[**再谈C#的装箱和拆箱**](http://www.cnblogs.com/yukaizhao/archive/2011/10/19/csharp_box_unbox_2.html)

上一篇写了一下[装箱拆箱的定义和IL分析](http://www.cnblogs.com/yukaizhao/archive/2011/10/18/csharp_box_unbox_1.html)，这一篇我们看下使用泛型和不使用泛型引发装箱拆箱的情况

1. 使用非泛型集合时引发的装箱和拆箱操作

看下面的一段代码：

|  |  |
| --- | --- |
| 1  2  3  4  5  6  7  8 | var array = new ArrayList();  array.Add(1);  array.Add(2);    foreach (int value in array)  {  Console.WriteLine(“value is {0}”,value);  } |

代码声明了一个ArrayList对象，向ArrayList中添加两个数字1，2；然后使用foreach将ArrayList中的元素打印到控制台。

在这个过程中会发生两次装箱操作和两次拆箱操作，在向ArrayList中添加int类型元素时会发生装箱，在使用foreach枚举ArrayList中的int类型元素时会发生拆箱操作，将object类型转换成int类型，在执行到Console.WriteLine时，还会执行两次的装箱操作；这一段代码执行了6次的装箱和拆箱操作；如果ArrayList的元素个数很多，执行装箱拆箱的操作会更多。

你可以通过使用ILSpy之类的工具查看IL代码的box，unbox指令查看装箱和拆箱的过程

2. 使用泛型集合的情况

请看如下代码：

|  |
| --- |
| var list = new List<int>();  list.Add(1);  list.Add(2);    foreach (int value in list)  {  Console.WriteLine("value is {0}", value);  } |

代码和1中的代码的差别在于集合的类型使用了泛型的List，而非ArrayList；我们同样可以通过查看IL代码查看装箱拆箱的情况，上述代码只会在Console.WriteLine()方法时执行2次装箱操作，不需要拆箱操作。

可以看出泛型可以避免装箱拆箱带来的不必要的性能消耗；当然泛型的好处不止于此，泛型还可以增加程序的可读性，使程序更容易被复用等等。

本文使用的C#代码如下：

|  |  |
| --- | --- |
| 1  2  3  4  5  6  7  8  9  10  11  12  13  14  15  16  17  18  19  20  21  22  23  24  25  26  27  28  29  30  31  32  33  34  35  36  37  38  39  40  41  42  43  44  45  46  47  48  49 | using System;  using System.Collections;  using System.Collections.Generic;    namespace boxOrUnbox  {      class Program      {          static void Main(string[] args)          {              //do nothing          }            static void Box()          {              object objValue = 9;          }            static void Unbox()          {              object objValue = 4;              int value = (int)objValue;          }            static void LookatArrayList()          {              var array = new ArrayList();              array.Add(1);              array.Add(2);                foreach (int value in array)              {                  Console.WriteLine("value is {0}", value);              }          }            static void LookatGenericList()          {              var list = new List<int>();              list.Add(1);              list.Add(2);                foreach (int value in list)              {                  Console.WriteLine("value is {0}", value);              }          }      }  } |

C#的IL代码如下：

|  |  |
| --- | --- |
| 1  2  3  4  5  6  7  8  9  10  11  12  13  14  15  16  17  18  19  20  21  22  23  24  25  26  27  28  29  30  31  32  33  34  35  36  37  38  39  40  41  42  43  44  45  46  47  48  49  50  51  52  53  54  55  56  57  58  59  60  61  62  63  64  65  66  67  68  69  70  71  72  73  74  75  76  77  78  79  80  81  82  83  84  85  86  87  88  89  90  91  92  93  94  95  96  97  98  99  100  101  102  103  104  105  106  107  108  109  110  111  112  113  114  115  116  117  118  119  120  121  122  123  124  125  126  127  128  129  130  131  132  133  134  135  136  137  138  139  140  141  142  143  144  145  146  147  148  149  150  151  152  153  154  155  156  157  158  159  160  161  162  163  164  165  166  167  168  169  170  171  172  173  174  175  176  177  178  179  180  181  182  183  184  185  186  187  188  189  190  191  192  193  194  195  196  197  198  199  200  201  202  203  204  205  206  207  208  209  210  211  212  213 | .class private auto ansi beforefieldinit boxOrUnbox.Program      extends [mscorlib]System.Object  {      // Methods      .method private hidebysig static          void Main (              string[] args          ) cil managed      {          // Method begins at RVA 0x2050          // Code size 2 (0x2)          .maxstack 8          .entrypoint            IL\_0000: nop          IL\_0001: ret      } // end of method Program::Main        .method private hidebysig static          void Box () cil managed      {          // Method begins at RVA 0x2054          // Code size 10 (0xa)          .maxstack 1          .locals init (              [0] object objValue          )            IL\_0000: nop          IL\_0001: ldc.i4.s 9          IL\_0003: box [mscorlib]System.Int32          IL\_0008: stloc.0          IL\_0009: ret      } // end of method Program::Box        .method private hidebysig static          void Unbox () cil managed      {          // Method begins at RVA 0x206c          // Code size 16 (0x10)          .maxstack 1          .locals init (              [0] object objValue,              [1] int32 'value'          )            IL\_0000: nop          IL\_0001: ldc.i4.4          IL\_0002: box [mscorlib]System.Int32          IL\_0007: stloc.0          IL\_0008: ldloc.0          IL\_0009: unbox.any [mscorlib]System.Int32          IL\_000e: stloc.1          IL\_000f: ret      } // end of method Program::Unbox        .method private hidebysig static          void LookatArrayList () cil managed      {          // Method begins at RVA 0x2088          // Code size 114 (0x72)          .maxstack 2          .locals init (              [0] class [mscorlib]System.Collections.ArrayList 'array',              [1] int32 'value',              [2] class [mscorlib]System.Collections.IEnumerator CS$5$0000,              [3] bool CS$4$0001,              [4] class [mscorlib]System.IDisposable CS$0$0002          )            IL\_0000: nop          IL\_0001: newobj instance void [mscorlib]System.Collections.ArrayList::.ctor()          IL\_0006: stloc.0          IL\_0007: ldloc.0          IL\_0008: ldc.i4.1          IL\_0009: box [mscorlib]System.Int32          IL\_000e: callvirt instance int32 [mscorlib]System.Collections.ArrayList::Add(object)          IL\_0013: pop          IL\_0014: ldloc.0          IL\_0015: ldc.i4.2          IL\_0016: box [mscorlib]System.Int32          IL\_001b: callvirt instance int32 [mscorlib]System.Collections.ArrayList::Add(object)          IL\_0020: pop          IL\_0021: nop          IL\_0022: ldloc.0          IL\_0023: callvirt instance class [mscorlib]System.Collections.IEnumerator [mscorlib]System.Collections.ArrayList::GetEnumerator()          IL\_0028: stloc.2          .try          {              IL\_0029: br.s IL\_004a              // loop start (head: IL\_004a)                  IL\_002b: ldloc.2                  IL\_002c: callvirt instance object[mscorlib]System.Collections.IEnumerator::get\_Current()                  IL\_0031: unbox.any [mscorlib]System.Int32                  IL\_0036: stloc.1                  IL\_0037: nop                  IL\_0038: ldstr "value is {0}"                  IL\_003d: ldloc.1                  IL\_003e: box [mscorlib]System.Int32                  IL\_0043: call void [mscorlib]System.Console::WriteLine(string, object)                  IL\_0048: nop                  IL\_0049: nop                    IL\_004a: ldloc.2                  IL\_004b: callvirt instance bool [mscorlib]System.Collections.IEnumerator::MoveNext()                  IL\_0050: stloc.3                  IL\_0051: ldloc.3                  IL\_0052: brtrue.s IL\_002b              // end loop                IL\_0054: leave.s IL\_0070          } // end .try          finally          {              IL\_0056: ldloc.2              IL\_0057: isinst [mscorlib]System.IDisposable              IL\_005c: stloc.s CS$0$0002              IL\_005e: ldloc.s CS$0$0002              IL\_0060: ldnull              IL\_0061: ceq              IL\_0063: stloc.3              IL\_0064: ldloc.3              IL\_0065: brtrue.s IL\_006f                IL\_0067: ldloc.s CS$0$0002              IL\_0069: callvirt instance void [mscorlib]System.IDisposable::Dispose()              IL\_006e: nop                IL\_006f: endfinally          } // end handler            IL\_0070: nop          IL\_0071: ret      } // end of method Program::LookatArrayList        .method private hidebysig static          void LookatGenericList () cil managed      {          // Method begins at RVA 0x2118          // Code size 90 (0x5a)          .maxstack 2          .locals init (              [0] class [mscorlib]System.Collections.Generic.List`1<int32> list,              [1] int32 'value',              [2] valuetype [mscorlib]System.Collections.Generic.List`1/Enumerator<int32> CS$5$0000,              [3] bool CS$4$0001          )            IL\_0000: nop          IL\_0001: newobj instance void class[mscorlib]System.Collections.Generic.List`1<int32>::.ctor()          IL\_0006: stloc.0          IL\_0007: ldloc.0          IL\_0008: ldc.i4.1          IL\_0009: callvirt instance void class[mscorlib]System.Collections.Generic.List`1<int32>::Add(!0)          IL\_000e: nop          IL\_000f: ldloc.0          IL\_0010: ldc.i4.2          IL\_0011: callvirt instance void class[mscorlib]System.Collections.Generic.List`1<int32>::Add(!0)          IL\_0016: nop          IL\_0017: nop          IL\_0018: ldloc.0          IL\_0019: callvirt instance valuetype [mscorlib]System.Collections.Generic.List`1/Enumerator<!0> class[mscorlib]System.Collections.Generic.List`1<int32>::GetEnumerator()          IL\_001e: stloc.2          .try          {              IL\_001f: br.s IL\_003c              // loop start (head: IL\_003c)                  IL\_0021: ldloca.s CS$5$0000                  IL\_0023: call instance !0 valuetype [mscorlib]System.Collections.Generic.List`1/Enumerator<int32>::get\_Current()                  IL\_0028: stloc.1                  IL\_0029: nop                  IL\_002a: ldstr "value is {0}"                  IL\_002f: ldloc.1                  IL\_0030: box [mscorlib]System.Int32                  IL\_0035: call void [mscorlib]System.Console::WriteLine(string, object)                  IL\_003a: nop                  IL\_003b: nop                    IL\_003c: ldloca.s CS$5$0000                  IL\_003e: call instance bool valuetype [mscorlib]System.Collections.Generic.List`1/Enumerator<int32>::MoveNext()                  IL\_0043: stloc.3                  IL\_0044: ldloc.3                  IL\_0045: brtrue.s IL\_0021              // end loop                IL\_0047: leave.s IL\_0058          } // end .try          finally          {              IL\_0049: ldloca.s CS$5$0000              IL\_004b: constrained. valuetype [mscorlib]System.Collections.Generic.List`1/Enumerator<int32>              IL\_0051: callvirt instance void [mscorlib]System.IDisposable::Dispose()              IL\_0056: nop              IL\_0057: endfinally          } // end handler            IL\_0058: nop          IL\_0059: ret      } // end of method Program::LookatGenericList        .method public hidebysig specialname rtspecialname          instance void .ctor () cil managed      {          // Method begins at RVA 0x2190          // Code size 7 (0x7)          .maxstack 8            IL\_0000: ldarg.0          IL\_0001: call instance void [mscorlib]System.Object::.ctor()          IL\_0006: ret      } // end of method Program::.ctor    } // end of class boxOrUnbox.Program |

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