N-way set associative cache design

The NWayCache allocates a chunk of memory, subdivides this into buckets, each bucket contains N slots, or lines. Total occupied memory is N multiplied by number of buckets.

NWayCache allows to access cached elements via the indexer operator. If an element is not present in the cache, it is considered as the cache miss. When the cache miss occurs then a special delegate handler is called to retrieve the missing value and update the cache.

To determine which bucket to place a key-value pair at, the key's hash code is processed by modulo operator on number of buckets in the cache. If there is no free line in the appropriate bucket to place the key-value pair, then a replacement algorithm is called. This algorithm is given with all key-value pairs, as well as usage metadata, from the corresponding bucket.

Each cache line contains the usage metadata. This metadata includes information about the date and time when a key-value pair was placed and accessed. Also it includes the counts of cache line hits and misses.

NWayCache is not thread-safe.

NWayCache<K,V> supports generics for both keys and stored values. To construct the class it requires the following parameters to be passed

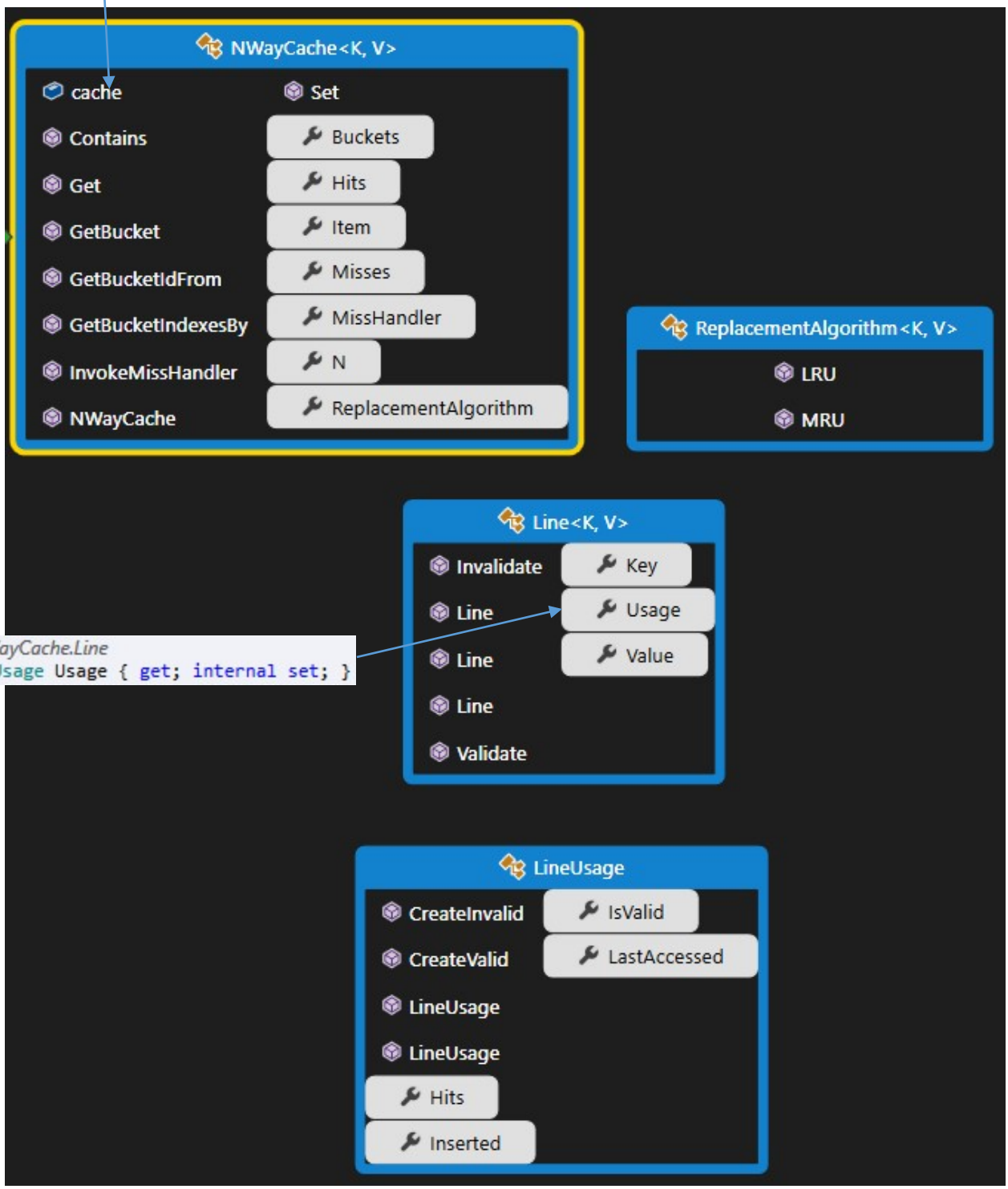
```
public NWayCache(ushort n, ushort buckets, Action<IEnumerable<Line<K, V>>> replacementAlgorithm, Func<K, V> missHandler)
```

- n (N-way, or number of lines in a bucket).
- buckets (number of buckets).
- replacementAlgorithm (a delegate which decides what line to invalidate for cache update, it is invoked when a bucket is full).
- missHandler (a delegate which knows how to populate the missing key-value pair from external source, e.g. a database or a file).

On the diagram below you may see the core classes, methods and properties which are used in the current implementation.

The solution contains Class Library (.dll) which implements NWayCache<K,V> and unit tests project.

TradeDesk.NWayCache.NWayCache
```
private Line<K, V>[] cache
```
The actual cache representation.



TradeDesk.NWayCache.Line
```
public LineUsage Usage { get; internal set; }
```