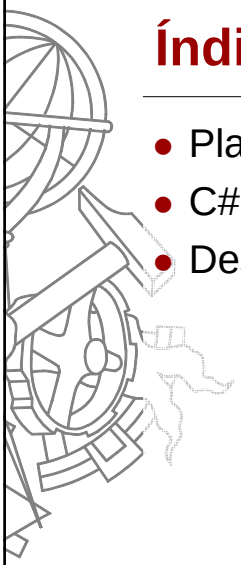

Ambientes de Desenvolvimento Avançados
http://www.dei.isep.ipp.pt/~jtavares/ADAV
Aula 2
Engenharia Informática
2005/2006
José António Tavares
jrt@isep.ipp.pt


BASEADO na "Introdução ao Desenvolvimento .NET"
de Paulo Sousa
Instituto Superior de Engenharia do Porto
Instituto Politécnico do Porto

Índice

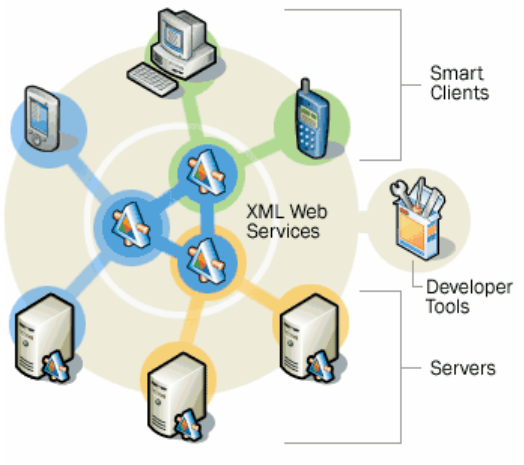
- Plataforma .net
- C#
- Desenvolvimento



Plataforma .net

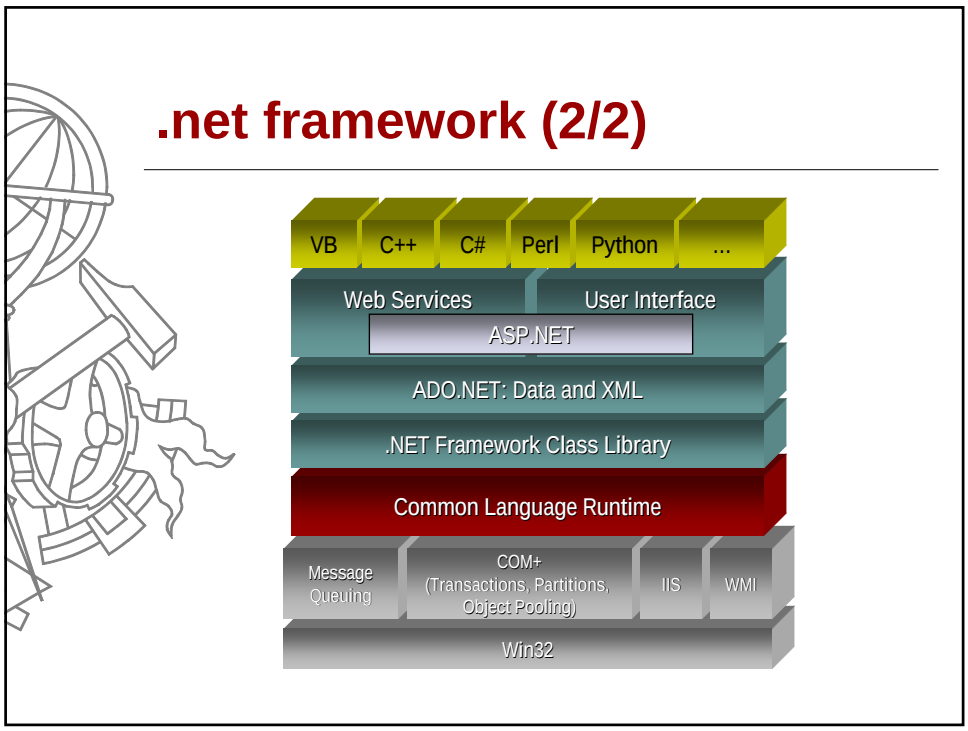
Introdução ao desenvolvimento .net

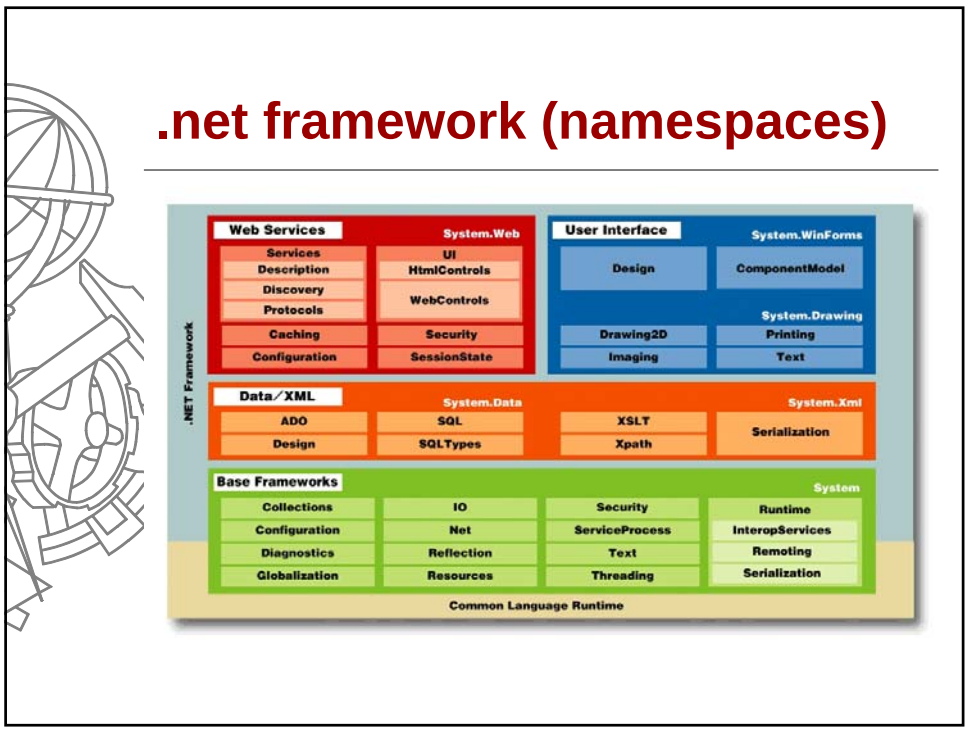
Visão .net



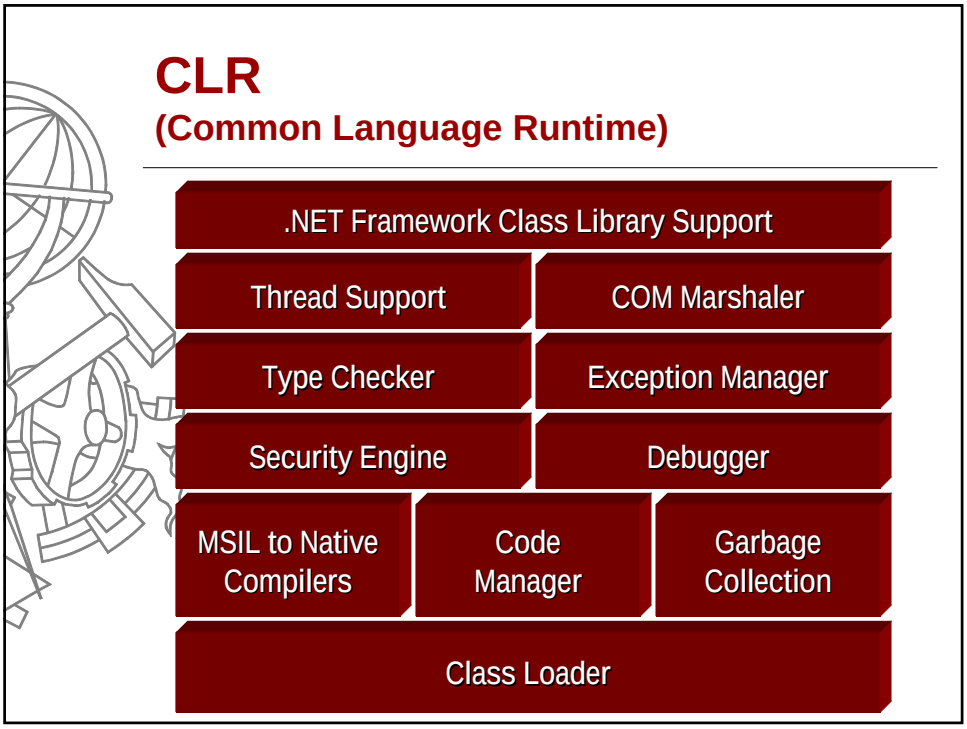
.net framework

- Plataforma de desenvolvimento
- Máquina virtual para execução
  - CLR (Common Language Runtime)
- Biblioteca de classes
  - .net framework Class Library
  - Conjunto de classes base sobre a qual se desenvolve


.net framework (2/2)
VB
C++
C#
Perl
Python
...
Web Services
User Interface
ASP.NET
ADO.NET: Data and XML
.NET Framework Class Library
Common Language Runtime
Message Queuing
COM+ (Transactions, Partitions, Object Pooling)
IIS
WMI
Win32

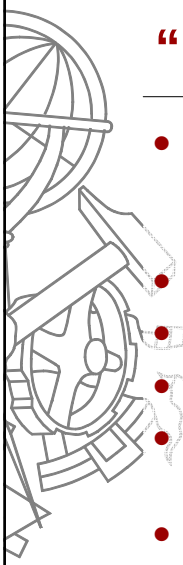

.net framework (namespaces)
Web Services
System.Web
Services
Description
Discovery
Protocols
UI
HtmlControls
WebControls
Caching
Configuration
Security
SessionState
User Interface
System.WinForms
Design
ComponentModel
System.Drawing
Drawing2D
Printing
Imaging
Text
.NET Framework
Data/XML
System.Data
System.Xml
ADO
Design
SQL
SQLTypes
XSLT
Xpath
Serialization
Base Frameworks
System
Collections
Configuration
Diagnostics
Globalization
IO
Net
Reflection
Resources
Security
ServiceProcess
Text
Threading
Runtime
InteropServices
Remoting
Serialization
Common Language Runtime

CLR
(Common Language Runtime)



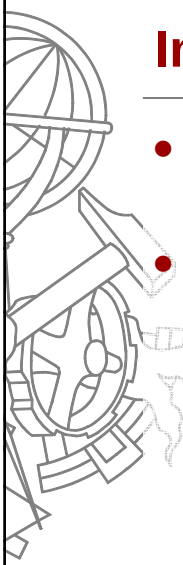
Características CLR

- Gestão de memória → **Garbage collection**
  - Evita "perdas" de memória
- Excepções
  - Tratamento de erros mais elegante
- Type safety
  - Validações de compile e run time para casts e inicializações
- *Versioning*
- Gestão de processos e *threads*
- Sistema comum de tipos
- Tudo são objectos
- Orientada aos "componentes"



“Máquina virtual”

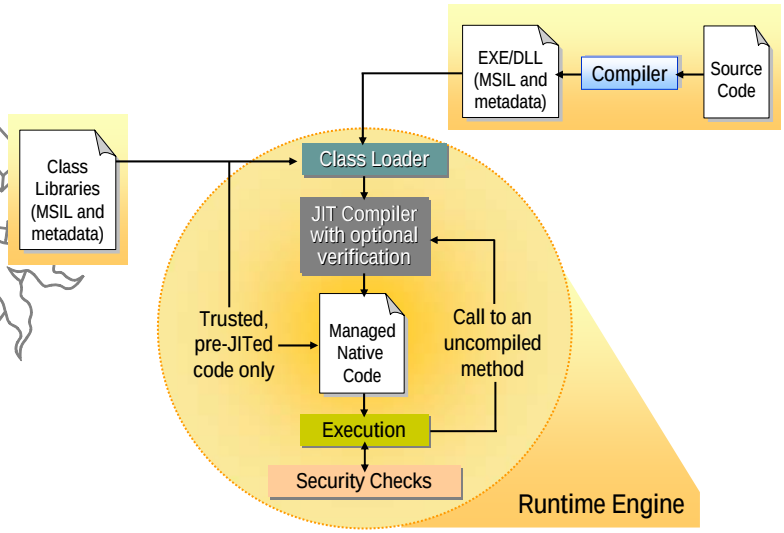
- Instanciação de **Common Language Infrastructure** (CLI)
  - Standard ECMA
- Um mesmo formato de ficheiro binário
- Um sistema de tipos comum
- Meta dados
- Linguagem intermédia (MSIL)
  - Permite várias linguagens de programação
- Conjunto de classes base



Implementações CLI

- Microsoft ➔ CLR
- Shared Source CLI
  - Mono (Linux)
  - Rotor (FreeBSD)

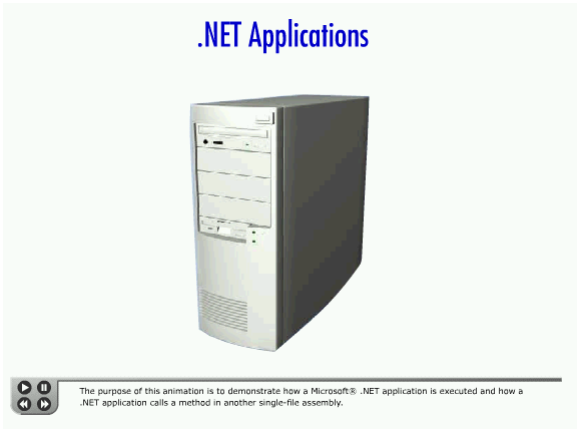
Compilação e Execução



Assembly

- Blocos de construção de aplicações
- Unidade fundamental de *deployment*, *versioning*, reutilização e segurança
- Colecção de tipos e recursos
- Fornece meta-informação ao CLR para execução
- Todos os tipos existem no contexto de um assembly
- Tipos de assembly: DLL, EXE

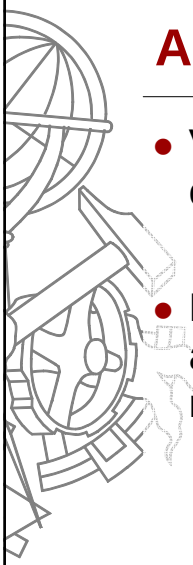
Aplicação .net



(Vídeo)

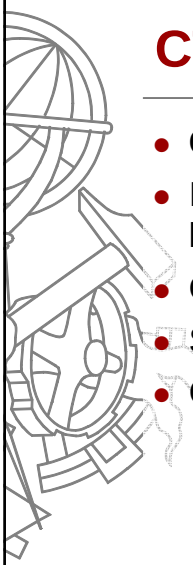
Application Domain

- Fornecem isolamento (execução e segurança) entre aplicações diferentes
- Podem existir diferentes *appdomain* em mais que um processo (ex., IIS)
  - Garantia de isolamento e segurança sem overhead de criação de processo
  - Permite comunicação entre *appdomain* sem overhead de IPC (mas utiliza à mesma RPC)
  - Cada appdomain pode ser parado sem parar o processo



Appdomain & assembly

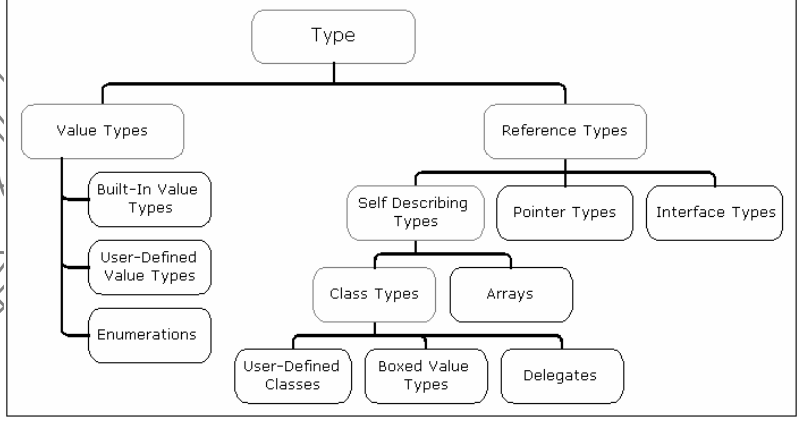
- Vários assemblys são tipicamente carregados para um appdomain
- É possível partilhar código de um assembly utilizado em vários appdomain mas não os dados



CTS

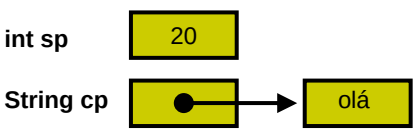
- **Common Type System**
- Infra-estrutura para inter-operabilidade entre linguagens de programação
- Orientado a objectos
- Suporta tipos de referência e tipos de valor
- Compatível com linguagens procedimentais

CTS (2/2)

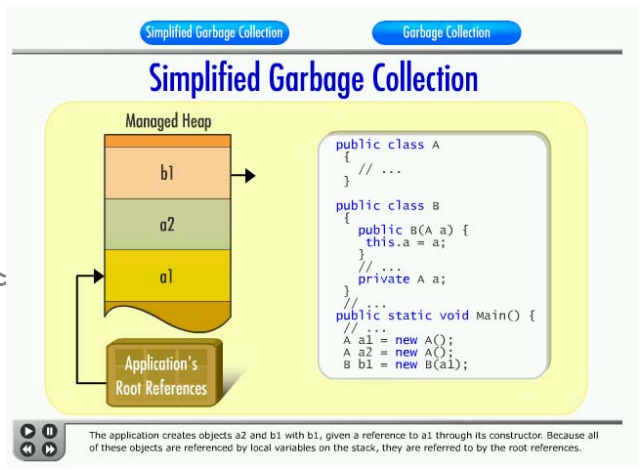


Value-types & Reference-types

- Value types
  - Contém directamente os dados
  - Não pode ser null
- Reference types
  - Contém referência para objecto
  - Pode ser null



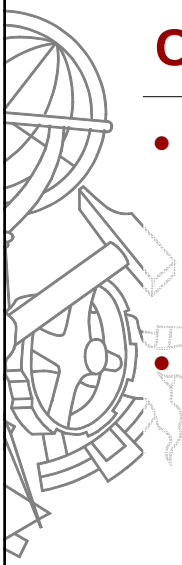
Garbage Collection



(Vídeo)

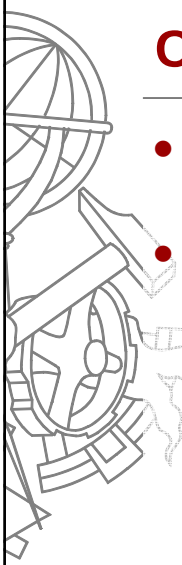
Eventos

- Mecanismo de “sinalização”
- Intrínseco ao *framework*
- extensivamente utilizado internamente
- Permite programação assíncrona
- *Publish / subscribe*



Componentes .net

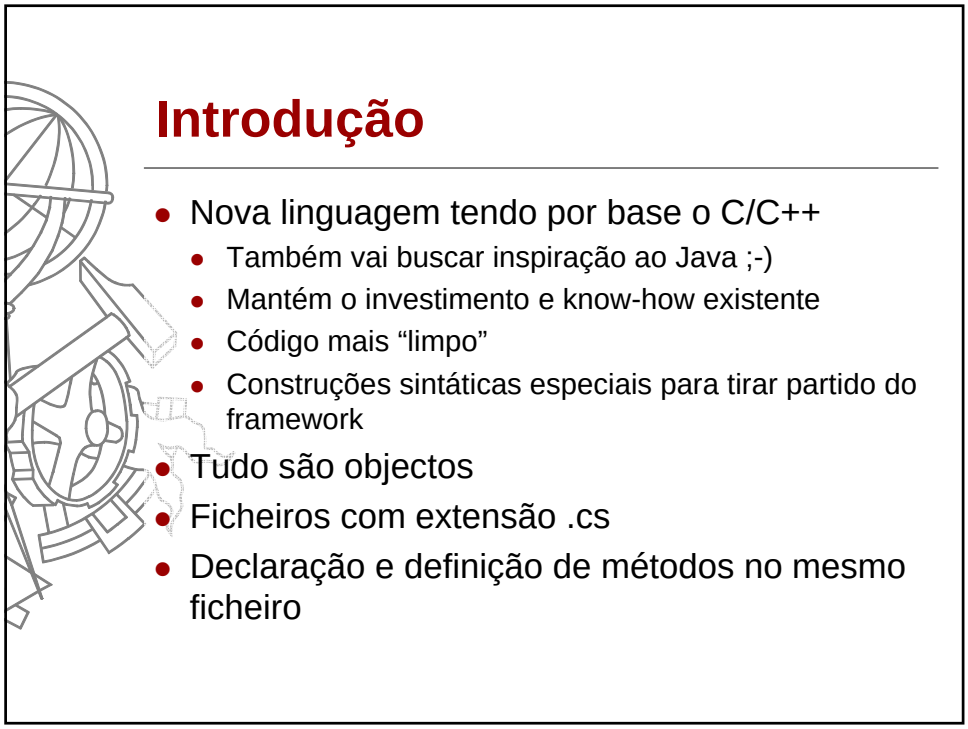
- Orientada aos “componentes”
  - Propriedades, métodos e eventos
  - Design e run –time
  - Especialmente vocacionados para utilização com “design surfaces” (ex., Visual Studio)
- O termo componente em .net corresponde a uma classe que implementa a interface **`IComponent`** ou deriva directa ou indirectamente de **`System.ComponentModel.Component`**

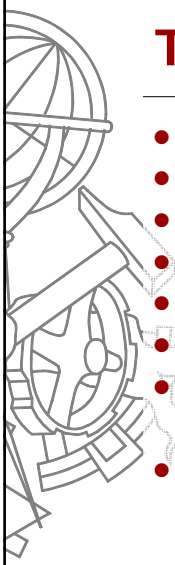


Componentes .net (2/2)

- Componentes com interface gráfica são chamados *Control*.
- Devem derivar directa ou indirectamente de **`System.Windows.Forms.Control`** ou **`System.Web.UI.Control`**


C#
Introdução ao desenvolvimento .net


Introdução
Nova linguagem tendo por base o C/C++
Também vai buscar inspiração ao Java ;-)
Mantém o investimento e know-how existente
Código mais “limpo”
Construções sintáticas especiais para tirar partido do framework
Tudo são objectos
Ficheiros com extensão .cs
Declaração e definição de métodos no mesmo ficheiro



Tipos de dados

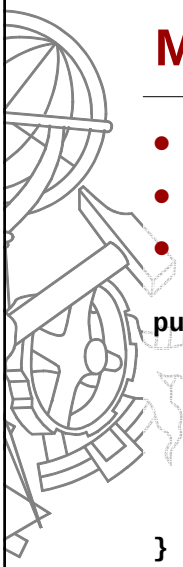
- object
- string
- sbyte, short, int, long
- byte, ushort, uint, ulong
- char
- float, double, decimal
- bool

- Estes tipos são *alias* para os tipos definidos na framework
  - Ex., int == System.Int32

Classes e namespaces

- Organização do código dentro de classes
- Classes organizadas dentro de *namespaces*

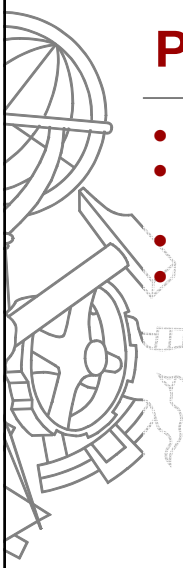
```
namespace Demo {
    public class MyClass {
    ...
    }
}
```



Métodos

- Sintaxe semelhante ao C/C++
- Podem ser públicos ou privados
- Suporta *overloading*

```
public class MyHelloWorld {
   ...
   public void SayHello()
   { ... }

   private void SetTitle(String Title)
   { ... }
}
```

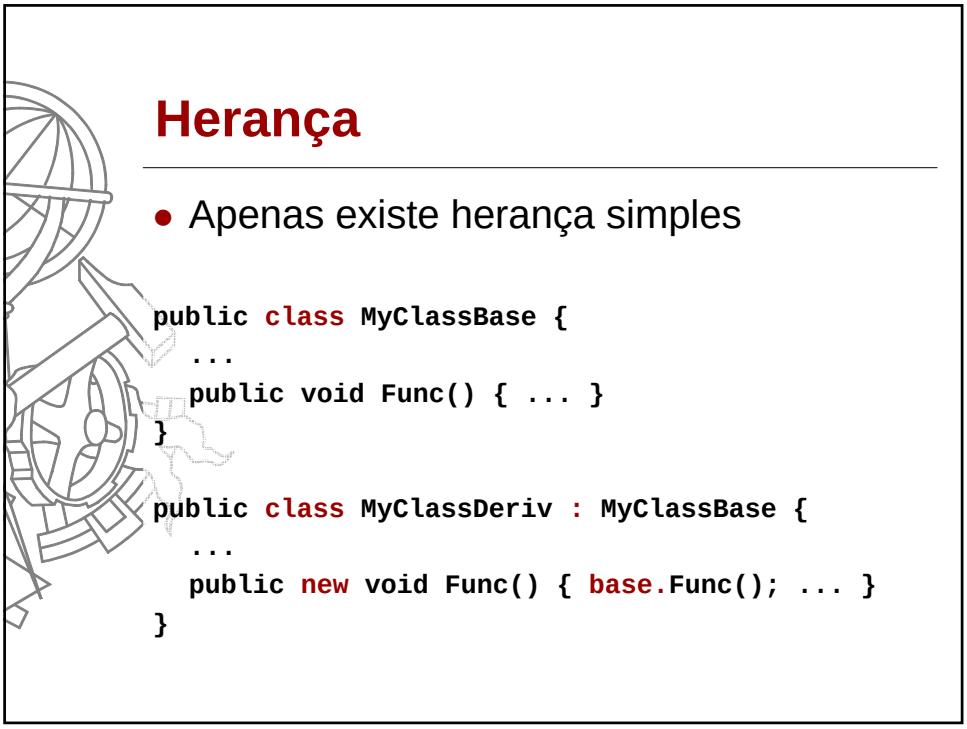


Passagem de parâmetros

- Por valor
- Por referência

- `out` – parâmetro de saída
- `ref` – parâmetro de entrada e saída

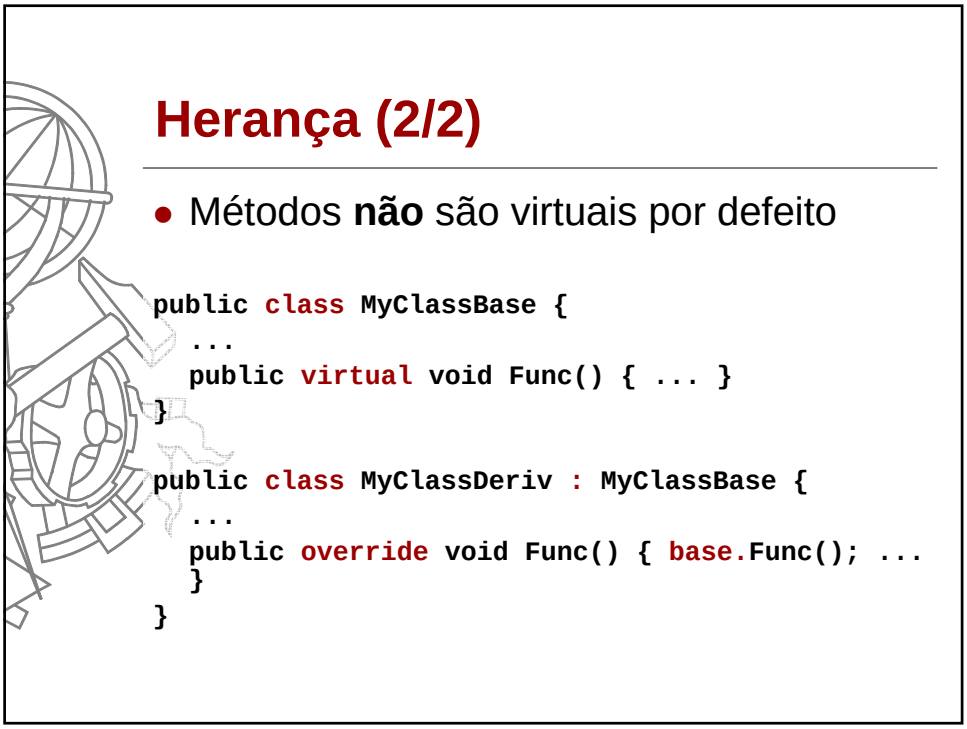
```
public void func1(int x)
{ ... }

public void func2(out int x)
{ ... }

public void func2(ref int x)
{ ... }
```



Herança

- Apenas existe herança simples

```
public class MyClassBase {
   ...
   public void Func() { ... }
}

public class MyClassDeriv : MyClassBase {
   ...
   public new void Func() { base.Func(); ... }
}
```



Herança (2/2)

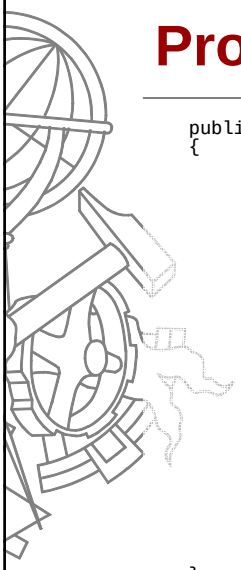
- Métodos **não** são virtuais por defeito

```
public class MyClassBase {
   ...
   public virtual void Func() { ... }
}

public class MyClassDeriv : MyClassBase {
   ...
   public override void Func() { base.Func(); ...
   }
}
```

Propriedades

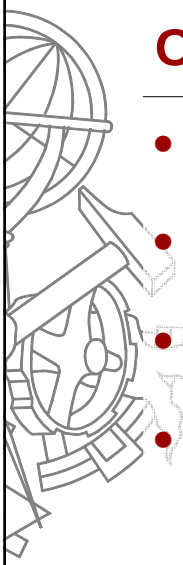
- Sintaxe alternativa para acesso a membros de dados da classe mas com as vantagens dos métodos

```
public class Button : Control
{
    private string caption;
    public string Caption {
        get { return caption; }
        set { caption = value; Repaint(); }
    }
    ...
}
```



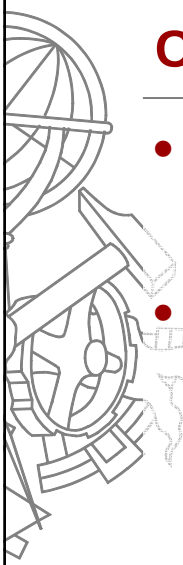
Propriedades (example)

```
public class Button: Control
{
	private string caption;
	public string Caption
	{
		get
		{
			return caption;
		}
		set
		{
			if (caption != value)
			{
				caption = value;
				Repaint();
			}
		}
	}

	public override void Paint(Graphics g, Rectangle r)
	{
		// Painting code goes here
	}
}
```



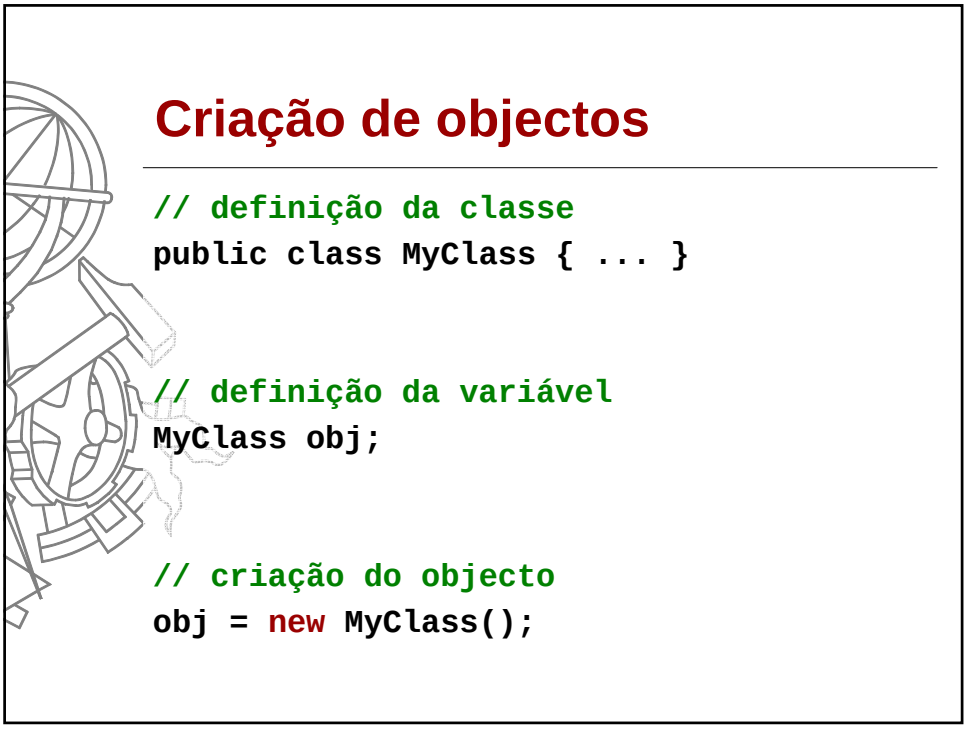
Operadores

- Atribuição
  - =
- Relacionais
  - < <= > >= == !=
- Lógicos
  - && || !
- Aritméticos
  - + - * / %
  - += -= *= /= ++ --



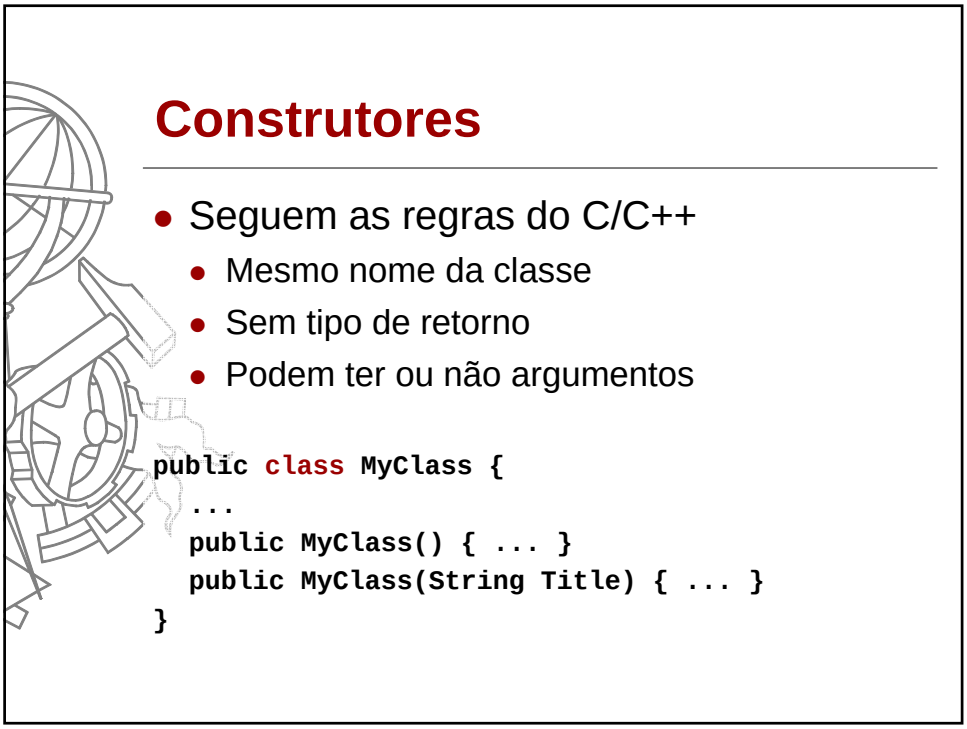
Constantes

- Pré-definidas
  - `null`
  - `true false`
- De utilizador
  - `const string Ver = “1.0b”;`



Criação de objectos

```
// definição da classe
public class MyClass { ... }


// definição da variável
MyClass obj;


// criação do objecto
obj = new MyClass();
```



Construtores

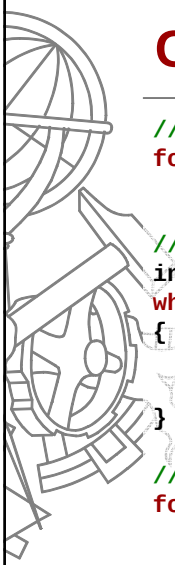
- Seguem as regras do C/C++
  - Mesmo nome da classe
  - Sem tipo de retorno
  - Podem ter ou não argumentos

```
public class MyClass {
  ...
  public MyClass() { ... }
  public MyClass(String Title) { ... }
}
```

Arrays

- Suportados ao nível da biblioteca base de classes em **`System.Array`**

```
// declaração do vector
String[] vec;

// criação do vector
vec = new String[10];

// número de elementos pode ser dinâmico
vec = new String[n];
```

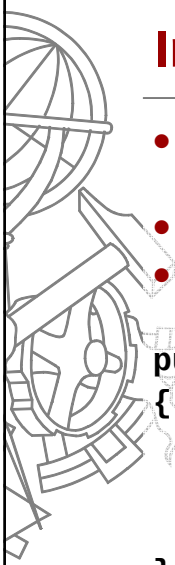


Ciclos

```
// repetição n vezes
for (int x = 0; i < vec.Length; i++)
   Console.WriteLine(vec[i]);

// repetição condicional
int i = 0;
while (i < vec.Length)
{
   Console.WriteLine(vec[i]);
   i++;
}

// enumeração
foreach (String x in vec)
   Console.WriteLine(x);
```

Condicionais

```
// teste de decisão
if (i < vec.Length)
   Console.WriteLine(vec[i]);
else
    Console.WriteLine(“Erro!!!”);

// teste múltiplo
switch (x)
{
   case 1: ...; break;
   case 2: ...; goto case 3;
   case 3: ...; break;
   default: ...; break;
}
```



Interfaces

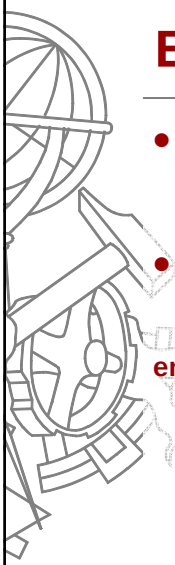
- Semelhantes a classes mas não têm implementação dos métodos
- Apenas definem as assinaturas
- Todos os métodos são públicos

```
public interface IMovimentavel
{
   void MoverEsquerda();
   void MoverDireita();
   ...
}
```

Implementação de Interfaces

- Qualquer classe pode implementar uma ou mais interfaces

```
public class Pessoa : IMovimentavel
{
  void MoverEsquerda() { ... }
  void MoverDireita() { ... }
  ...
}
```



Enumerados

- Fortemente “tipados”
  - Sem conversão automática para int
  - Suportam operadores +, -, ++, --, &, |, ^, ~
- Pode-se definir tipo de dados base
  - `Byte`, `short`, `int`, `long`

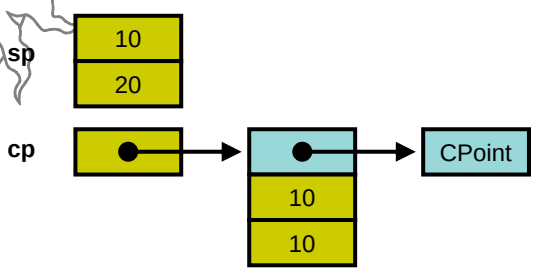
```
enum Color : byte {
  Red = 1,
  Green = 2,
  Blue = 4,
  Black = 0,
  White = Red | Green | Blue
}
```

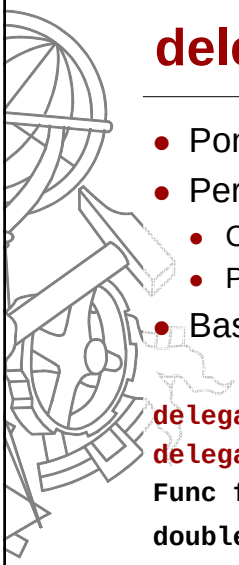
structs

- Semelhantes a classes, excepto
  - Alocação na *stack* e não no *heap*
  - Não suporta herança
  - Cópia (atribuição) de contéudo e não de referência
  - Ideal para conceitos pequenos (ex., Complex)
  - Utilizada nos tipos primitvos da framework (ex. int)
- Benefícios
  - Como não são alocadas no heap não colocam carga sobre o mecanismo de *garbage collection*

Classes e estruturas

```
class CPoint { int x, y; ... }
struct SPoint { int x, y; ... }
SPoint sp = new SPoint(10, 20);
CPoint cp = new CPoint(10, 20);
```





delegates

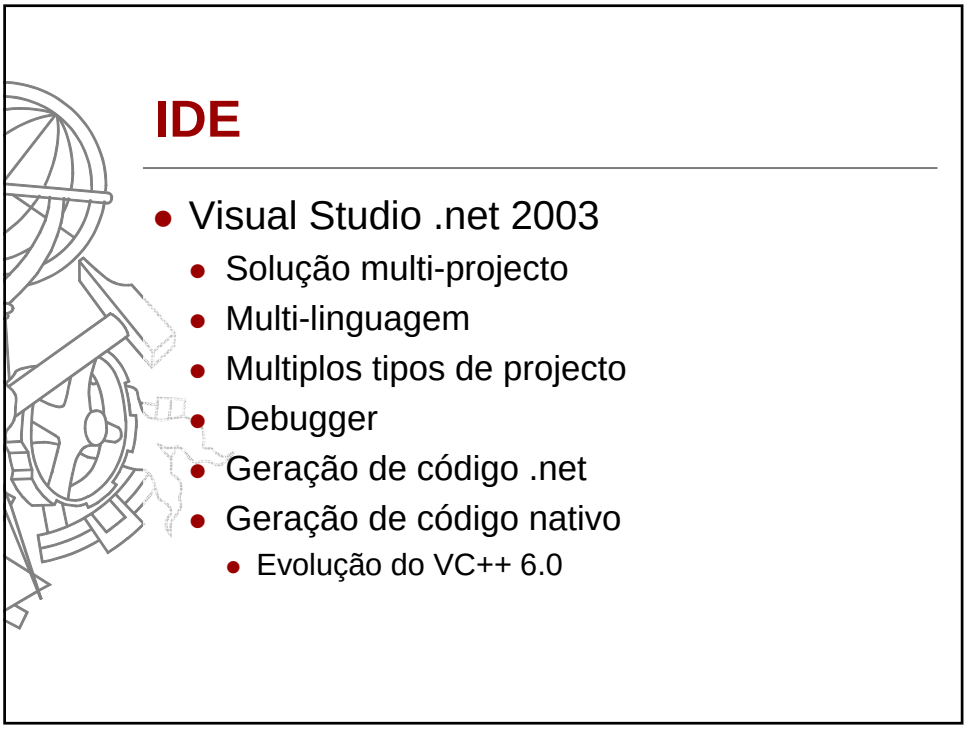
- Ponteiros (orientados a objectos) para métodos
- Permite múltiplos receptores
  - Cada `delegate` tem uma lista de invocação
  - Publish/subscribe
- Base para o mecanismo de eventos

```
delegate void MouseEvent(int x, int y);
delegate double Func(double x);
Func fn = new Func(Math.Sin);
double x = fn(1.0);
```

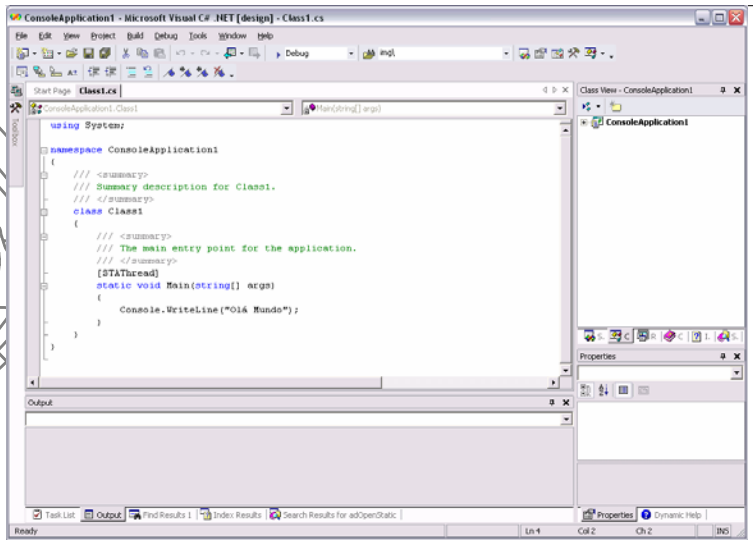
Comentários XML

```
class XmlElement
{
   /// <summary>
   /// Returns the attribute with the given name and
   /// namespace</summary>
   /// <param name="name">
   /// The name of the attribute </param>
   /// <param name="ns">
   /// The namespace of the attribute, or null if
   /// the attribute has no namespace</param>
   /// <return>
   /// The attribute value, or null if the attribute
   /// does not exist</return>
   /// <seealso cref=" ="GetAttr(string)"/>
   public string GetAttr(string name, string ns) {
      ... ...
   }
}
```

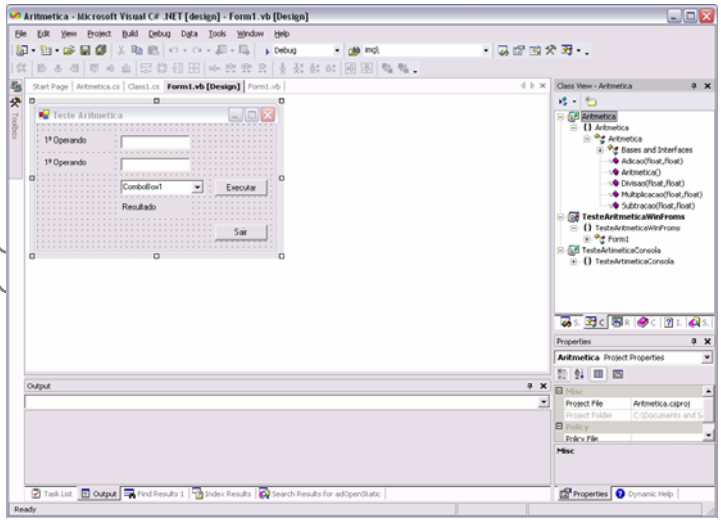

Desenvolvimento .Net
Introdução ao desenvolvimento .net


IDE
Visual Studio .net 2003
Solução multi-projecto
Multi-linguagem
Multiplos tipos de projecto
Debugger
Geração de código .net
Geração de código nativo
Evolução do VC++ 6.0

Demo – Hello World

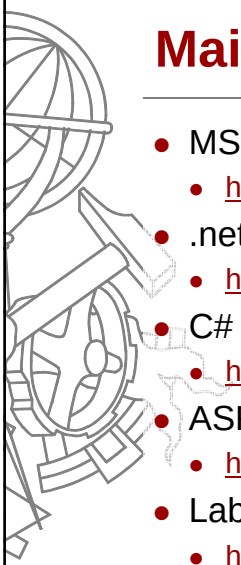


Demo - Aritmética



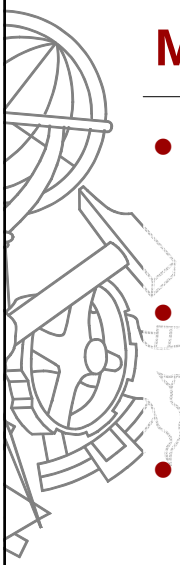
Perguntas & Respostas

Introdução ao desenvolvimento .net



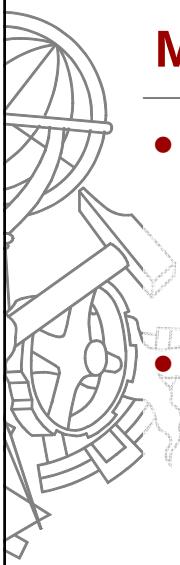
Mais Informação...

- MSDN Library
  - http://msdn.microsoft.com/library
- .net framework center
  - http://msdn.microsoft.com/netframework/
- C#
  - http://msdn.microsoft.com/vcsharp/
- ASP.net
  - http://www.asp.net
- Laboratório .net do ISEP/IPP
  - http://www.dei.isep.ipp.pt/labdotnet/



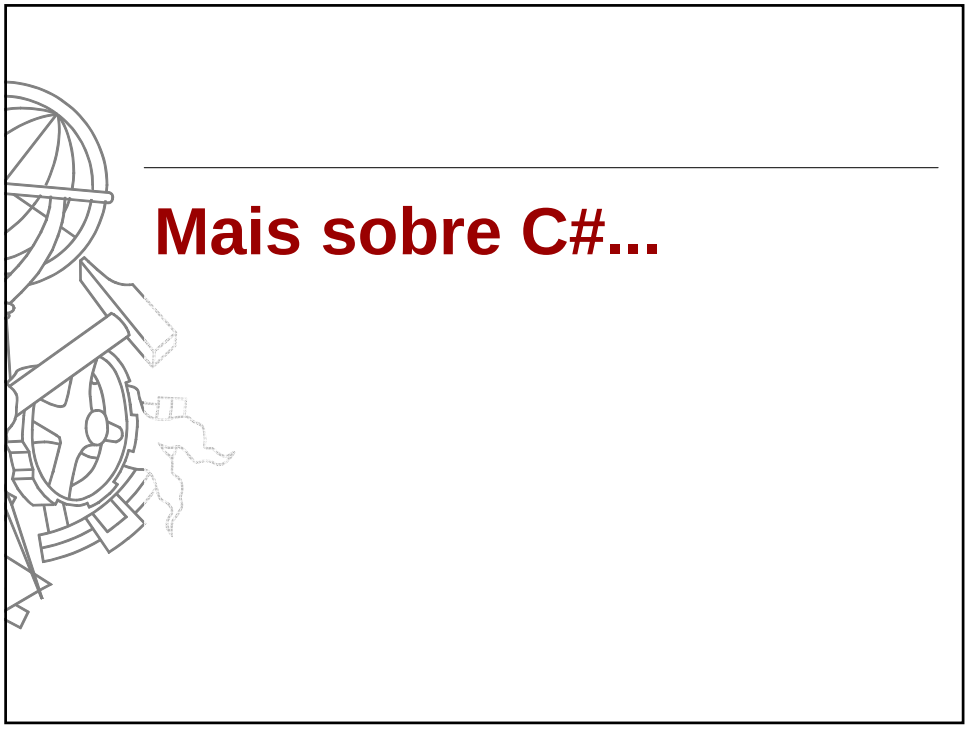
Mais Informação...

- Open CLI
  - http://sourceforge.net/projects/ocl
- Mono (.net @ Unix)
  - http://www.go-mono.com/
- ECMA
  - http://www.ecma-international.org/

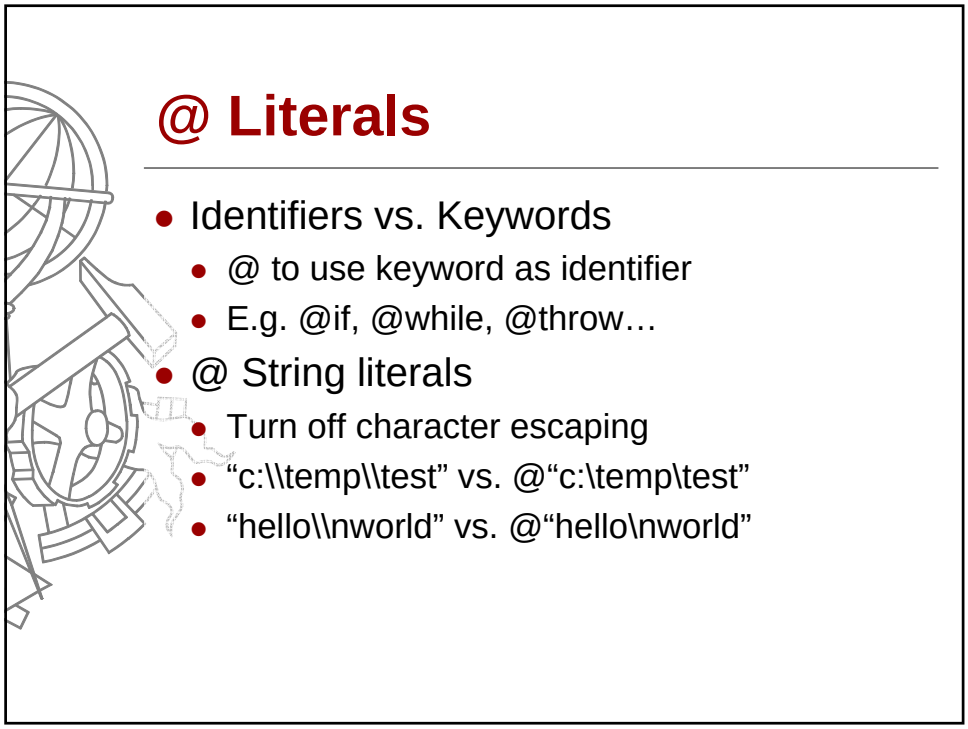


Mais Informação...

- Introduction to C# @ ECMA
  - http://www.ecma-international.org/activities/Languages/Introduction%20to%20Csharp.pdf
- Common Language Infrastructure @ ECMA
  - http://www.ecma-international.org/activities/Languages/ECMA%20CLI%20Presentation.pdf



Mais sobre C#...



@ Literals

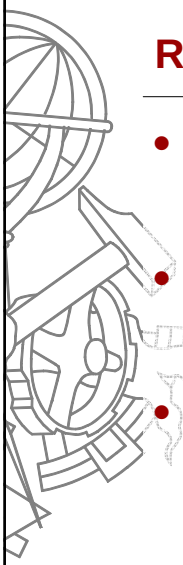
- Identifiers vs. Keywords
  - @ to use keyword as identifier
  - E.g. @if, @while, @throw…
- @ String literals
  - Turn off character escaping
  - “c:\\temp\\test” vs. @“c:\temp\test”
  - “hello\\nworld” vs. @“hello\nworld”

@ Literals (examples)

```
string a = "hello, world";              // hello, world
string b = @"hello, world";             // hello, world
string c = "hello \t world";            // hello          world
string d = @"hello \t world";           // hello \t world
string e = "Joe said \"Hello\" to me";  // Joe said "Hello" to me
string f = @"Joe said ""Hello"" to me"; // Joe said "Hello" to me
string g = "\\\\server\\share\\file.txt";       // \\server\share\file.txt
string h = @"\\server\share\file.txt";  // \\server\share\file.txt
string i = "one\ntwo\nthree";
string j = @"one
two
three";
```

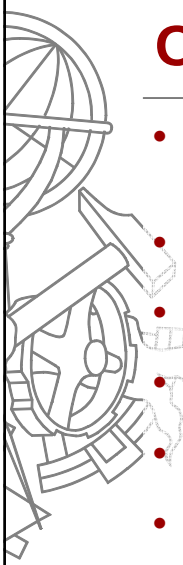
Enumerations

- Have underlying type
- First class value (not int as in C/C++)
- Defines conversions
- Defines parsing
- Runtime information



Reference and Output parameters

- ref keyword
  - Does not accept null
  - Needs to be initialized
- out keyword
  - Cannot be read inside the function
  - Need not be initialized outside
- Example:
  - Declaration: void f (int x, ref int y, out int z);
  - Call: f(5, ref a, out b);

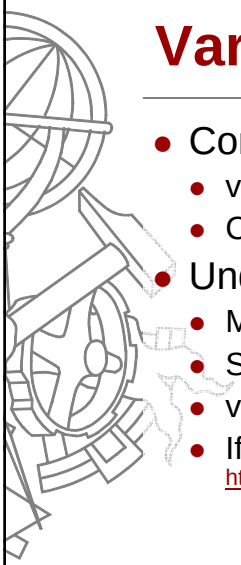


Operator Overloading

- Overloadable
  - Unary: + - ! ~ ++ -- true false
  - Binary: + - * / % & | ^ << >> == != < > <= >=
- Non-overloadable
  - . -> = && || ? : new typeof sizeof is as
- Implicit assignment overloading
  - E.g. *= when * is overloaded
- Cast overloading
  - Conversions
- [] Overloading
  - Indexer properties
- At least one parameter is the declaring class

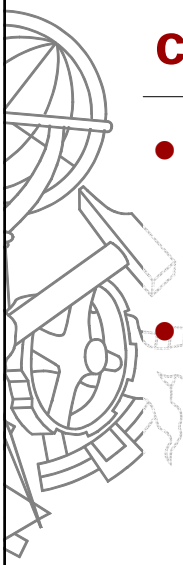
Operator Overloading (cont.)

- Advanced cases:
  - Operators “true” and “false”
    - Used in Boolean conditions and && ||
  - && is T.false(x) ? x : T.&(x, y)
  - || is T.true(x) ? x : T.|(x, y)



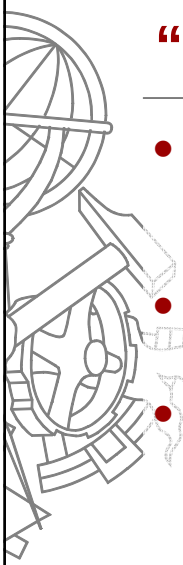
Variable argument lists

- Conventional way
  - void f (int x, int y, params float[] f);
  - Call: f(4, 5, 4.5, 2.3, …);
- Undocumented way
  - More general
  - Slower
  - void f(__arglist);
  - If you are interested see http://www.iunknown.com/Weblog/fog0000000098.html



checked and unchecked

- Checked and unchecked contexts
  - [un]checked(…)
  - [un]checked …;
- Affected:
  - ++ -- + - * /
  - Explicit conversions

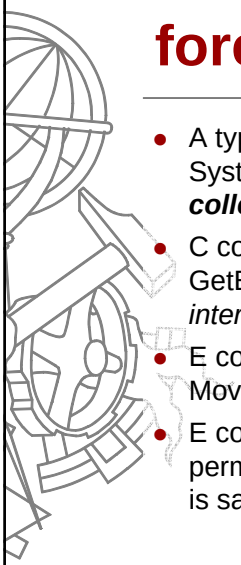


“is” and “as”

- Dynamic type checking
  - O is T
  - O as T
- Is can be very powerful
  - Knows about boxing and stuff…
- As in not like a cast
  - Returns null on error (not exception)

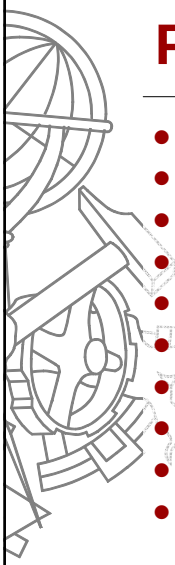
foreach

- Use of enumerators in the language
  - IEnumerable
  - Enumeration patter…
- foreach (*type identifier* in *expression)*
  embedded-statement



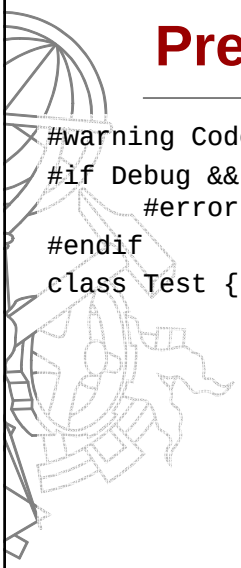
foreach (formal)

- A type C is said to be a ***collection type*** if it implements the System.IEnumerable interface or implements the ***collection pattern*** by meeting all of the following criteria:
- C contains a public instance method with the signature GetEnumerator() that returns a *struct-type*, *class-type*, or *interface-type*, which is called E in the following text.
- E contains a public instance method with the signature MoveNext() and the return type bool.
- E contains a public instance property named Current that permits reading the current value. The type of this property is said to be the ***element type*** of the collection type.



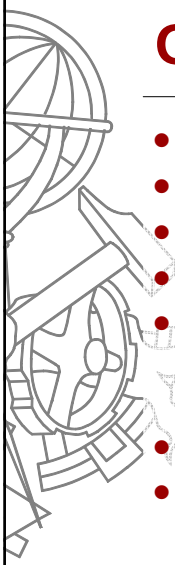
Preprocessor

- #define
- #undef
- #if
- #else
- #endif
- #region
- #endregion
- #error
- #warning
- #line



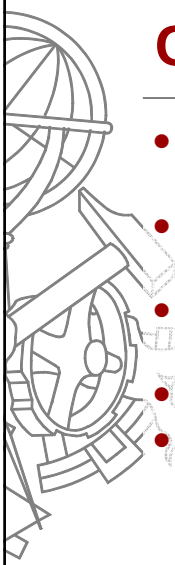
Preprocessor (examples)

```
#warning Code review needed before check-in
#if Debug && Retail
    #error A build can't be both debug and retail
#endif
class Test {...}
```



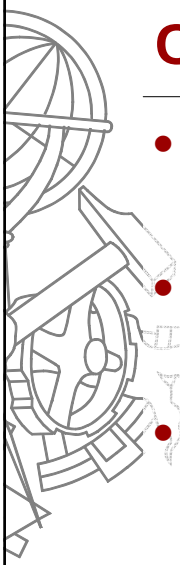
Others

- readonly keyword
- Static constructors
- “switch” works on strings
- “using” keyword
- “using” directives
  - nesting
  - aliases
- “lock” keyword
- “sealed” and “new” keywords



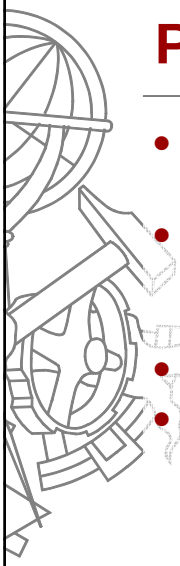
Classes

- Special Classes
  - Array, Delegate, Enum, ValueType
- “const” vs. “readonly” fields
  - “static readonly” fields
- “abstract”, “virtual”, “override” and “sealed” methods
- “external” methods
- Strange constructor behavior
  - Code for initialized fields executed before the constructor in object creation!



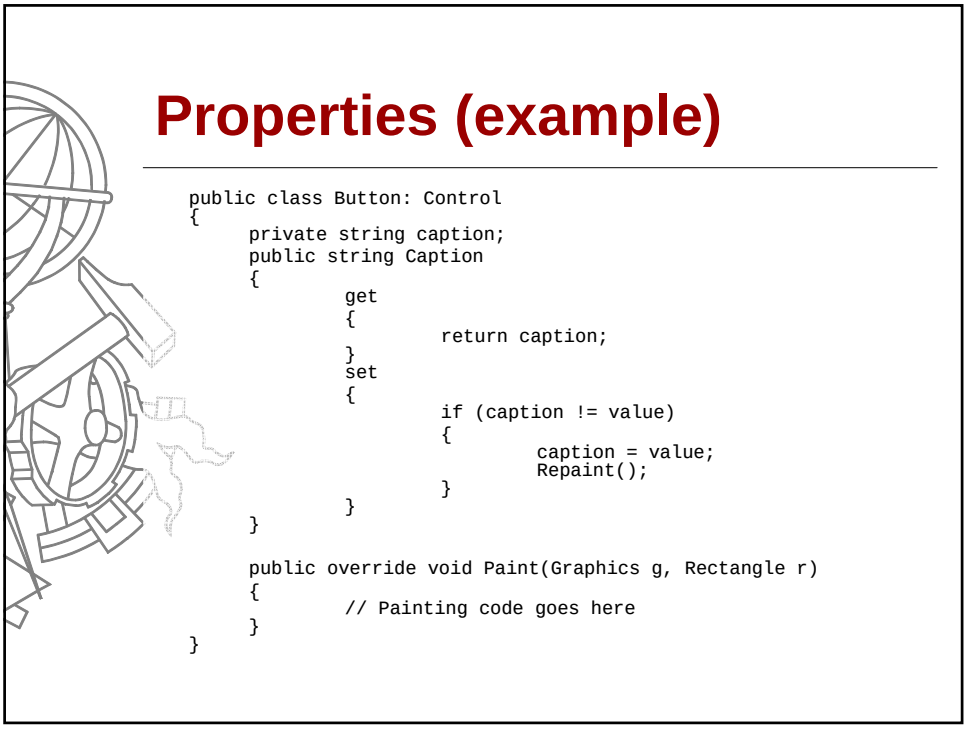
Classes (cont.)

- Constructors
  - Instance
  - Class (static)
- Overloading
  - this(...)
  - base(…)
- Default constructors
  - base()



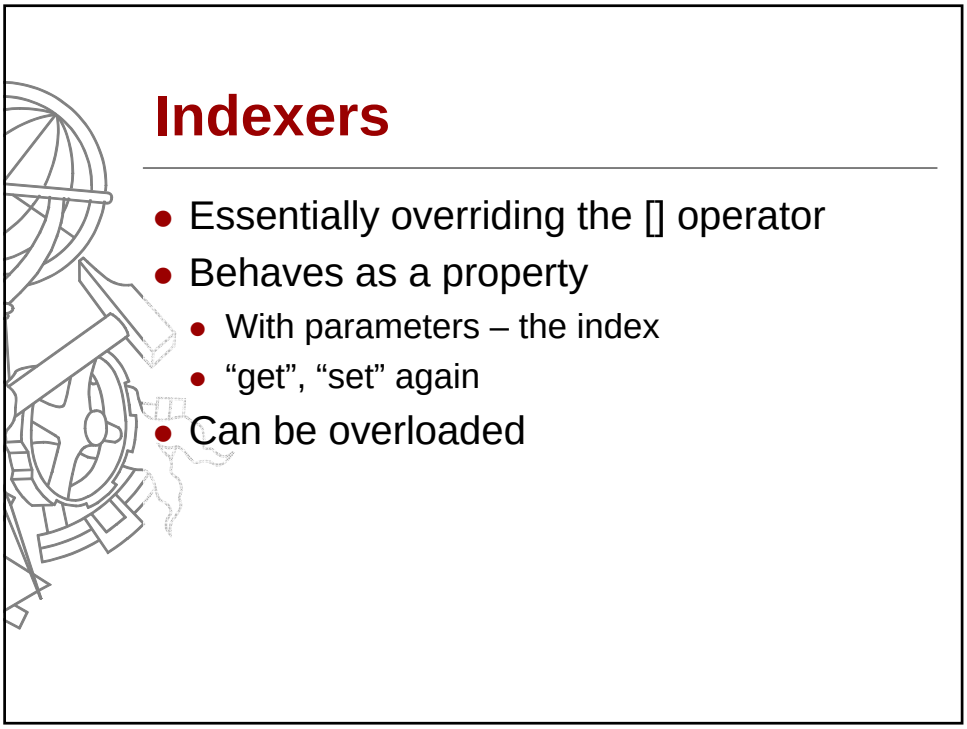
Properties

- Look like fields
  - Access pattern
- Behave like functions
  - Can be virtual, …
  - Have “get” and “set” methods
- Can be static
- Treated as a single member of the class
  - “new” hiding example



Properties (example)

```
public class Button: Control
{
	private string caption;
	public string Caption
	{
		get
		{
			return caption;
		}
		set
		{
			if (caption != value)
			{
				caption = value;
				Repaint();
			}
		}
	}

	public override void Paint(Graphics g, Rectangle r)
	{
		// Painting code goes here
	}
}
```



Indexers

- Essentially overriding the [] operator
- Behaves as a property
  - With parameters – the index
  - “get”, “set” again
- Can be overloaded

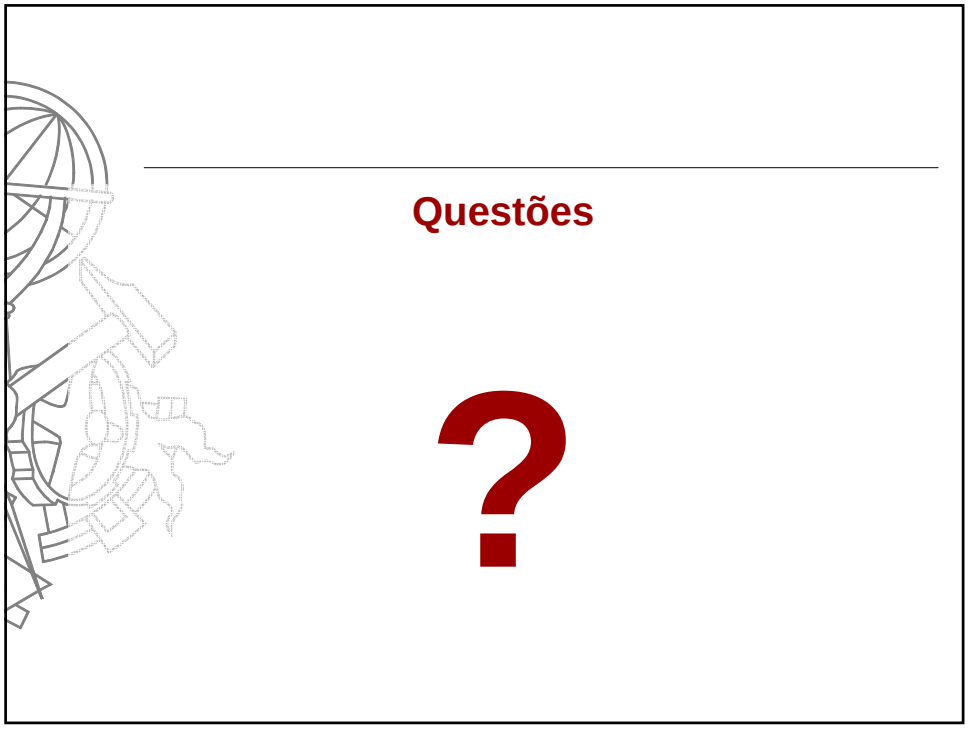
Indexers (example)

```
using System;
class BitArray
{
      int[] bits;
      int length;
      public BitArray(int length) {
                if (length < 0) throw new ArgumentException();
                bits = new int[((length - 1) >> 5) + 1];
                this.length = length;
      }
      public int Length {
                get { return length; }
      }
      public bool this[int index] {
                get {
                          if (index < 0 || index >= length) {
                                    throw new IndexOutOfRangeException();
                          }
                          return (bits[index >> 5] & 1 << index) != 0;
                }
                set {
                          if (index < 0 || index >= length) {
                                    throw new IndexOutOfRangeException();
                          }
                          if (value) {
                                    bits[index >> 5] |= 1 << index;
                          }
                          else {
                                    bits[index >> 5] &= ~(1 << index);
                          }
                }
      }
}
```

Topic 5: C# Syntax Features

Arrays

- Inherit from System.Array
- Initialization
- “foreach” works
- Jagged arrays
- Multi-dimensional arrays
- Array covariance
  - Example to follow…
  - Runtime check in assignment


Questões
?