Engineering Solutions Using Associative Collections

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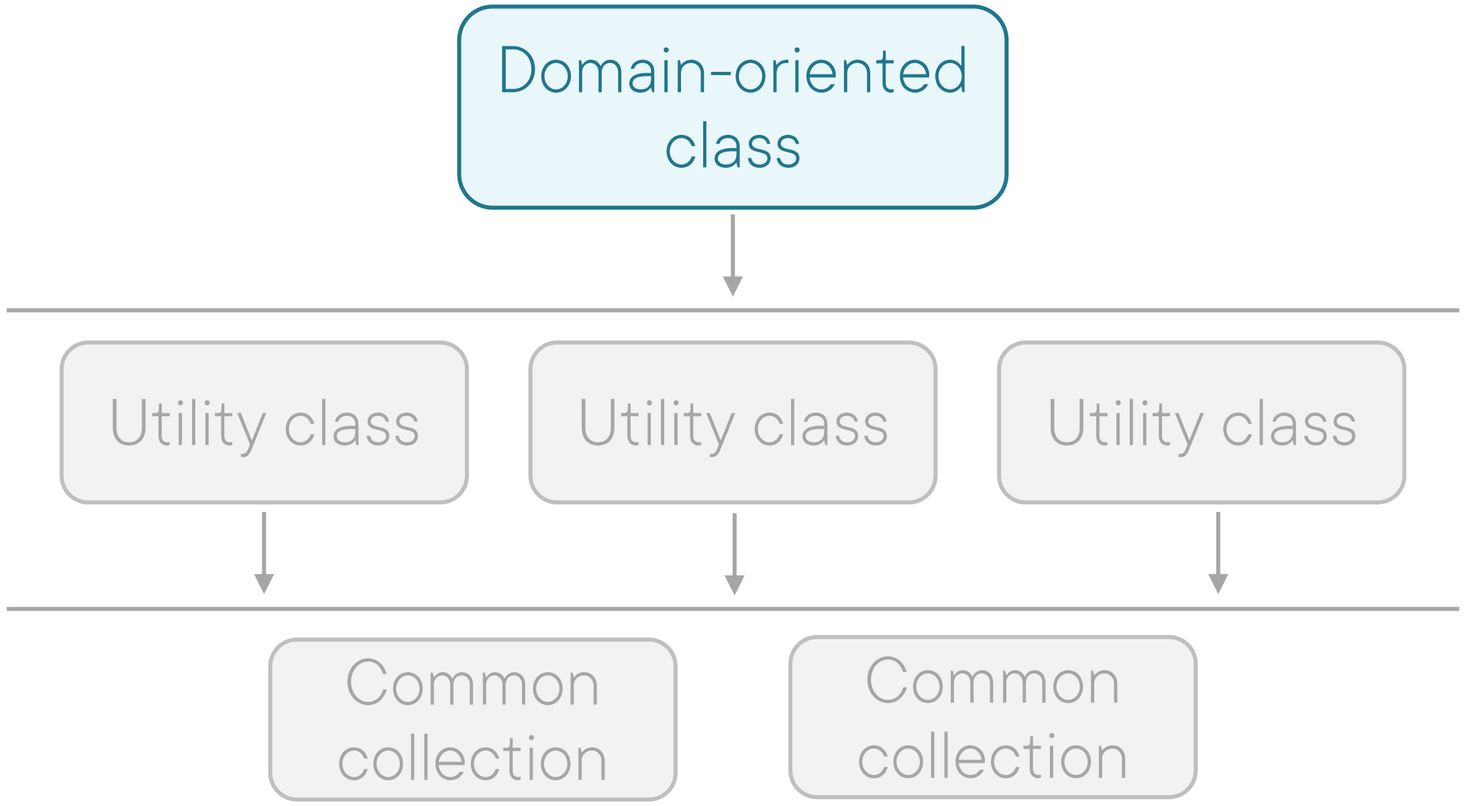
In This Module...

Demo 1

Transparent object cache

Demo 2



In This Module...

Demo 1

Transparent object cache

Caching solution 1

Use a `HashSet<T>`

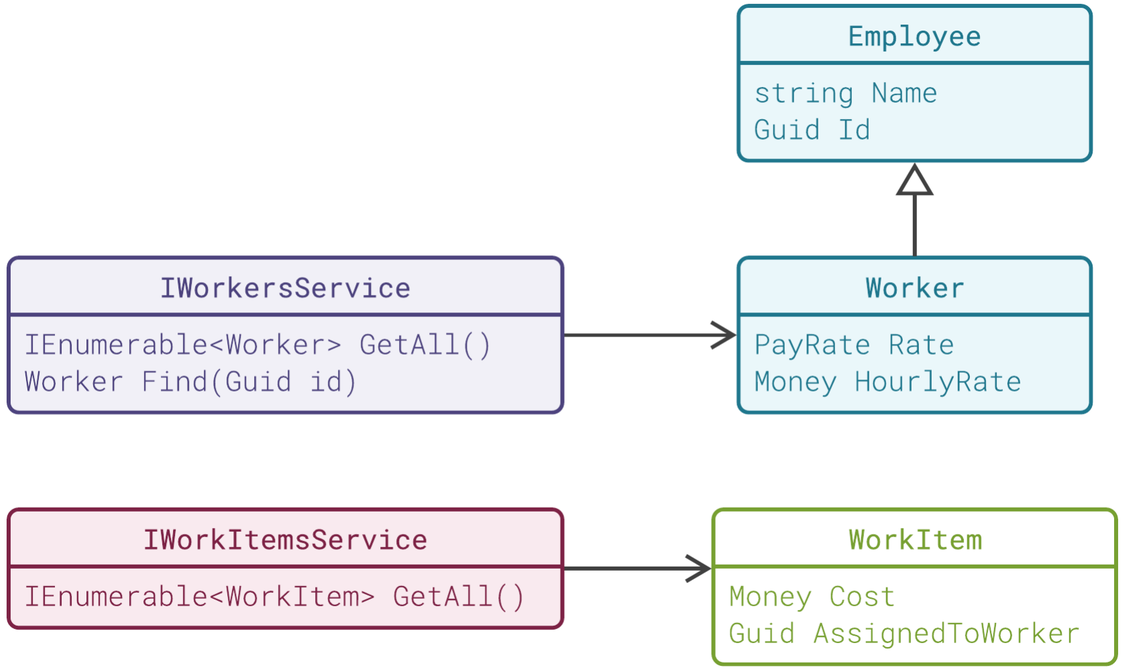
Test if an object is a duplicate

Caching solution 2

Use a `Dictionary<TKey, TValue>`

Use constructor arguments as the key

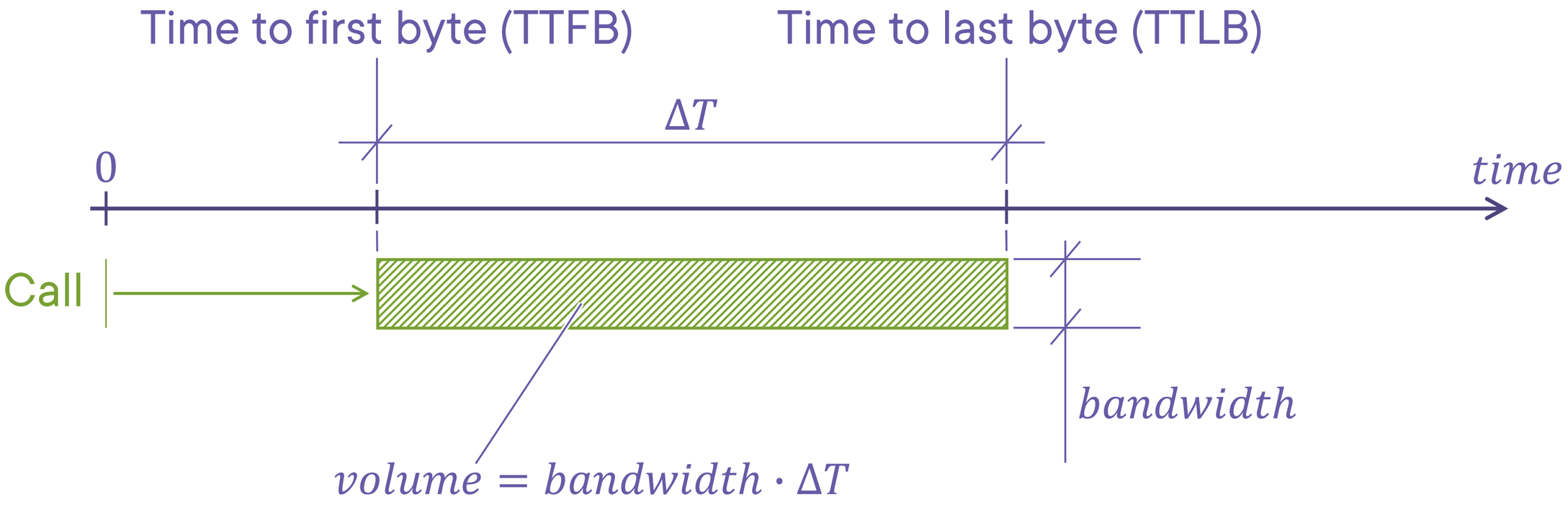
Demo



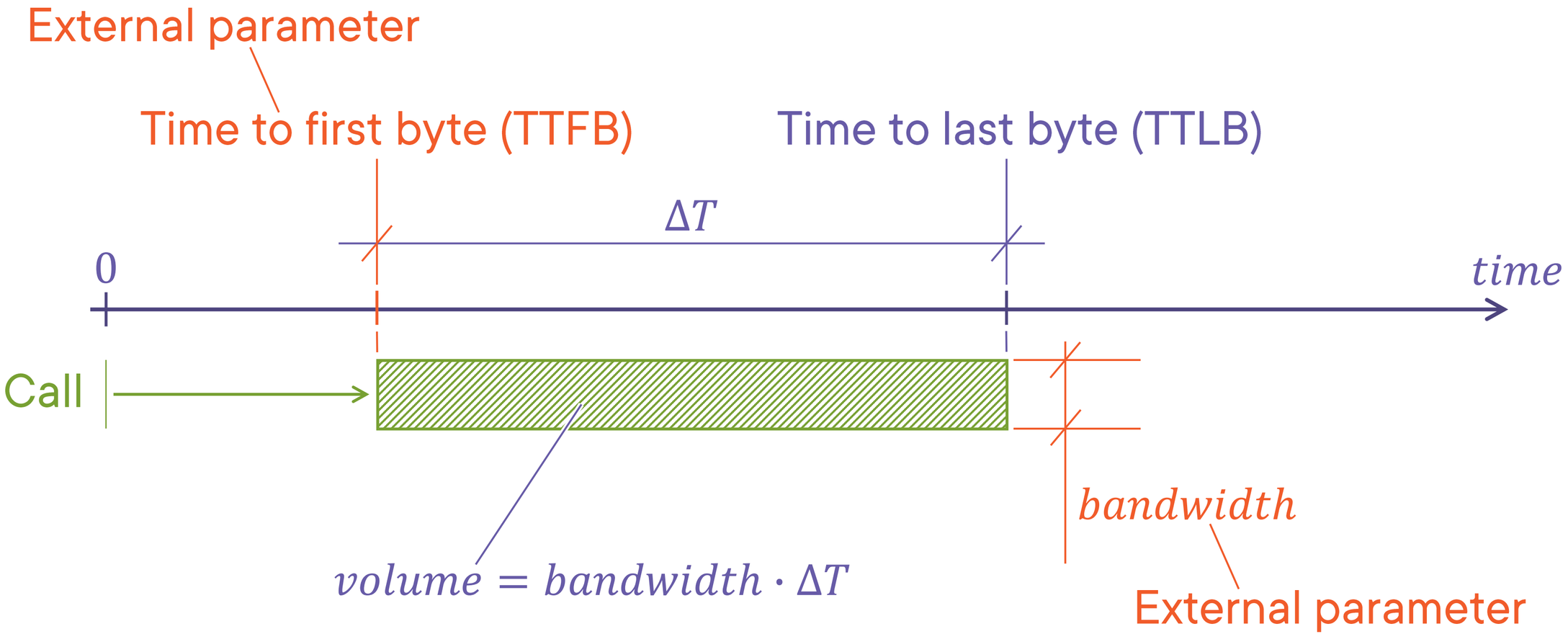
Use the `IWorkItemsService` to fetch work items

Use the `IWorkersService` to fetch the worker for each work item

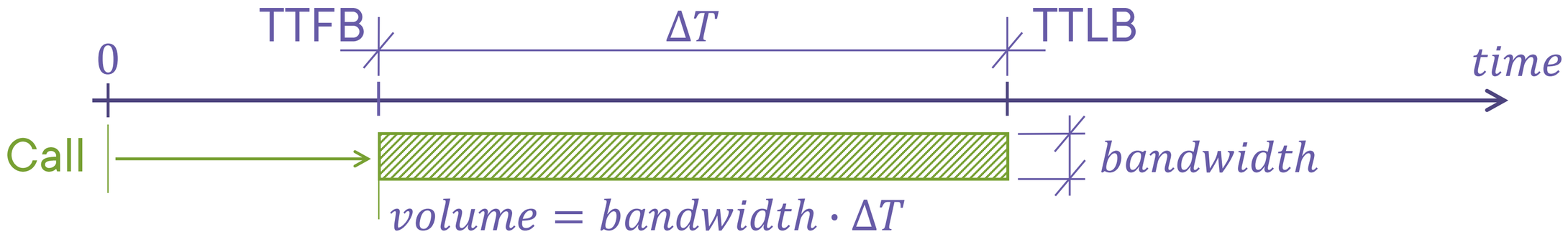
Service Communication Metrics



Service Communication Metrics



Service Communication Metrics



Chunky communication — Large volume implies $\Delta T \gg TTFB$

$$effective\ bandwidth \approx \frac{volume}{\Delta T} = bandwidth$$

Chatty communication — Small volume implies $TTFB \gg \Delta T$

$$effective\ bandwidth \approx \frac{volume}{TTFB} \ll bandwidth$$

```
1  using System.Diagnostics;
2
3  try
4  {
5      (IWorkersService workers, IWorkItemsService workItems) = CreateServices();
6
7      int batchSize = 1000;
8
9      Stopwatch time = Stopwatch.StartNew();
10     foreach (WorkItem workItem in workItems.GetAll().Take(batchSize))
11     {
12         workers.Find(workItem.AssignedToWorker);
13     }
14     Console.WriteLine($"Processed {batchSize} item(s) in {time.Elapsed}");
15 }
16
17
18
19
20
21
22
23
24
25
```

.vscode
ConsoleDemo
ConsoleDemo.csproj
CurrencyCreationBen...
Operators.cs
Program.cs
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IOrderedList.cs
LruCache.cs
TransparentCache.cs
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FinanceExtensions.cs
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IWorkItemsService.cs
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Money.cs
MoneyBag.cs
PayRate.cs
Worker.cs
WorkItem.cs
Models.Tests
Data
Services
DelayingWorkersSer...
TestWorkItemsServic...
Models.Tests.csproj

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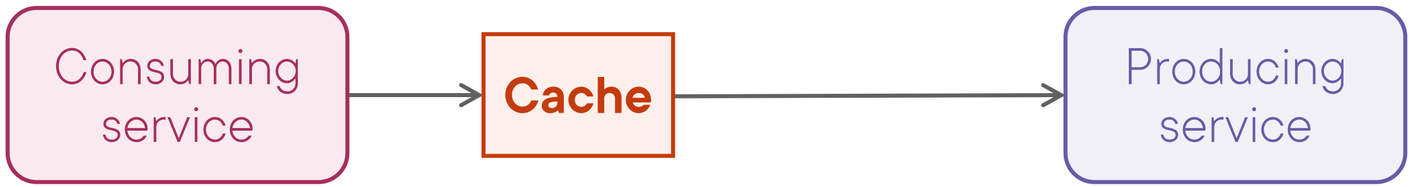

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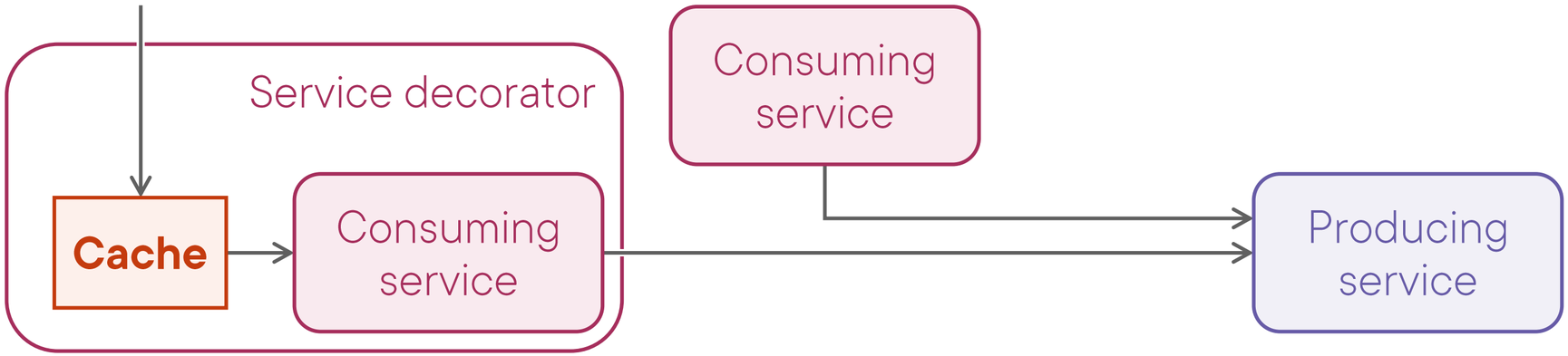

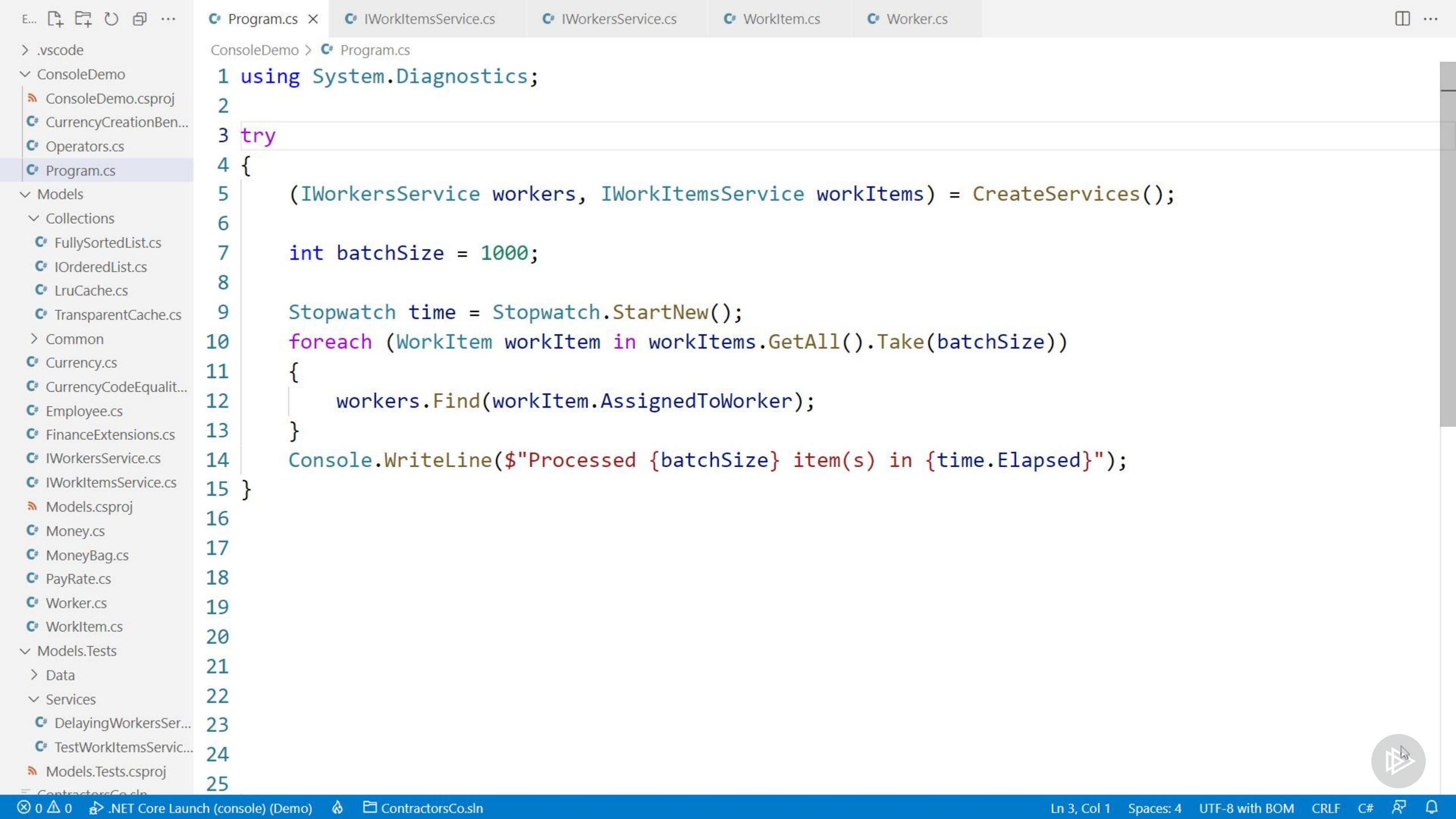
Program.cs
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ConsoleDemo > Program.cs
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0 0
.NET Core Launch (console) (Demo)
ContractorsCo.sln
Ln 3, Col 1
Spaces: 4
UTF-8 with BOM
CRLF
C#

- .vscode
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  - Common
    - Formatting
    - Pagination
    - Shuffling
    - ArgumentExtension...
    - IPage.cs
    - IPaginated.cs
    - Operators.cs
    - SinglePassSequence...
    - TransparentCaching....
  - Currency.cs
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  - IWorkItemsService.cs
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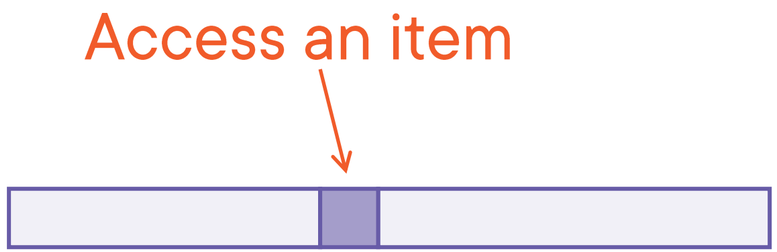
  - MoneyBag.cs


```
1 namespace Models.Collections;
2
3 public class LruCache<TKey, TValue> where TKey : IEquatable<TKey>
4 {
5 }
```



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The least recently used item

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5 }
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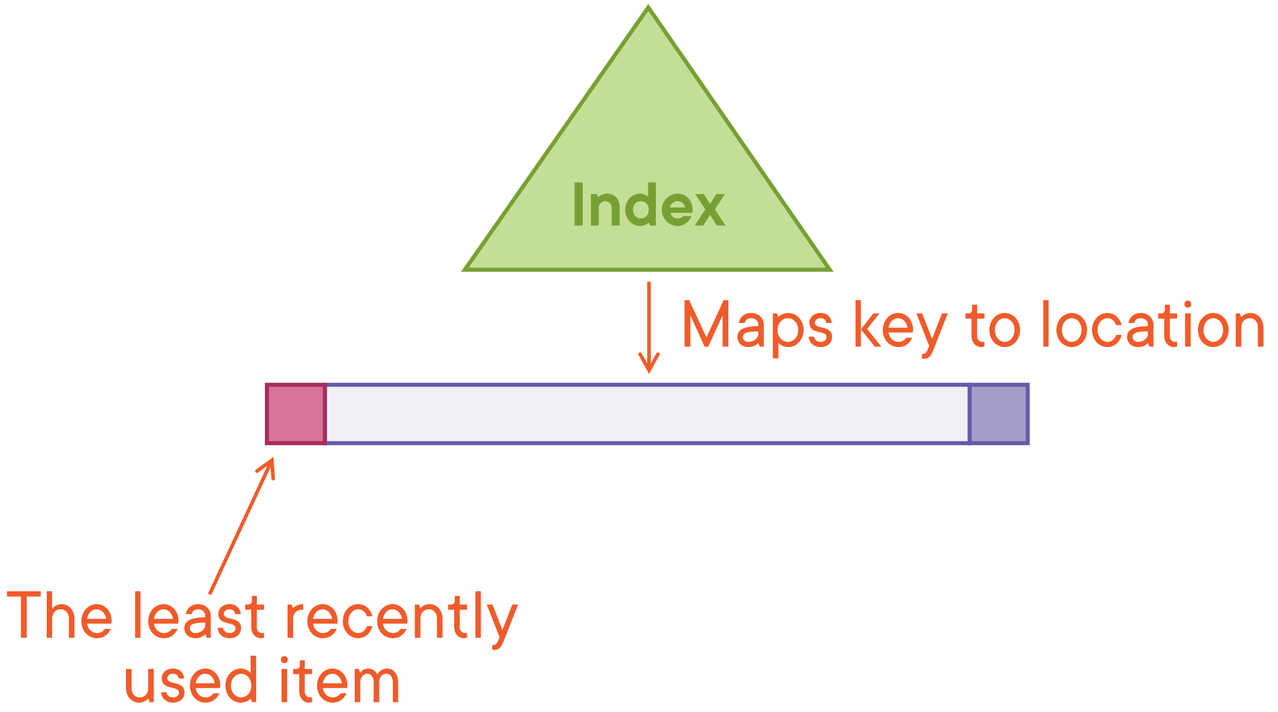

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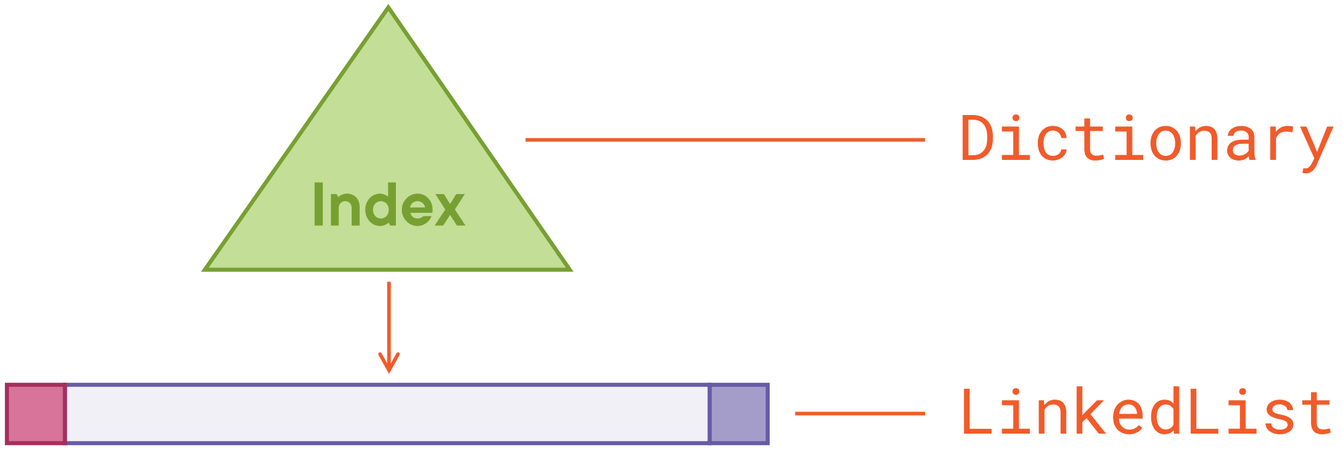

Summary

Applied OOD to associative collections

Used a `HashSet` to share equatable objects

- Caused lower memory footprint
- Caused shorter execution time
- Designed a cache based on a `HashSet`

Designed a general-purpose LRU cache

- Cache keeps record of costly objects
- Used LRU cache as a private component

Summary

Caching is a matter of configuration

- Used object composition to inject a cache
- Consumer never depends on a collection

A digression on communication protocols

- Identified chatty as a problem
- Applied a local cache

Summary

Is `Dictionary` only a cache?

- Promises $O(1)$ time for operations
- Outperforms any linear collection
- Its unique ability is to *seek* by the key
- Try to view dictionary as a temporary cache

Up Next: Engineering Custom Linear Collections