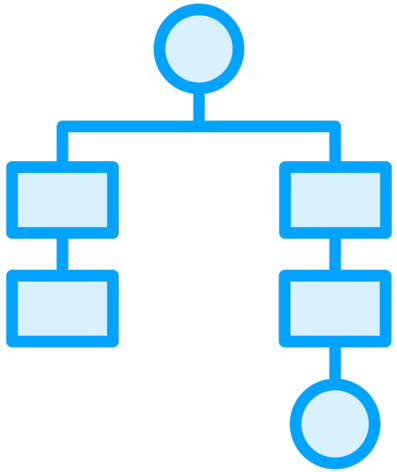
Use cases for this pattern

Pattern consequences

Related patterns

Describing the Flyweight Pattern

Creational



Structural

Behavioral

Flyweight

The intent of this pattern is to use sharing to support large number of fine-grained objects efficiently. It does that by sharing parts of the state between these objects instead of keeping all that state in all of the objects.

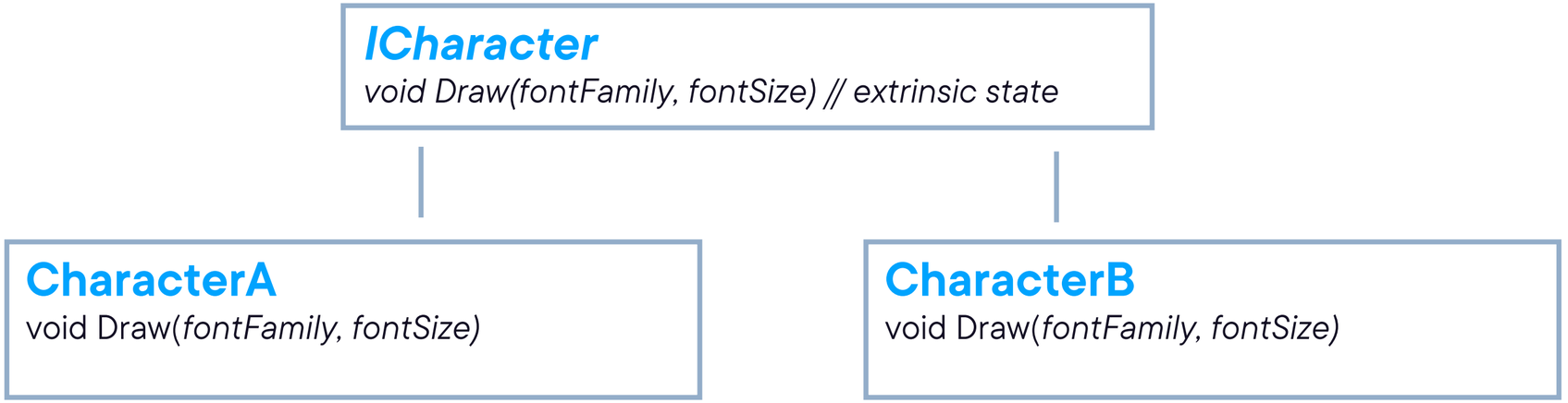
Describing the Flyweight Pattern

Sharing the characters of a document

- Creating a new object instance for each character would require a lot of memory

Describing the Flyweight Pattern

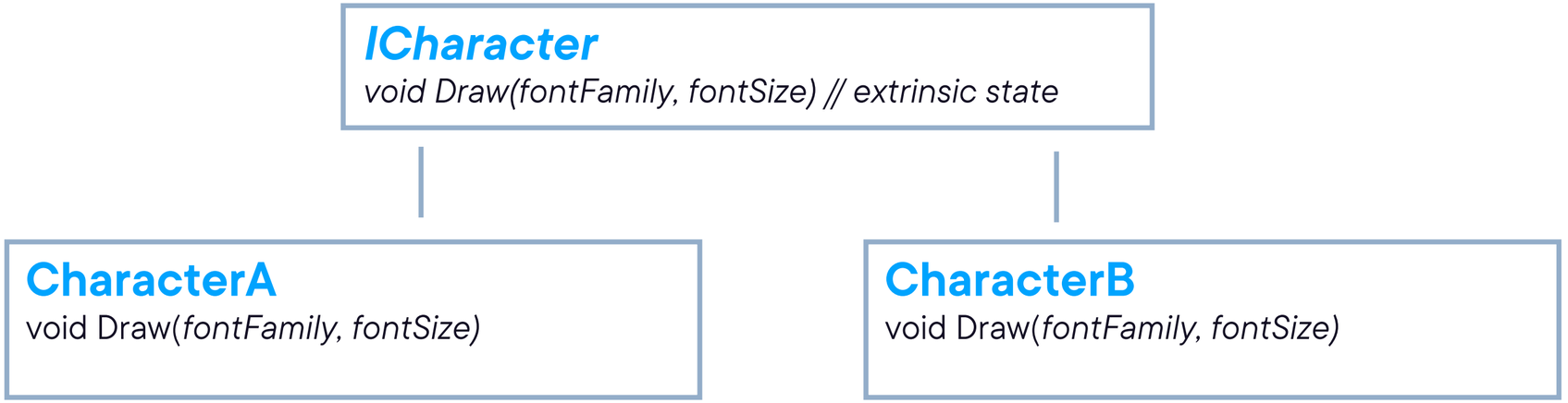
Describing the Flyweight Pattern



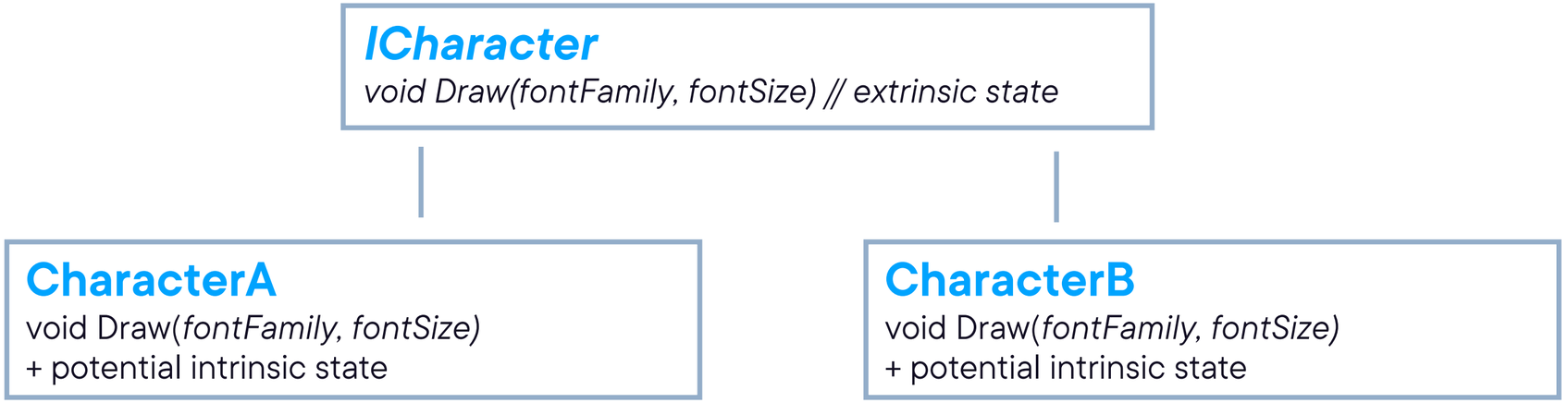
Intrisic versus Extrinsic State

Intrinsic state	vs	Extrinsic state
State data that is independent of the context For example: the actual character that's going to be drawn		State data that varies with the context: different class instances might have different extrinsic state data which cannot be shared For example: the font family and font size to draw a character with

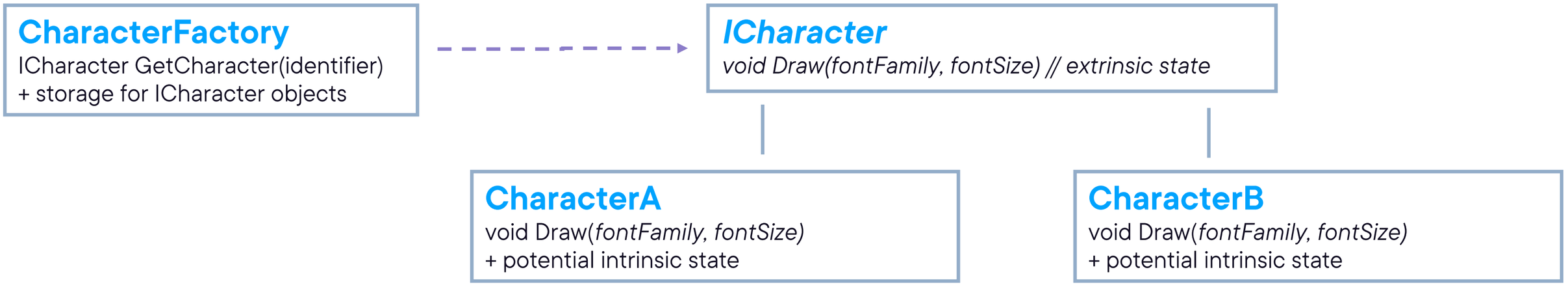
Describing the Flyweight Pattern



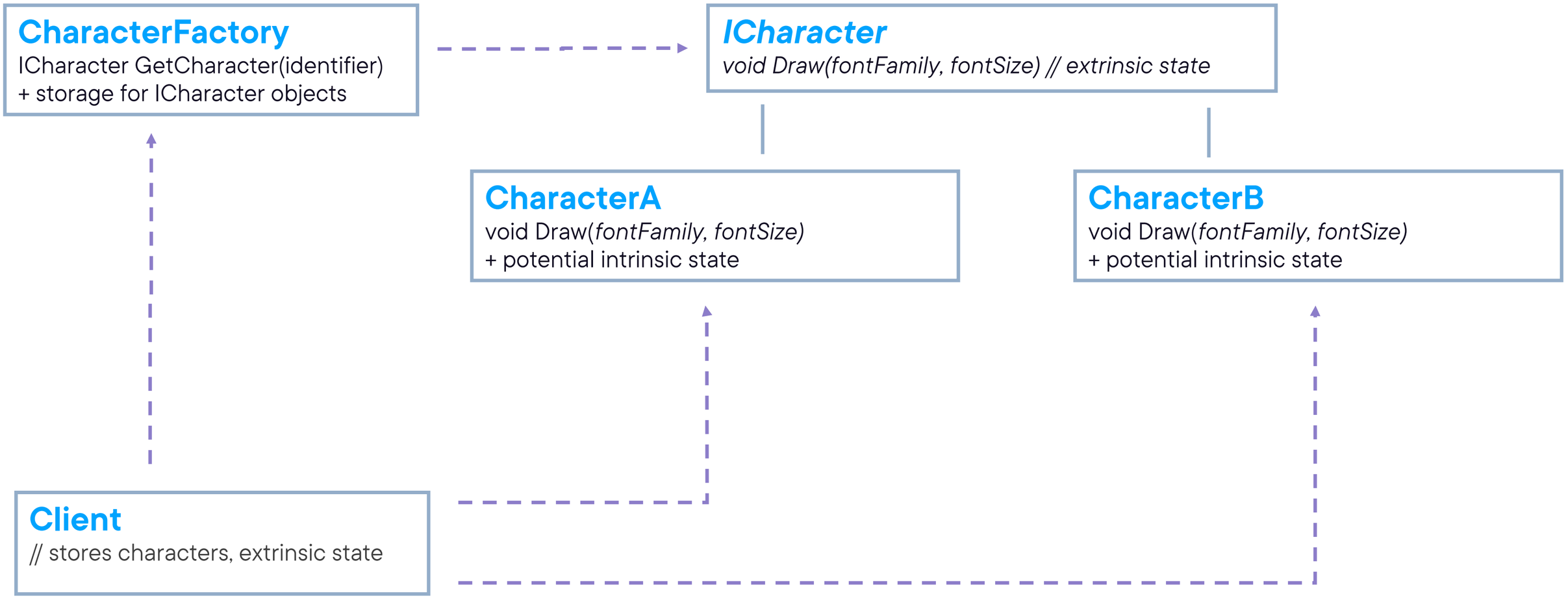
Describing the Flyweight Pattern



Describing the Flyweight Pattern



Describing the Flyweight Pattern



Describing the Flyweight Pattern

What about other examples?

- A product management system with products with a fixed category that differ in weight and names
- An ordering system with a few intrinsic values per order
- A library system

Considerations Before Choosing the Flyweight Pattern

Does the application use a large number of objects?

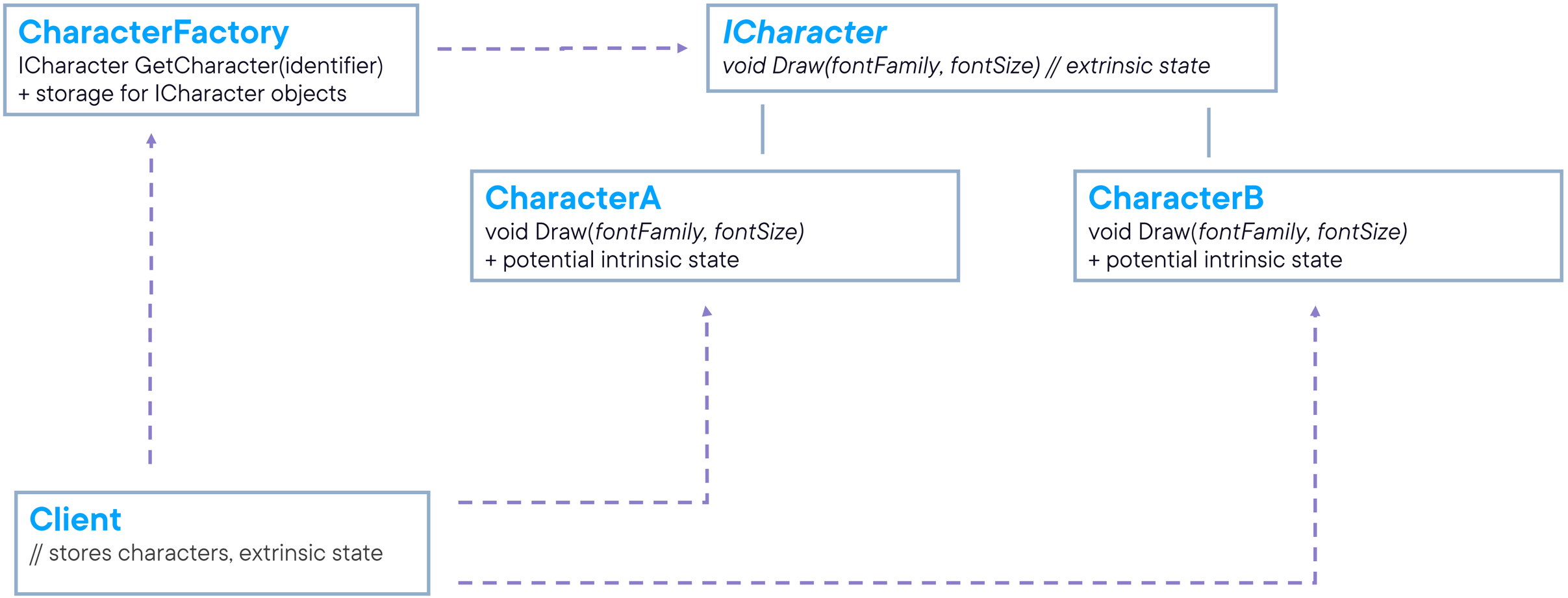
Are storage costs high because of the large amount of objects?

Can most of the object state be made extrinsic?

If you remove extrinsic state, can a large group of objects be replaced by relatively few shared objects?

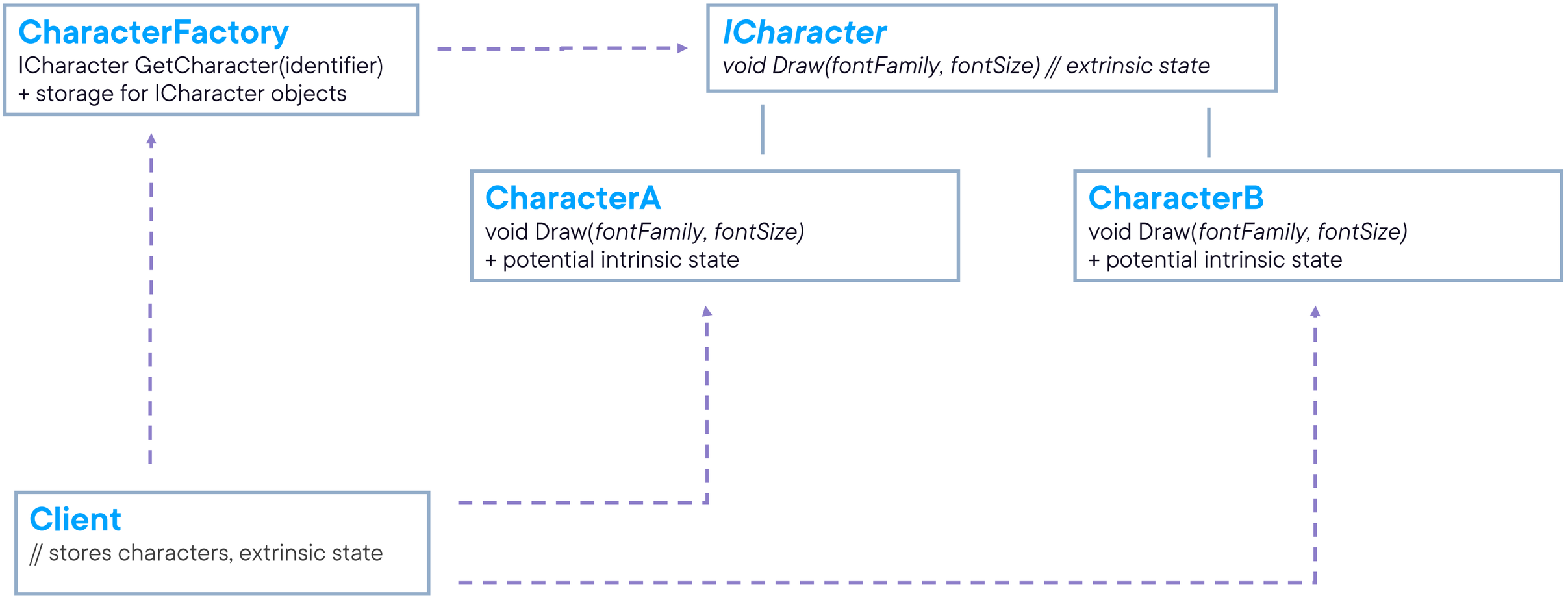
Does the application require object identity?

Structure of the Flyweight Pattern



`Flyweight` **declares an interface through which they can receive and act on extrinsic state**

Structure of the Flyweight Pattern



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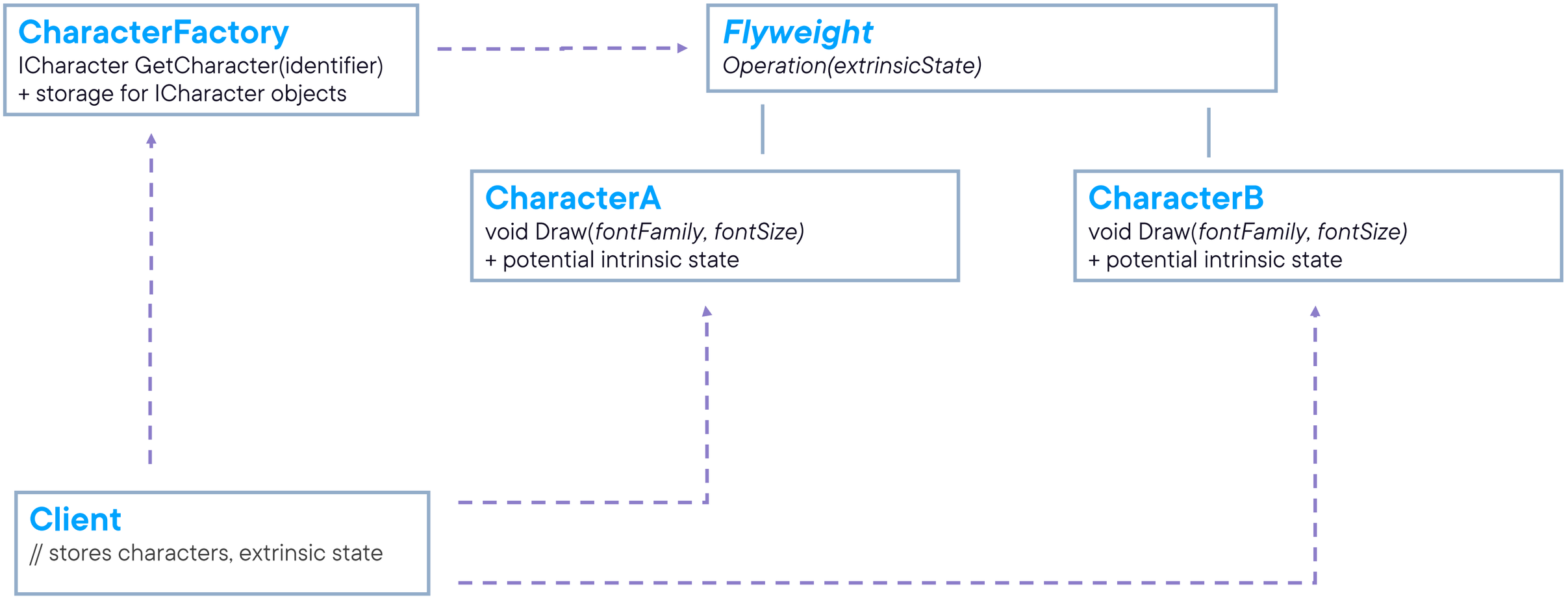

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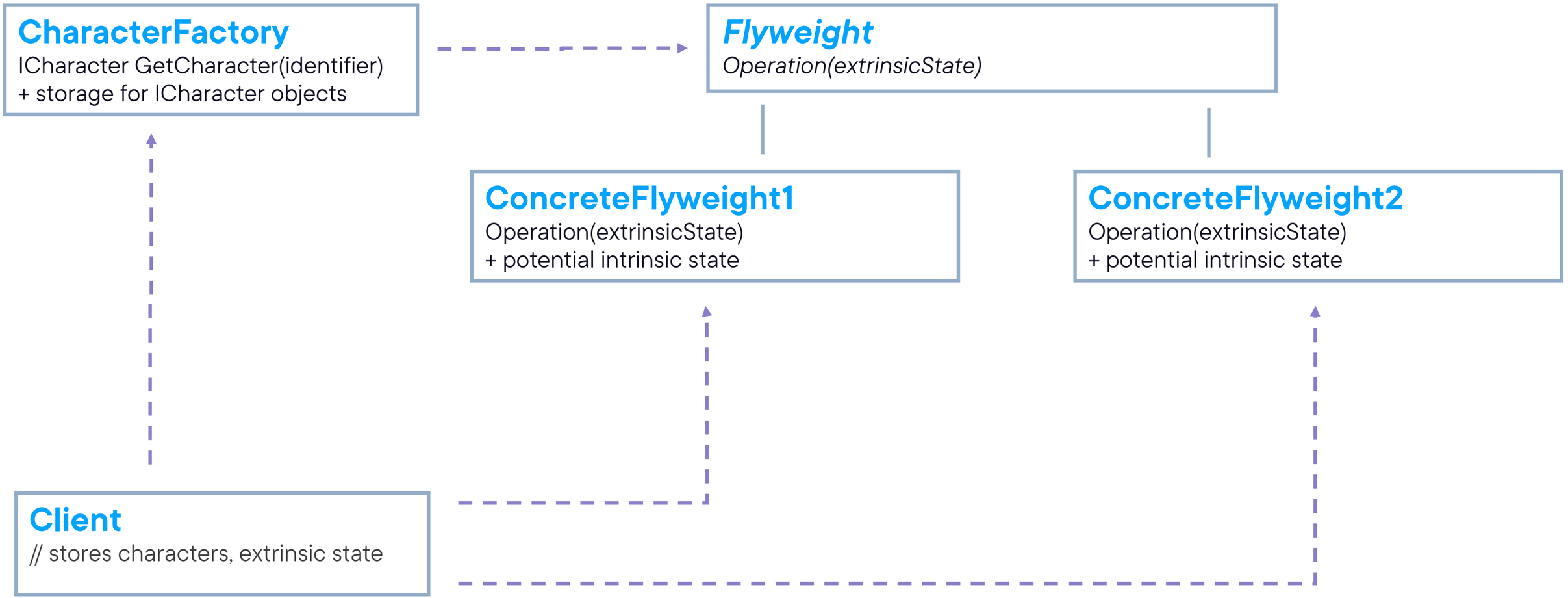
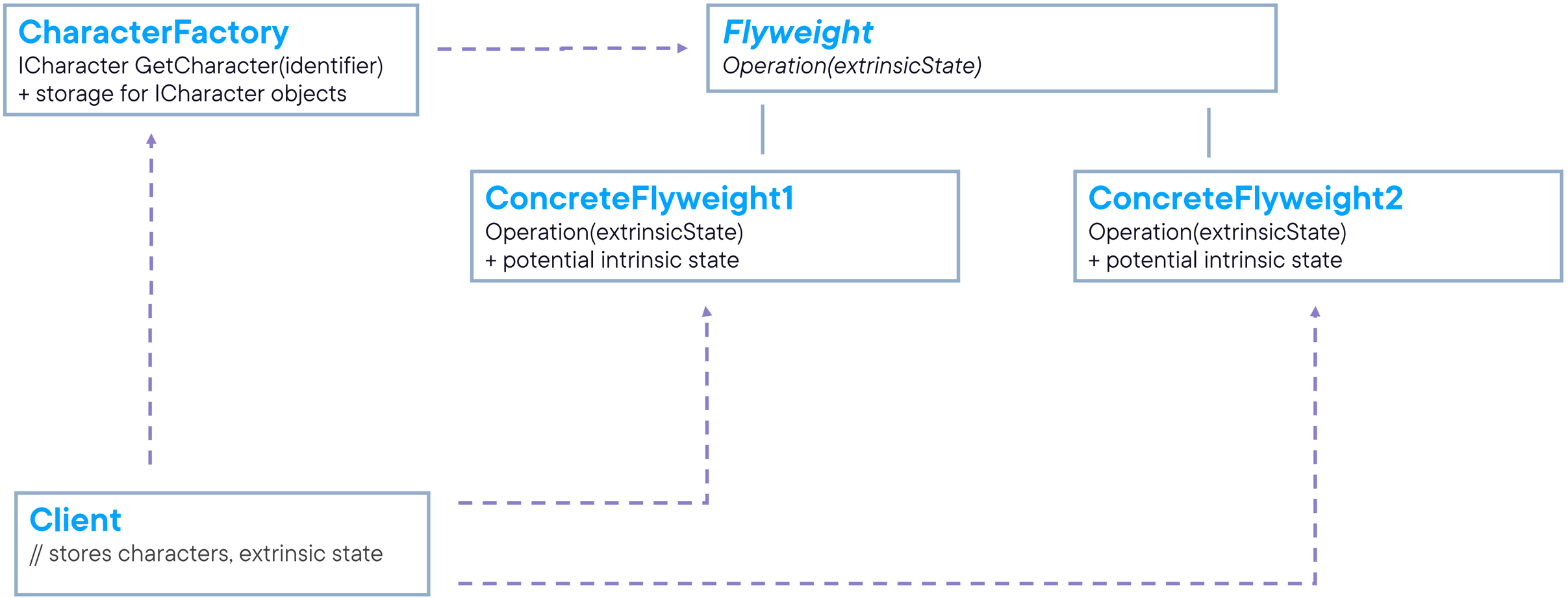


`ConcreteFlyweight` **implements the** `Flyweight` **interface and adds storage for intrinsic state, if any**

Structure of the Flyweight Pattern



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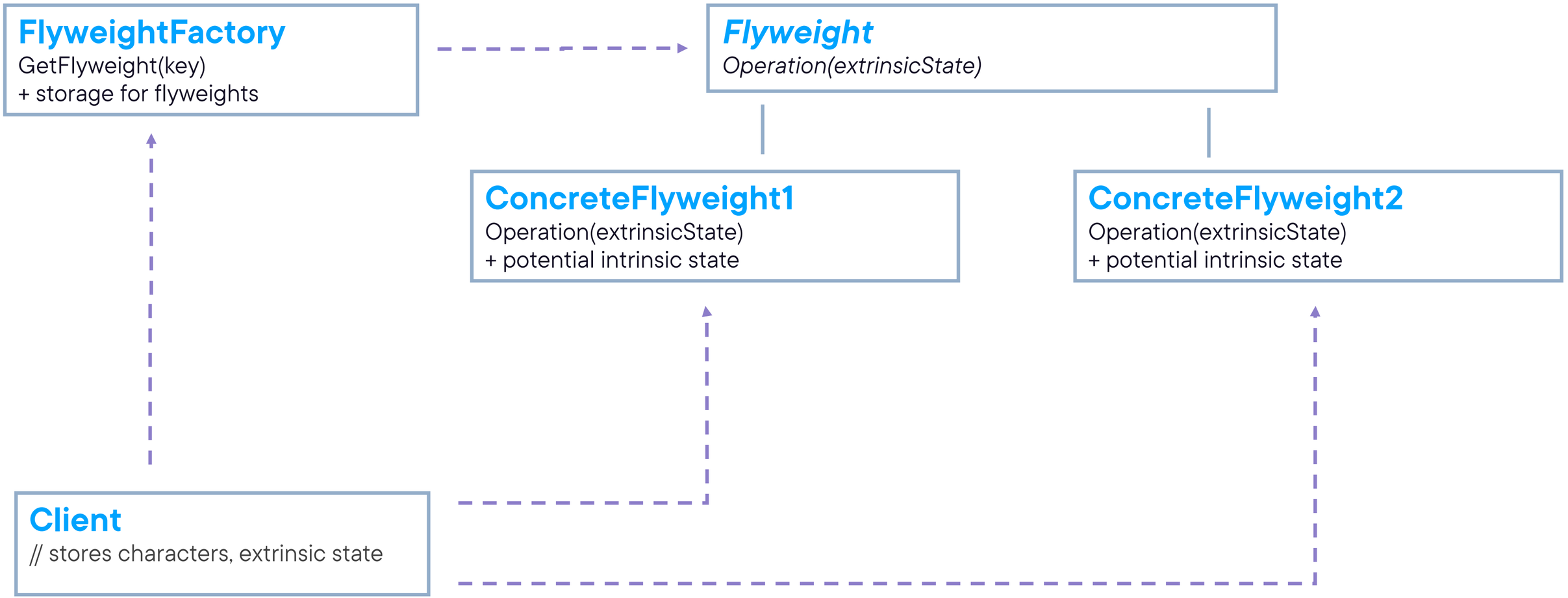
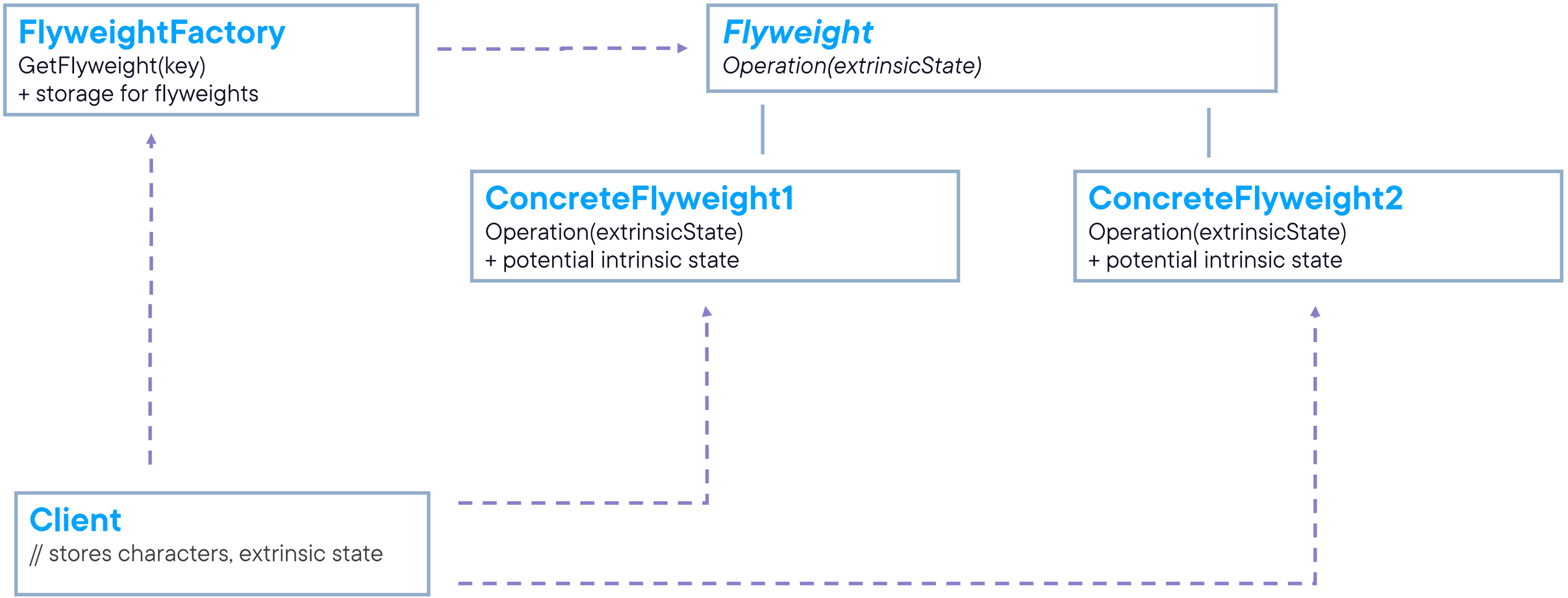


`FlyweightFactory` **creates and manages** `Flyweights` **and ensures they are propery shared**

Structure of the Flyweight Pattern



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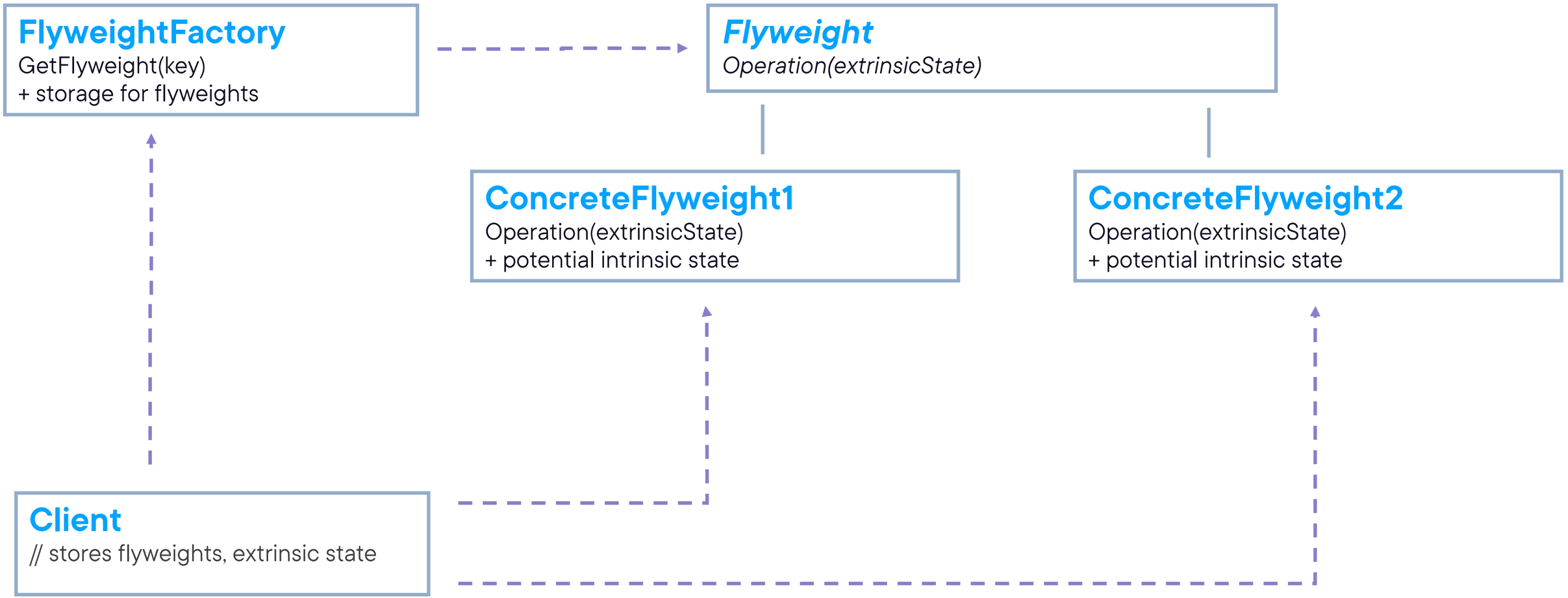
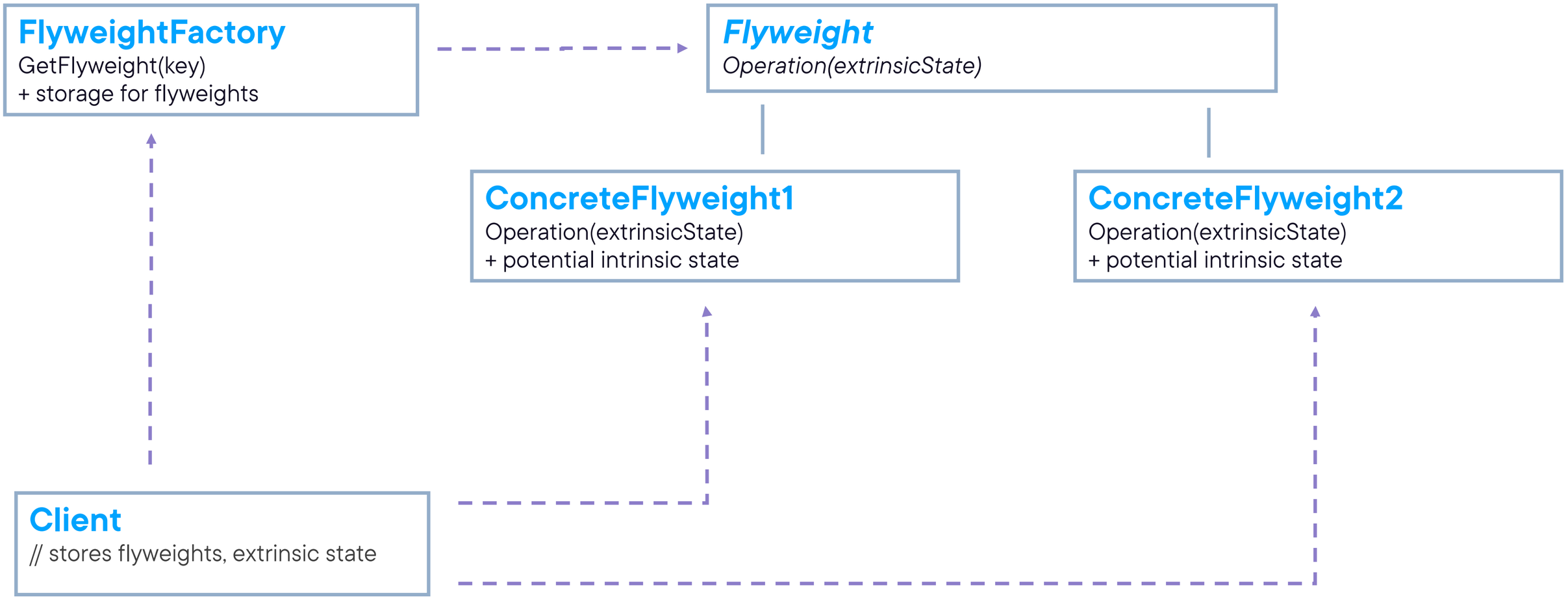


`Client` **maintains a reference of** `Flyweights` **and computes or stores their extrinsic state**

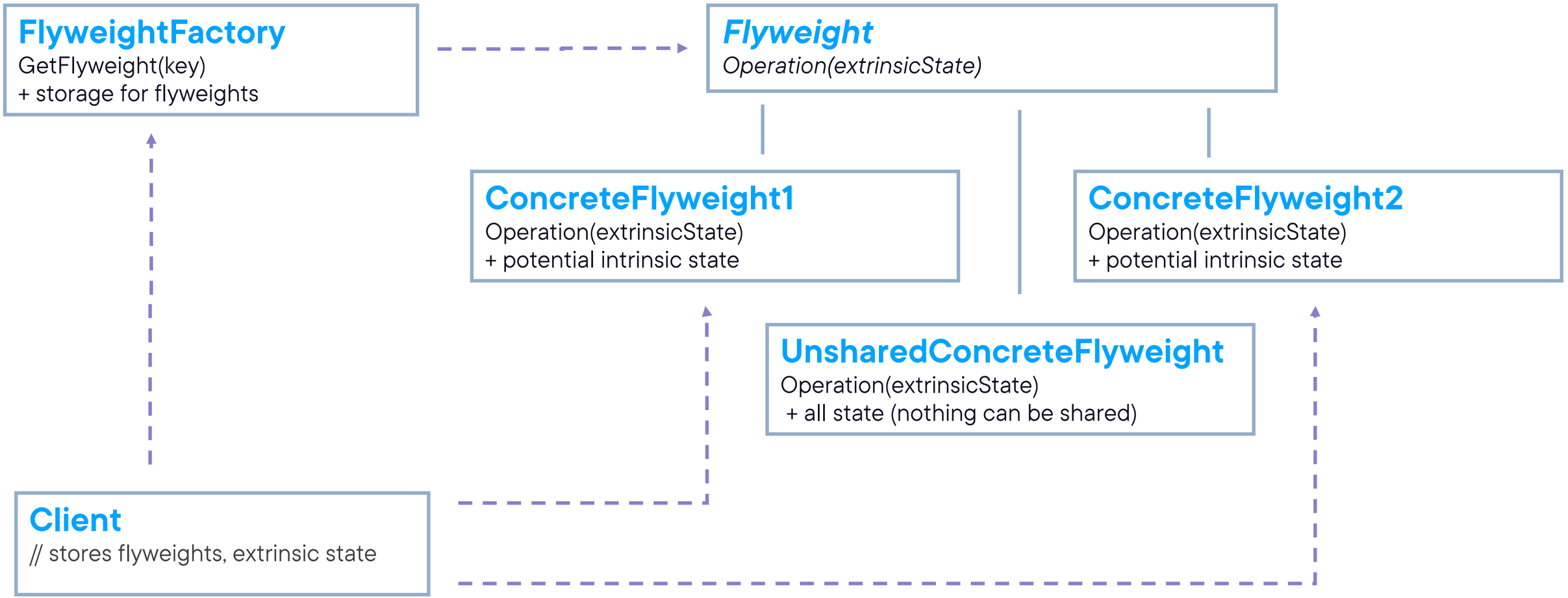
Demo

Implementing the flyweight pattern

Working with an Unshared Concrete Flyweight



Working with an Unshared Concrete Flyweight



Working with an Unshared Concrete Flyweight

Not all flyweights have to be shared

- `UnsharedConcreteFlyweight` enables acting on extrinsic state, while having unshareable intrinsic state

Working with an Unshared Concrete Flyweight

Adding the concept of a paragraph to our document

- Contains a location
- Contains characters (concrete flyweights)
- Doesn't contain anything that can be shared

Working with an Unshared Concrete Flyweight

No storage advantage anymore

- But working with the flyweight remains transparent to the client

Demo

Supporting an unshared concrete flyweight

Use Cases for the Flyweight Pattern

When the application use a large number of objects

When storage costs are high because of the large amount of objects

When most of the object state be made extrinsic

When, if you remove extrinsic state, a large group of objects be replaced by relatively few shared objects

When the application does not require object identity

Use Cases for the Flyweight Pattern

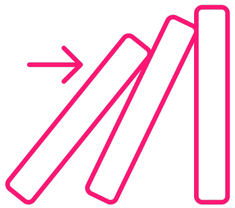
Music playback

Inventory management systems

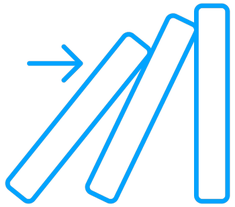
Document parsing and analysis

Game development

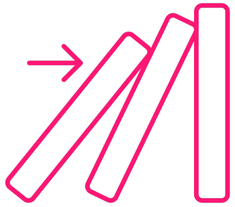
Pattern Consequences



You may save a lot of memory when using the pattern for an applicable use case

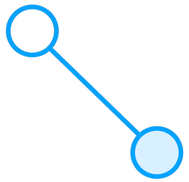


Processing costs might go up, but that's typically offsetted by the reduced storage costs

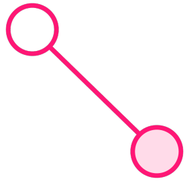


The pattern is complex, which makes the code base more complicated as well

Related Patterns



State
State without instance variables makes these objects flyweights



Strategy
Strategy can be implemented as a flyweight

Summary

Intent of the flyweight pattern:

- Use sharing to support large numbers of fine-grained object efficiently

Key concepts:

- Intrinsic state
- Extrinsic state

Summary

Variation: unshared flyweight

- Doesn’t have state to share

Up Next:

Behavioral Pattern: Template Method