Dictionaries

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Module Overview - Dictionaries

- `Dictionary<TKey, TValue>`
  - General purpose dictionary
- `ReadOnlyDictionary<TKey, TValue>`
- `SortedList<TKey, TValue>` and `SortedDictionary<TKey, TValue>`
  - Dictionaries that sort their elements
- `KeyedCollection<TKey, TValue>`
  - Customizable
- **Hash tables**
  - Hash codes

Dictionary<TKey, TValue>

: IDictionary<TKey, TValue>

Example: Dictionary of UK prime ministers

Basic dictionary workhorse

```
class PrimeMinister
{…
```

```
Dictionary<TKey, TValue>
```

PrimeMinister

Look up by year elected?

```
Dictionary<int, PrimeMinister>
```

Look up by name?

```
Dictionary<string, PrimeMinister>
```

Dictionary<TKey, TValue>

PrimeMinister

Look up by year elected?

```
Dictionary<int, PrimeMinister>
```

Look up by name?

```
Dictionary<string, PrimeMinister>
```

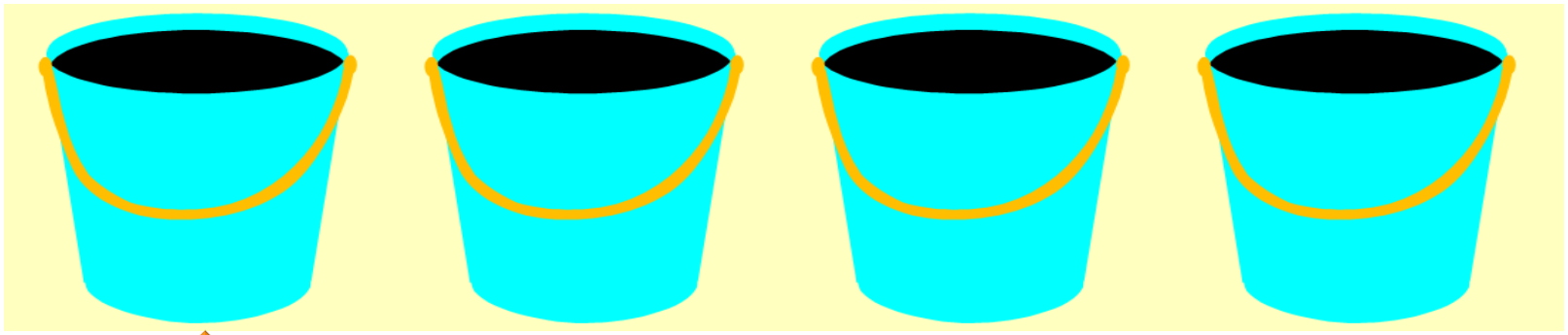
We will look up by initials

```
Dictionary<string, PrimeMinister>
```

`Dictionary<TKey, TValue>`

JC

James Callaghan



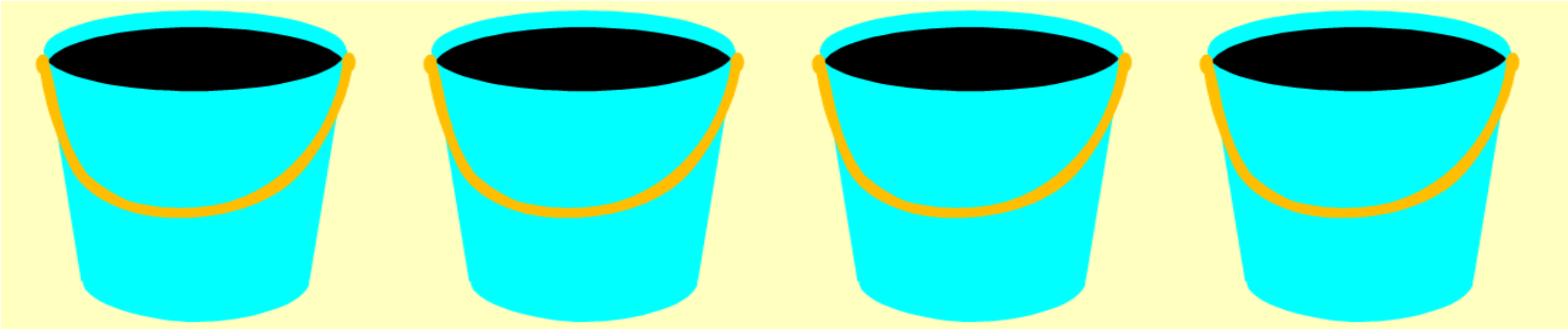
(James Callaghan)

(Like a linked list)

`Dictionary<TKey, TValue>`

MT

Margaret Thatcher



JC

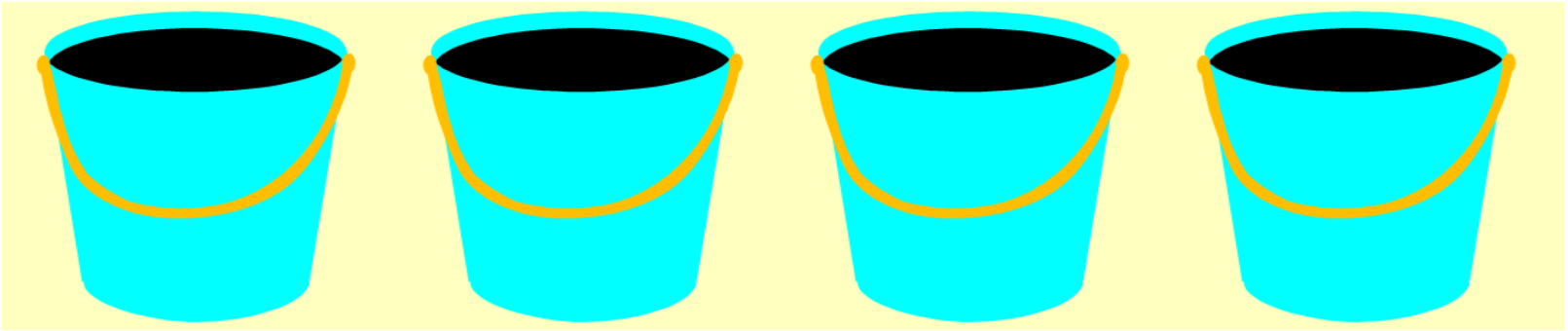
(James Callaghan)

(Margaret Thatcher)

`Dictionary<TKey, TValue>`

JM

John Major



(John Major)

JC

(James Callaghan)

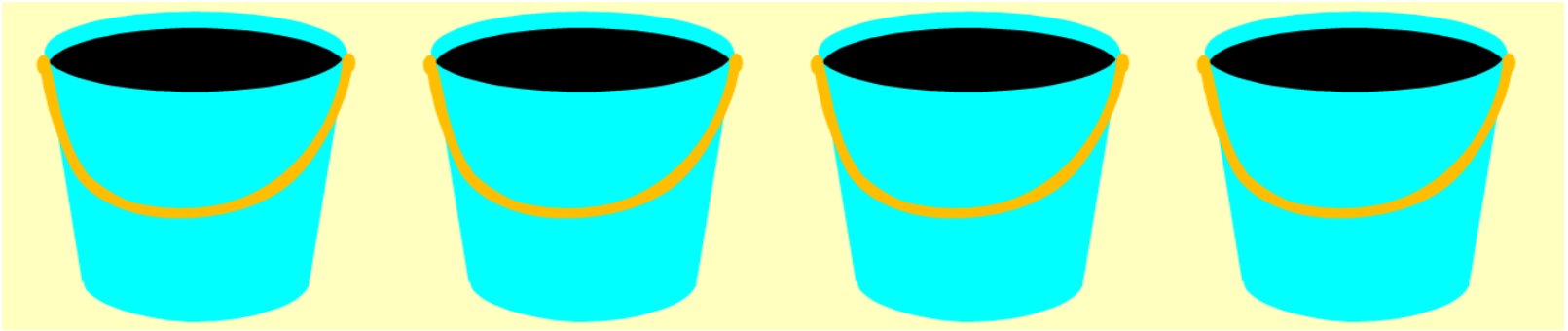
MT

(Margaret Thatcher)

`Dictionary<TKey, TValue>`

TB

Tony Blair



JM

(John Major)

(Tony Blair)

JC

(James Callaghan)

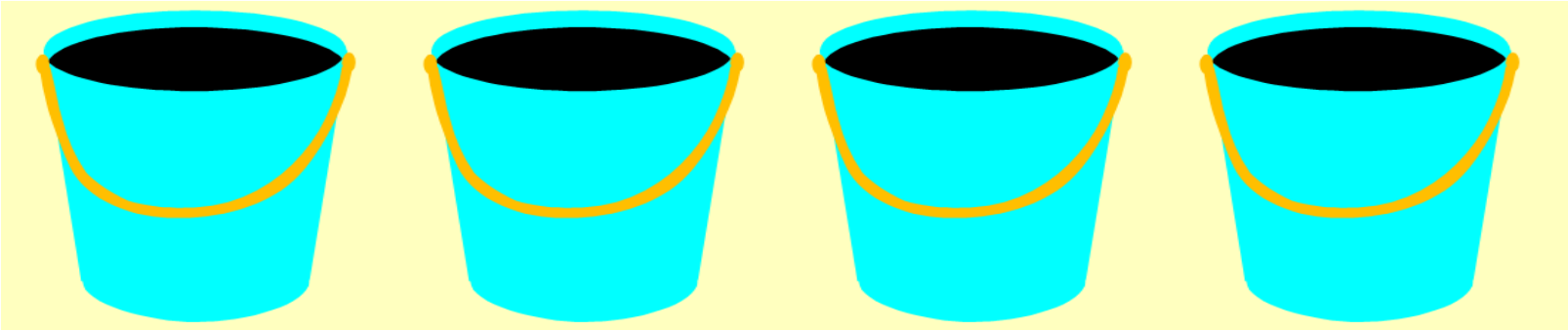
MT

(Margaret Thatcher)

Dictionary<TKey, TValue>

```
var pm = primeMinisters["TB"];
```

some algorithm



JM

(John Major)

TB

(Tony Blair)

JC

(James Callaghan)

MT

(Margaret Thatcher)

Dictionary<TKey, TValue>

Performance….?

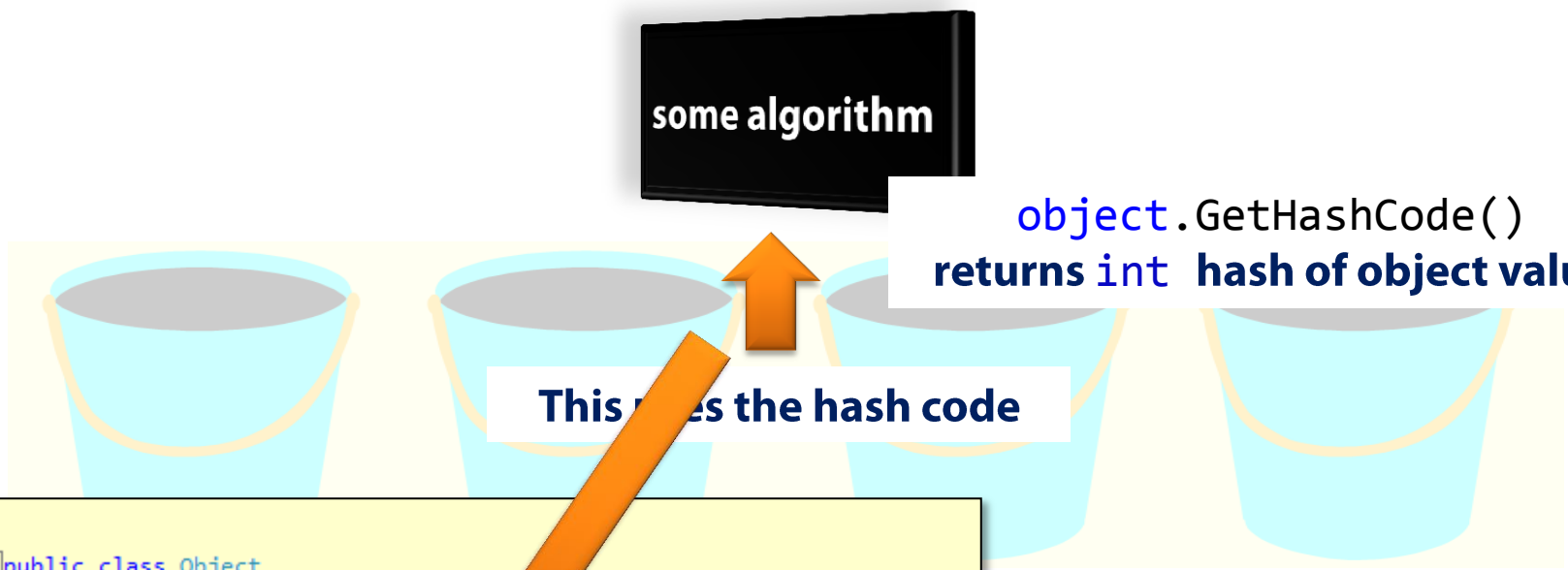
Algorithm to find bucket is quick ✔

Not many elem… bucket ✔

Adding/removing elements in bucket linked list is quick ✔

Good all-round performance

Dictionary<TKey, TValue>

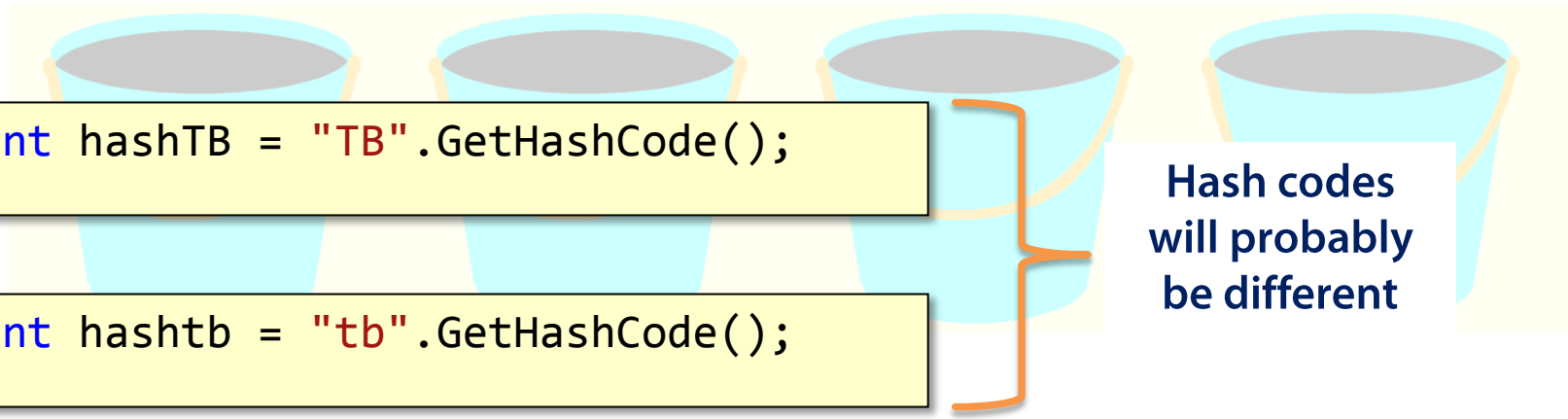



```
...public class Object
{
    ...public Object();

    ...public virtual bool Equals(object obj);
    ...public static bool Equals(object objA, object objB);
    ...public virtual int GetHashCode();
    ...public Type GetType();
    ...protected object MemberwiseClone();
    ...public static bool ReferenceEquals(object objA, object objB);
    ...public virtual string ToString();
}
```

Dictionary<TKey, TValue>

"TB" != "tb"



Dictionary<TKey, TValue>

```
var pm = primeMinisters["tb"];
```

some algorithm

```
ourComparer.GetHashCode("tb");
```

KeyNotFoundException!

TB

(Tony Blair)

JC

(James Callag

MT

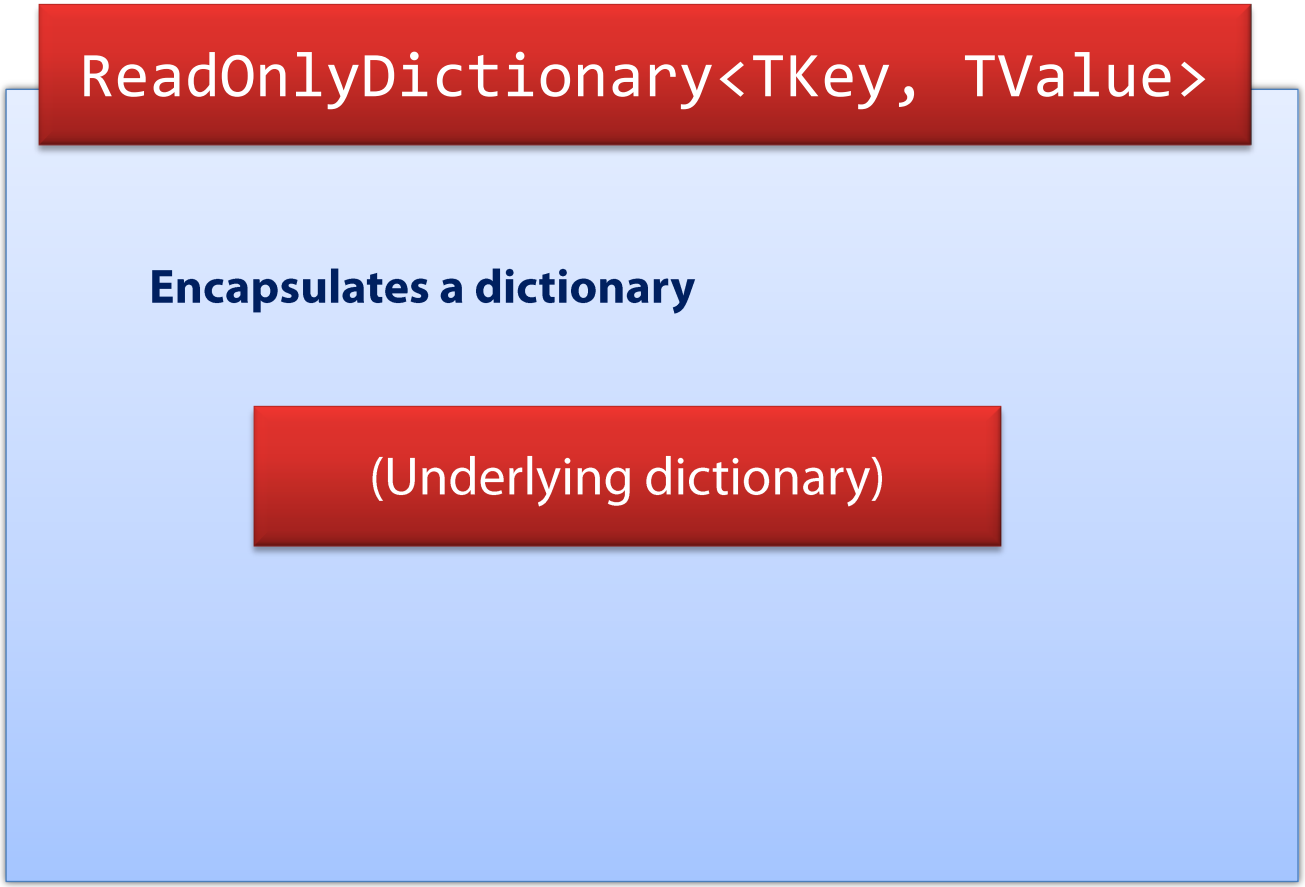
(Margaret Thatcher)

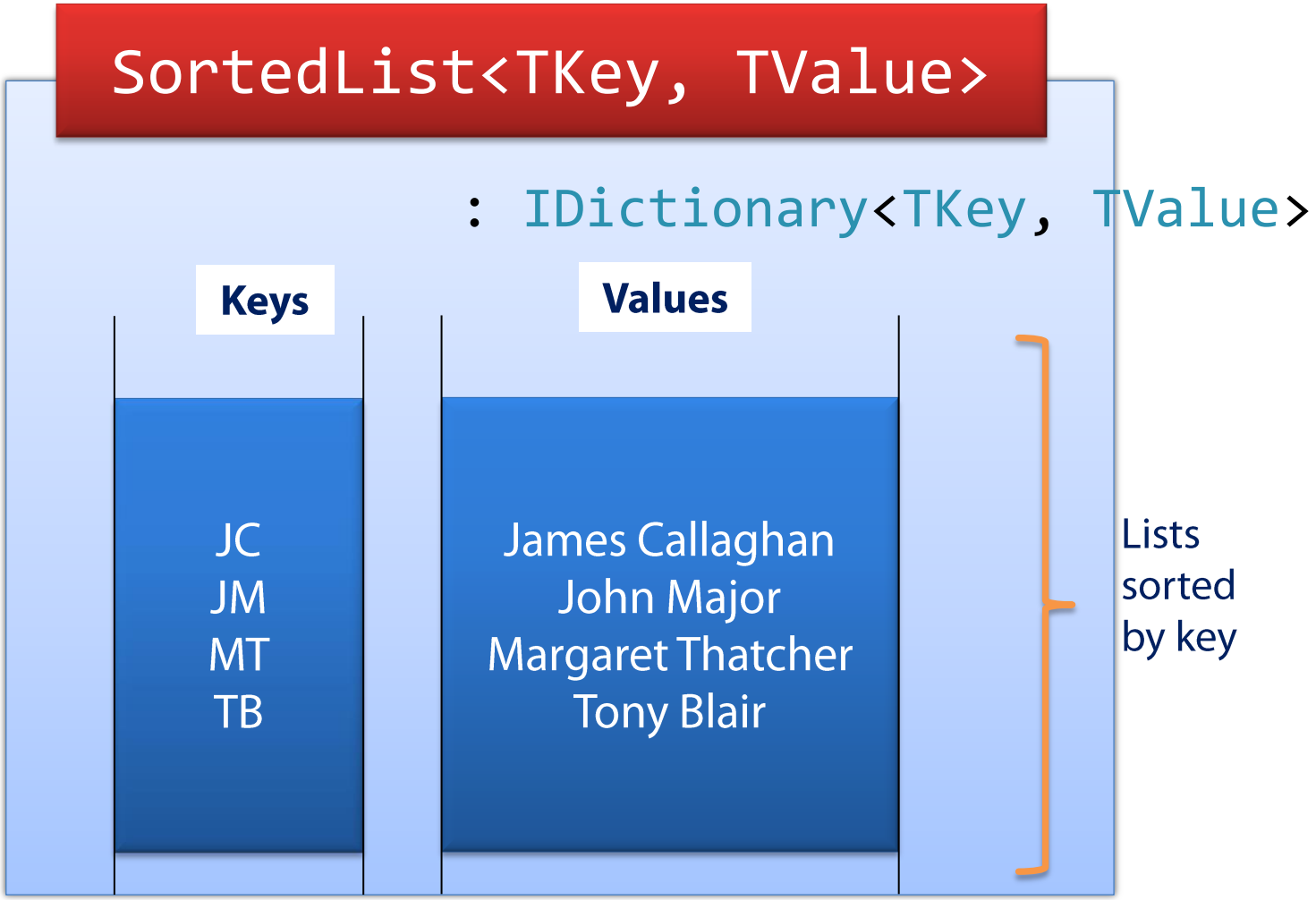
IEqualityComparer<T>

If two objects are equal, they must return the same hash code

```
public int GetHashCode(string obj)
{
     return obj.ToUpper().GetHashCode();
}
```

Best to reuse what Microsoft has already done

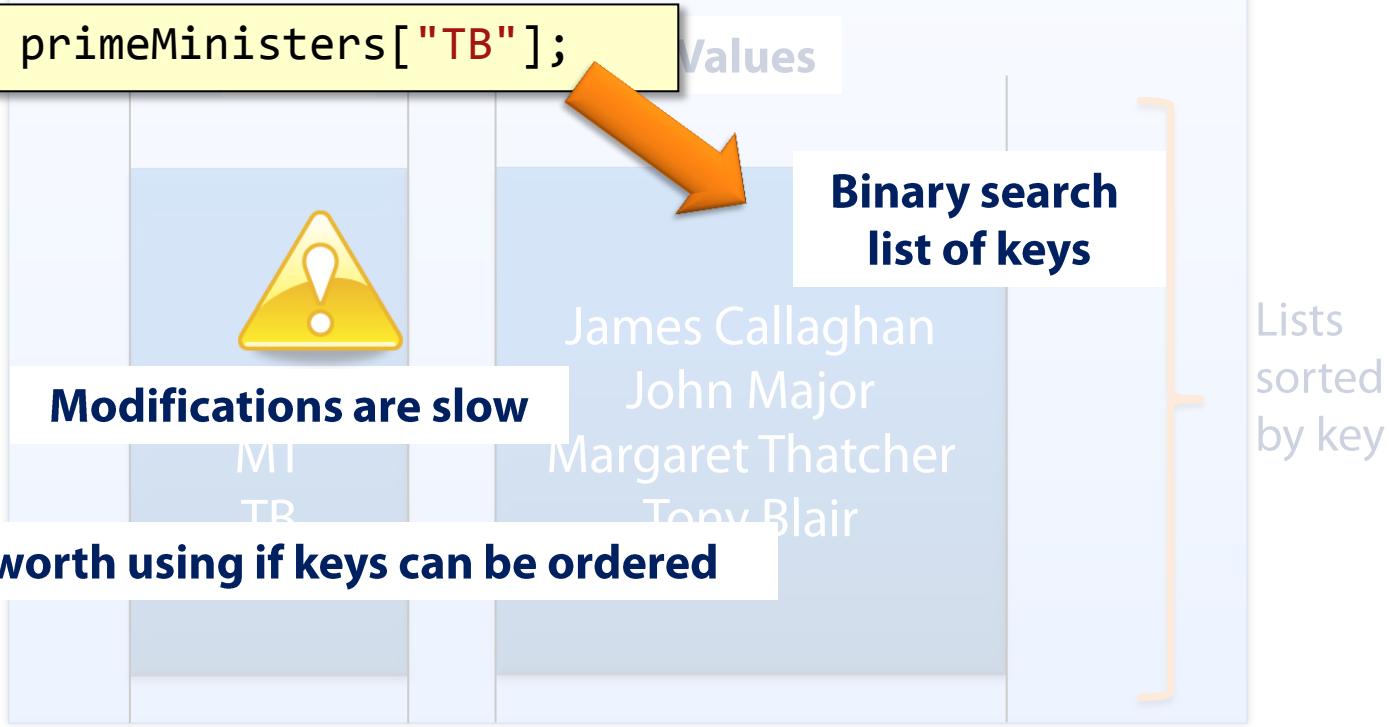

ReadOnlyDictionary<TKey, TValue>
Encapsulates a dictionary
(Underlying dictionary)

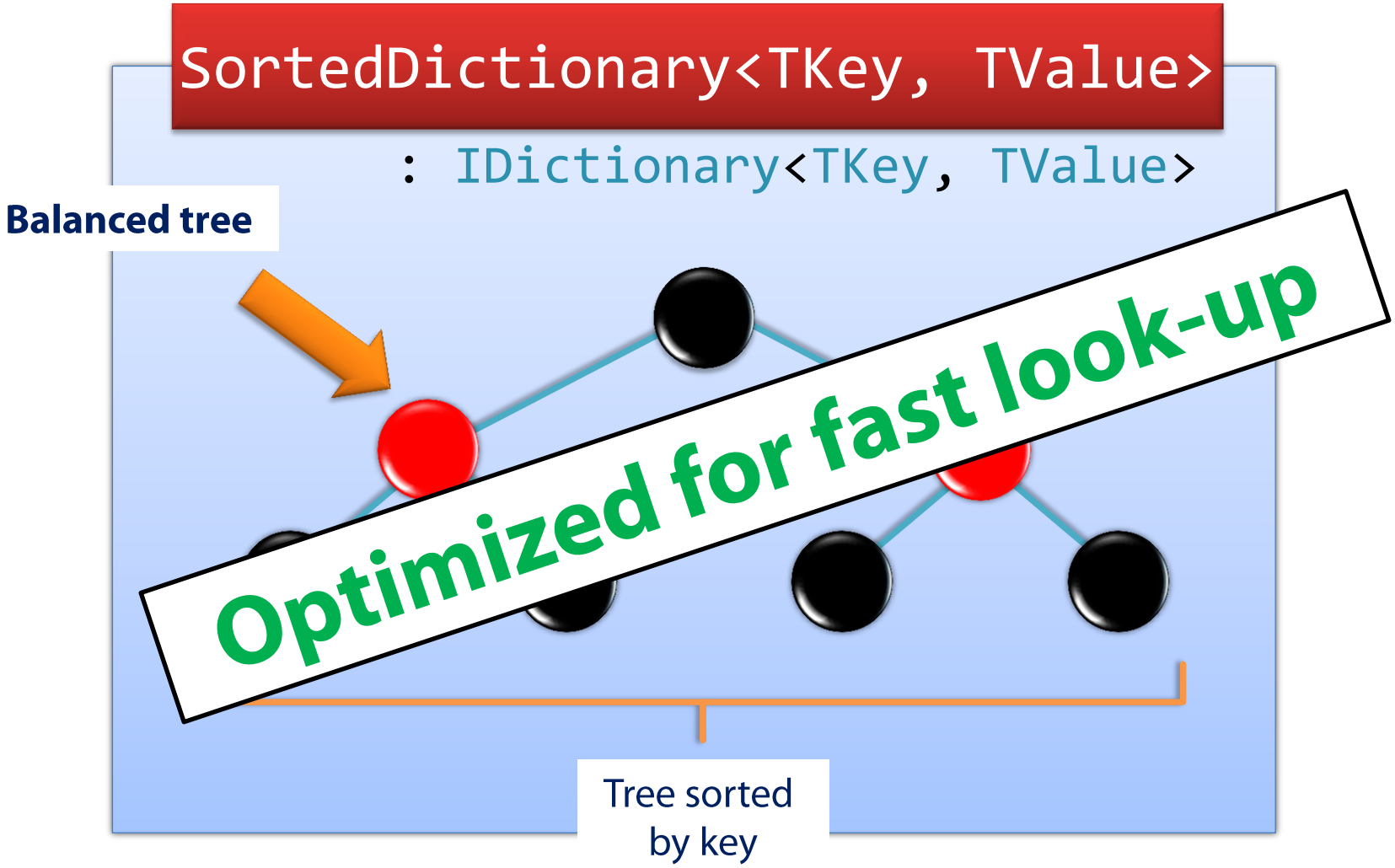

SortedList<TKey, TValue>
: IDictionary<TKey, TValue>
Keys
Values
JC
JM
MT
TB
James Callaghan
John Major
Margaret Thatcher
Tony Blair
Lists sorted by key

SortedList<TKey, TValue>

: IDictionary<TKey, TValue>

```
var pm = primeMinisters["TB"];
```




SortedDictionary<TKey, TValue>
: IDictionary<TKey, TValue>
Balanced tree
Optimized for fast look-up
Tree sorted
by key

SortedList<TKey, TValue>

Modifications slow 

Low overhead ✔

Fast look-up ✔

SortedDictionary<TKey, TValue>

Modifications fast ✔

Fast look-up ✔

Robert Horvick

Robert spent nearly 10 years at Microsoft creating software that made it easier for everyone else to write software. Most recently Robert worked on Team Foundation Server on the Administration and Version Control teams. Currently Robert can be found working in the utilities sector on Smart Grid technologies. Robert fled the Minnesota winters and currently lives near Raleigh, NC with his wife Susan and four children, Cecilia, Brian, Ben and Evelyn. When not tackling technical challenges he enjoys playing the guitar and hanging out with his family.

Course	Author	Level	Rating	Duration	Released
Algorithms and Data Structures - Part 1	Robert Horvick	Beginner	★★★★½	[03:13:48]	15 Aug 2011
Algorithms and Data Structures - Part 2 CC	Robert Horvick	Intermediate	★★★★½	[02:30:29]	11 Jun 2012
Data Visualizations Using Tableau Public CC	Robert Horvick	Intermediate	★★★★½	[01:47:56]	10 Sep 2013
Design Patterns Library	Steve Smith , et al.	Intermediate	★★★★½	[15:01:10]	10 Sep 2010
Team Foundation Server 2010 Version Control	Robert Horvick	Beginner	★★★★½	[03:49:00]	2 May 2011
Twilio Service Basics CC	Robert Horvick	Intermediate	★★★★½	[01:07:36]	6 Mar 2013

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Robert Horvick

Good detail about balanced trees, hash tables, etc.

feedback & support

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Algorithms and Data Structures - Part 1	Robert Horvick	Beginner	★★★★½	[03:13:48]	15 Aug 2011
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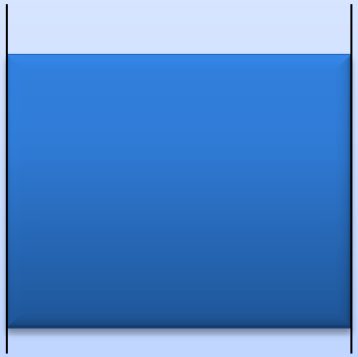
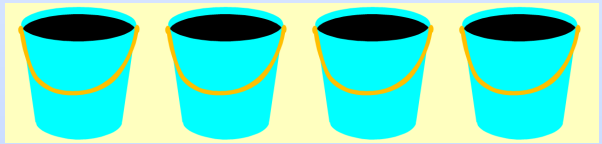
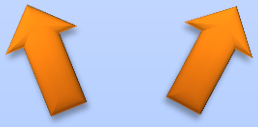
KeyedCollection<TKey, TValue>

List<TValue>

Dictionary<TKey, TValue>







Kept in sync!

Summary - Dictionaries

- **`Dictionary<TKey, TValue>`**
  - Main dictionary workhorse
  - Custom comparers use `IEqualityComparer<T>`
- **`ReadOnlyDictionary<TKey, TValue>`**
  - Provides readonly access to a dictionary
- **Sorted dictionaries:**
  - `SortedList<TKey, TValue>`
  - `SortedDictionary<TKey, TValue>`
  - Custom comparers use `IComparer<T>`
- **`KeyedCollection<TKey, TValue>`**
  - Auto-extract keys
  - List and dictionary