Ambientes de Desenvolvimento Avançados

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Aula 5

Engenharia Informática

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O que é um componente e o que não é?

Capítulo 4 de:

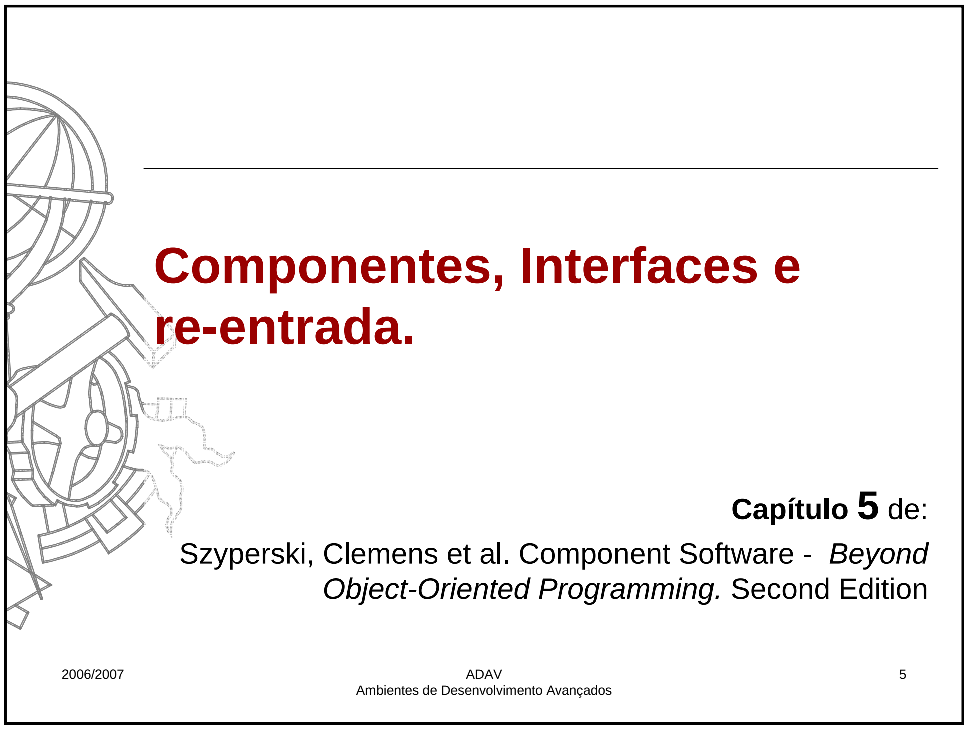
Szyperski, Clemens et al. Component Software - *Beyond Object-Oriented Programming.* Second Edition

O que é um componente?

- **“A software package which offers *service* through *interfaces*”**
  [Peter Herzum and Oliver Sims, “Business Components Factory: A Comprehensive Overview of Component-Based Development for the Enterprise”, John Wiley & Sons, Incorporated, 1999].
- **“A coherent package of software artifacts that can be independently developed and delivered as a unit and that can be composed, unchanged, with other components to build something larger”**
  [D.F. D’Souza and A.C. Wills, “Objects, Components, And Frameworks with UML – The Catalysis Approach” Addison-Wesley, 1998].
- **“A component is a unit of composition with contractually specified interfaces and *explicit context dependencies* only. A software component can be deployed independently and is subject to composition by third parties.”**
  [C. Szyperski, “Component Software: Beyond Object-Oriented Programming” Addison-Wesley, 1998].

O que não é um componente?

Component isn’t an object, not in sense of simply being an object in a Java or C++ program, although it is true at runtime.



Componentes, Interfaces e re-entrada.

Capítulo 5 de:

Szyperski, Clemens et al. Component Software - *Beyond Object-Oriented Programming.* Second Edition

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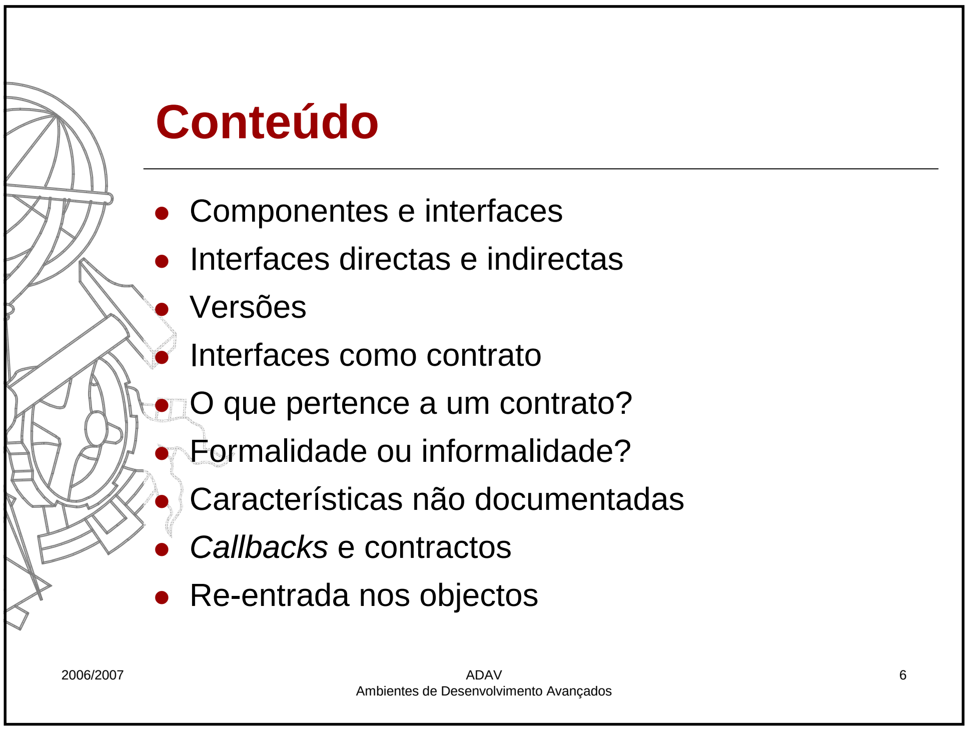

Conteúdo

- Componentes e interfaces
- Interfaces directas e indirectas
- Versões
- Interfaces como contrato
- O que pertence a um contrato?
- Formalidade ou informalidade?
- Características não documentadas
- *Callbacks* e contractos
- Re-entrada nos objectos

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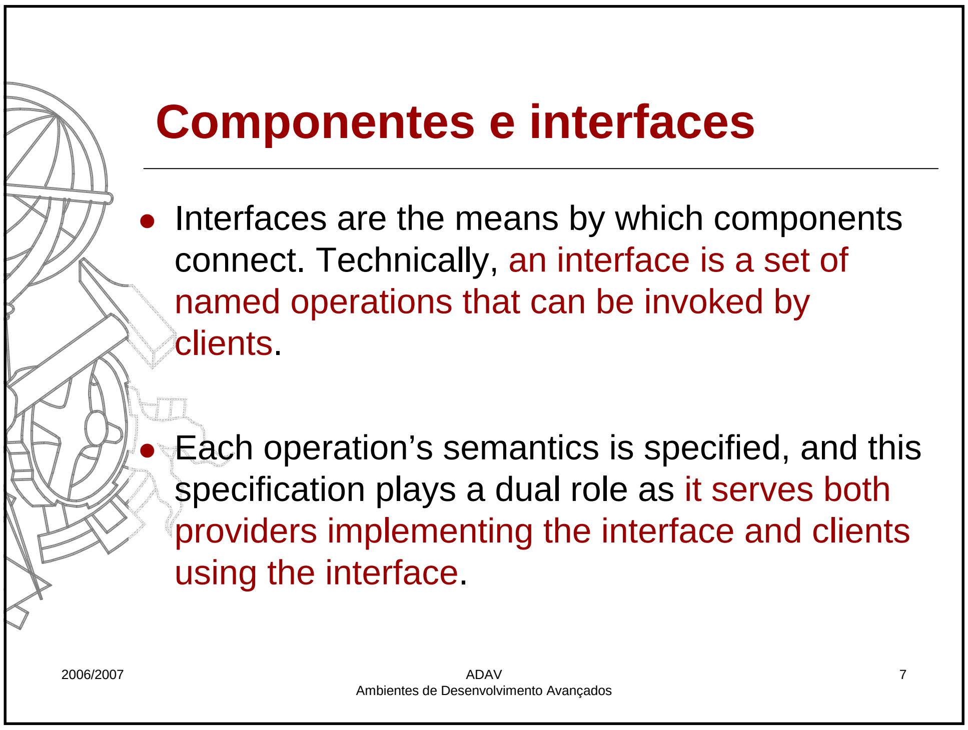
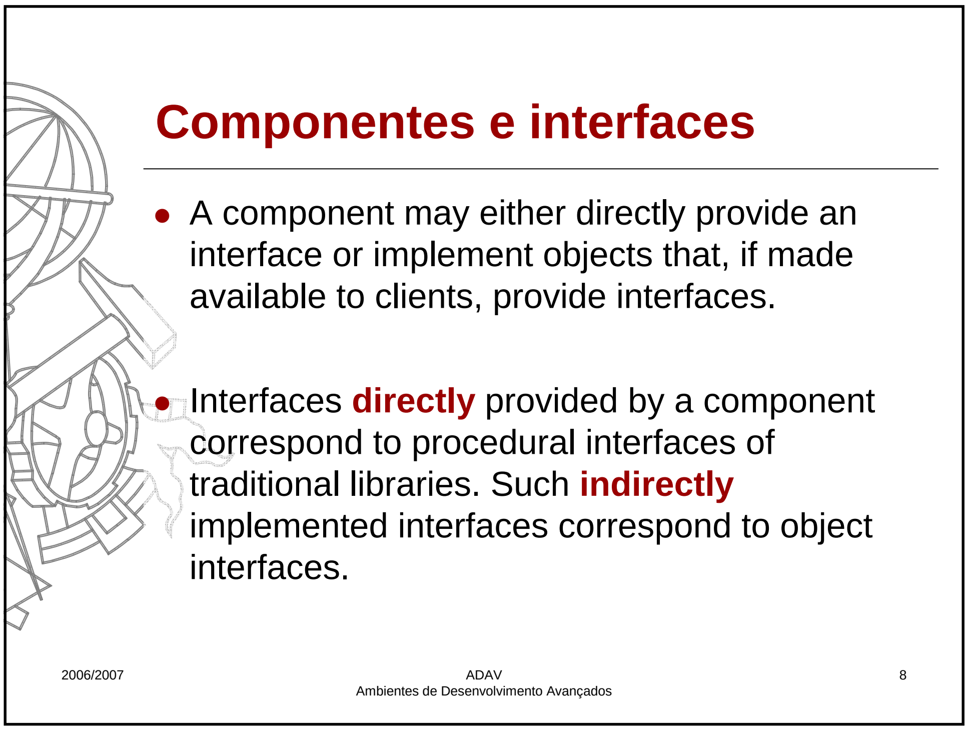


Componentes e interfaces

- Interfaces are the means by which components connect. Technically, an interface is a set of named operations that can be invoked by clients.
- Each operation’s semantics is specified, and this specification plays a dual role as it serves both providers implementing the interface and clients using the interface.



Componentes e interfaces

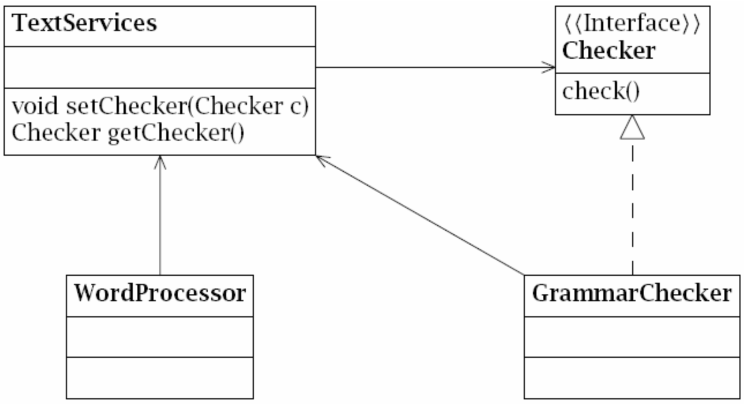
- A component may either directly provide an interface or implement objects that, if made available to clients, provide interfaces.
- Interfaces **directly** provided by a component correspond to procedural interfaces of traditional libraries. Such **indirectly** implemented interfaces correspond to object interfaces.

Interfaces Directas e indirectas

- A procedural (direct) interface to a component is modeled as an object interface of a static object within the component.
- An object (indirect) interface introduces an indirection called method dispatch or, sometimes, dynamic method lookup.

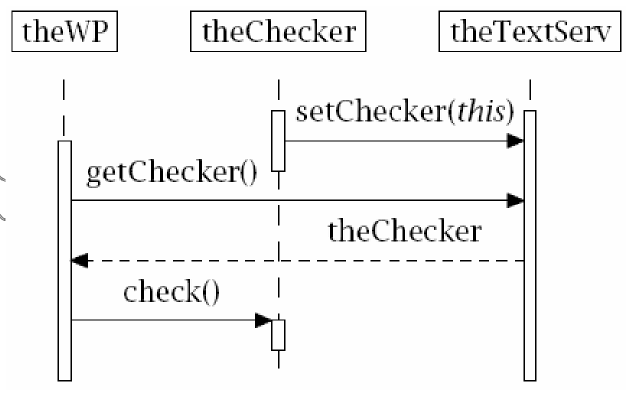
Interfaces Directas e indirectas

Example of indirection: classes



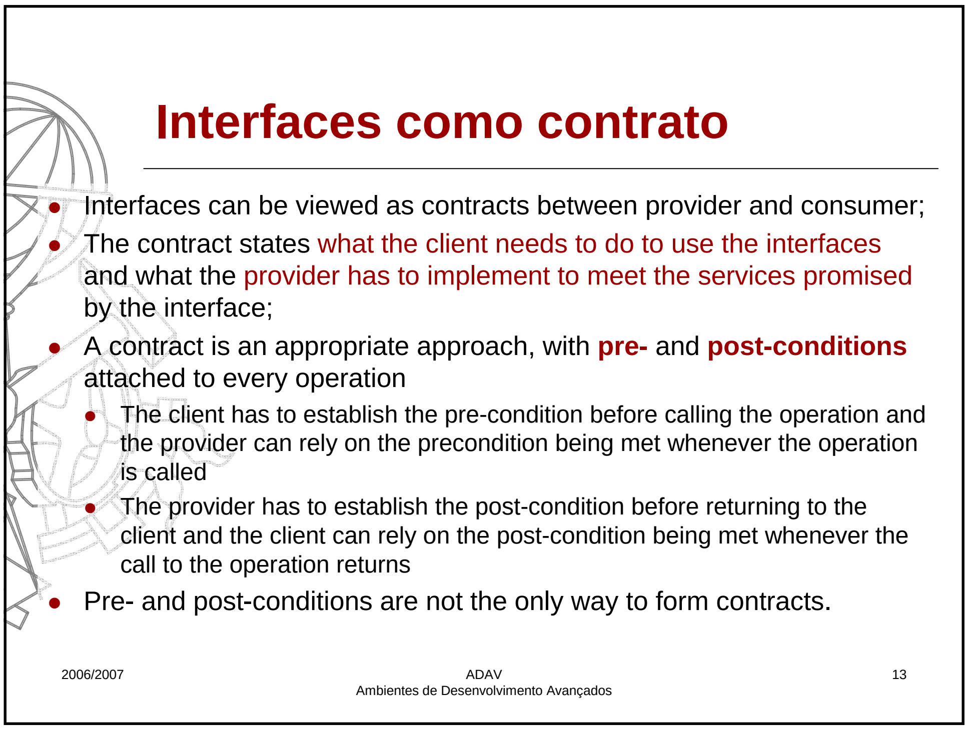
Interfaces Directas e indirectas

Example of indirection: messages



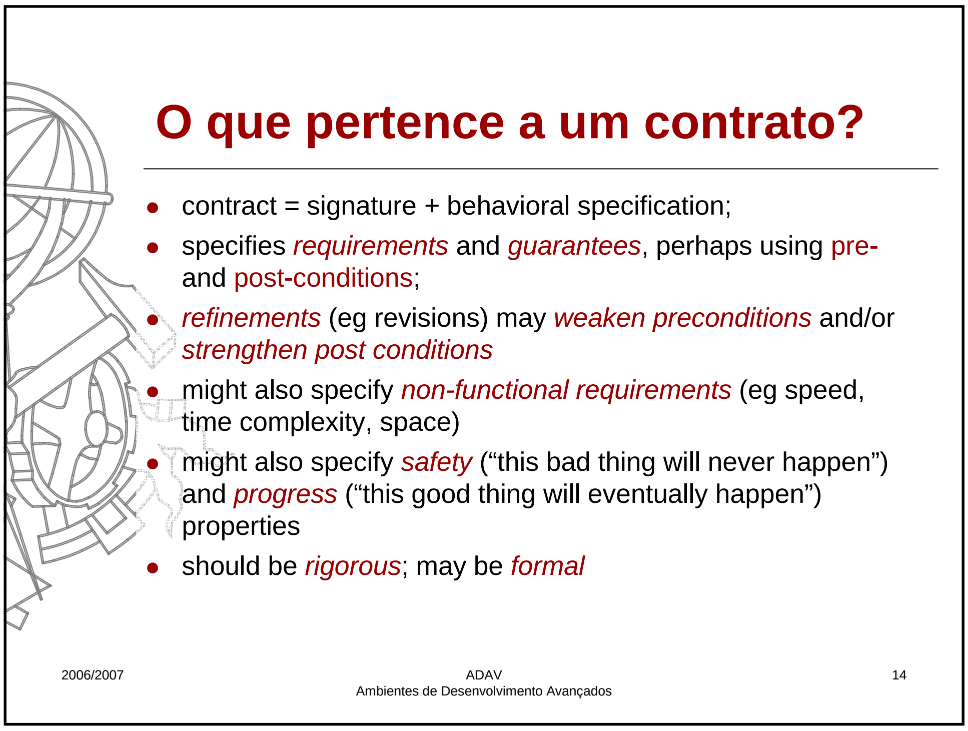
Versões

- Traditional version management assumes that the versions of a component evolve at a single source. In a free market, the evolution of versions is more complex and management of version numbers can become a problem in its own right.
- With direct interfaces it suffices to check versions at bind time, which is when a service is first requested.
- In indirect interfaces couple arbitrary third party.
- In a versioned system, care must be taken to avoid indirect coupling of parties that are of incompatible versions.
- The goal is to ensure that older and newer components are either compatible or clearly detected as incompatible.



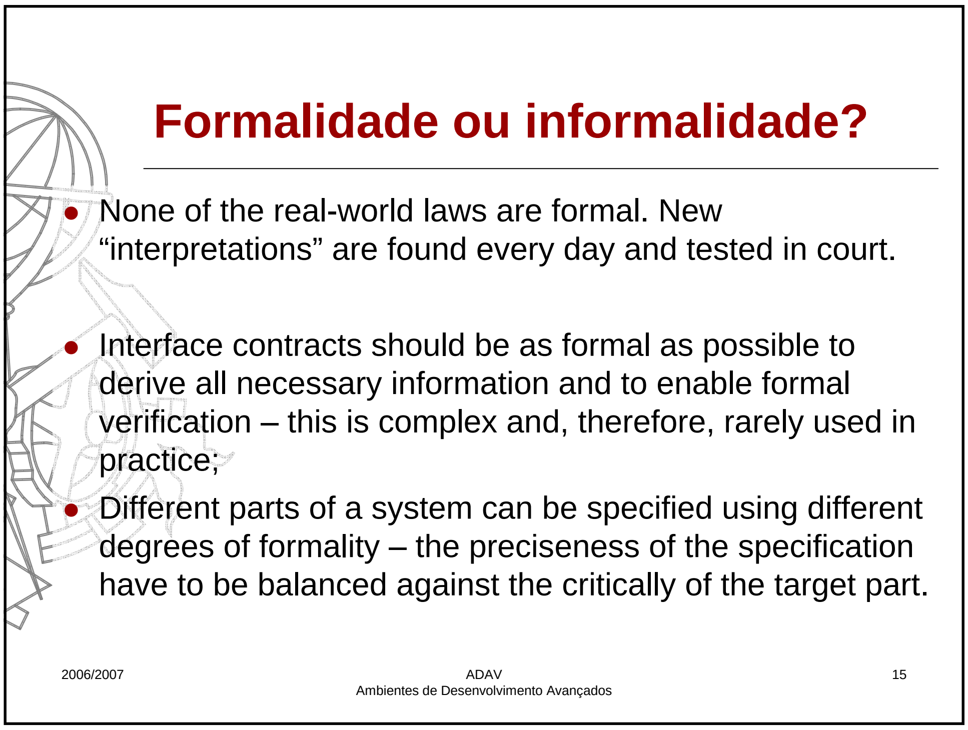
Interfaces como contrato

- Interfaces can be viewed as contracts between provider and consumer;
- The contract states what the client needs to do to use the interfaces and what the provider has to implement to meet the services promised by the interface;
- A contract is an appropriate approach, with **pre-** and **post-conditions** attached to every operation
  - The client has to establish the pre-condition before calling the operation and the provider can rely on the precondition being met whenever the operation is called
  - The provider has to establish the post-condition before returning to the client and the client can rely on the post-condition being met whenever the call to the operation returns
- Pre- and post-conditions are not the only way to form contracts.



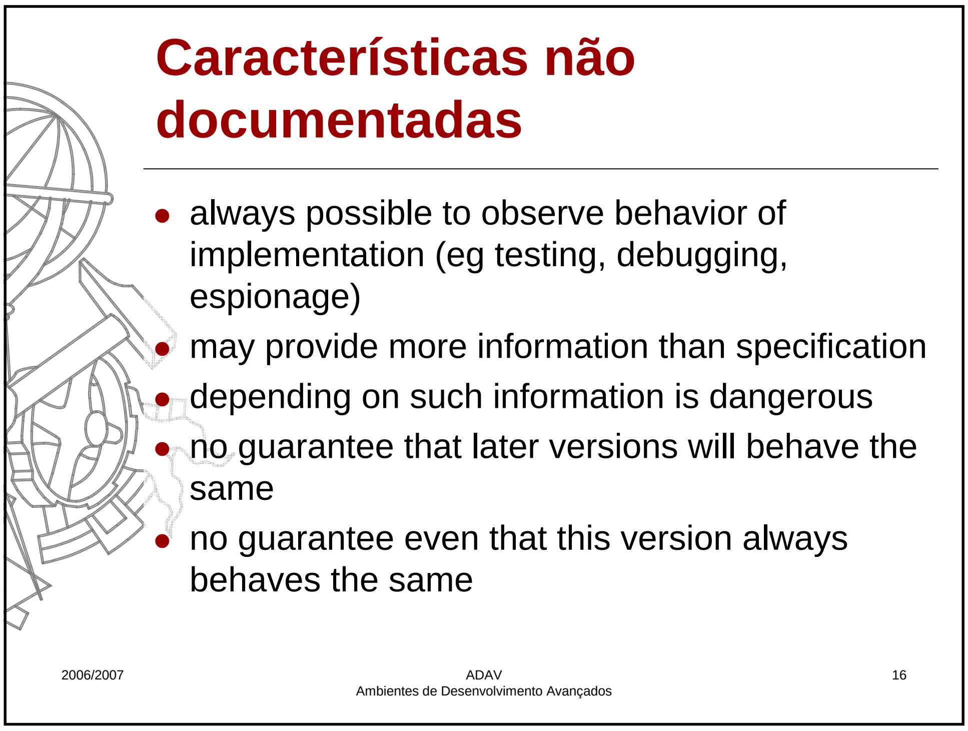
O que pertence a um contrato?

- contract = signature + behavioral specification;
- specifies *requirements* and *guarantees*, perhaps using pre- and post-conditions;
- *refinements* (eg revisions) may *weaken preconditions* and/or *strengthen post conditions*
- might also specify *non-functional requirements* (eg speed, time complexity, space)
- might also specify *safety* (“this bad thing will never happen”) and *progress* (“this good thing will eventually happen”) properties
- should be *rigorous*; may be *formal*



Formalidade ou informalidade?

- None of the real-world laws are formal. New “interpretations” are found every day and tested in court.
- Interface contracts should be as formal as possible to derive all necessary information and to enable formal verification – this is complex and, therefore, rarely used in practice;
- Different parts of a system can be specified using different degrees of formality – the preciseness of the specification have to be balanced against the critically of the target part.



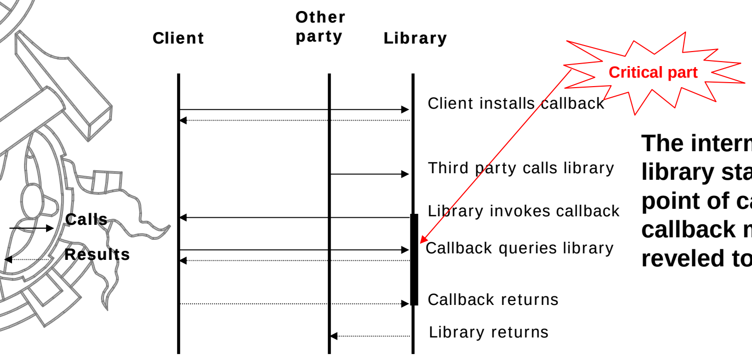
Características não documentadas

- always possible to observe behavior of implementation (eg testing, debugging, espionage)
- may provide more information than specification
- depending on such information is dangerous
- no guarantee that later versions will behave the same
- no guarantee even that this version always behaves the same

Callbacks e contractos

- *Callback* or *up-call* is procedure *registered with* and subsequently called by a library
- *Callbacks* are a common feature in procedural libraries that have to handle asynchronous events.
- A callback usually reverses the direction of the flow of controls, so a lower layer calls a procedure in a higher layer.
- The resulting contract are far less manageable than simple pre- and post-conditions.
- Validity of the library state is specified as part of a contract.

Callbacks e contractos

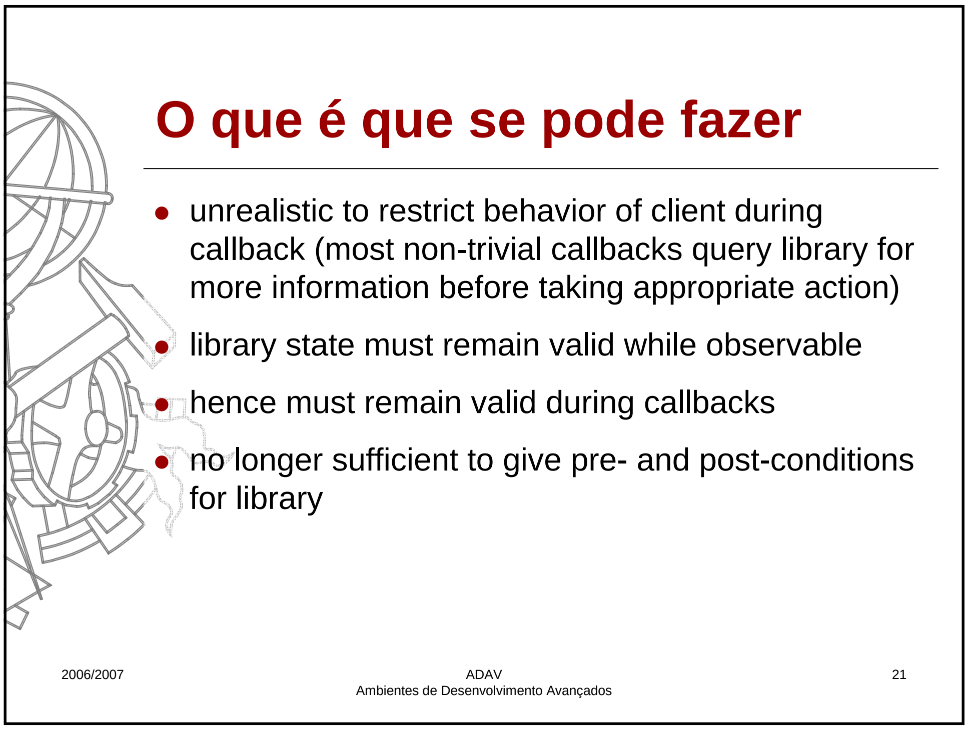


The intermediate library state at the point of calling the callback may be reveled to clients.

```
public delegate void MyDelegate();   // delegate declaration

public interface I {
   event MyDelegate MyEvent;
   void FireAway();
}

public class MyClass: I {
   public event MyDelegate MyEvent;

   public void FireAway()
   {
      if (MyEvent != null)
         MyEvent();
   }
}

public class MainClass {
   static private void f()    {
      Console.WriteLine(“Called when the event fires.");
   }

   static public void Main ()    {
      I i = new MyClass();

      i.MyEvent += new MyDelegate(f);
      i.FireAway();
   }
}
```

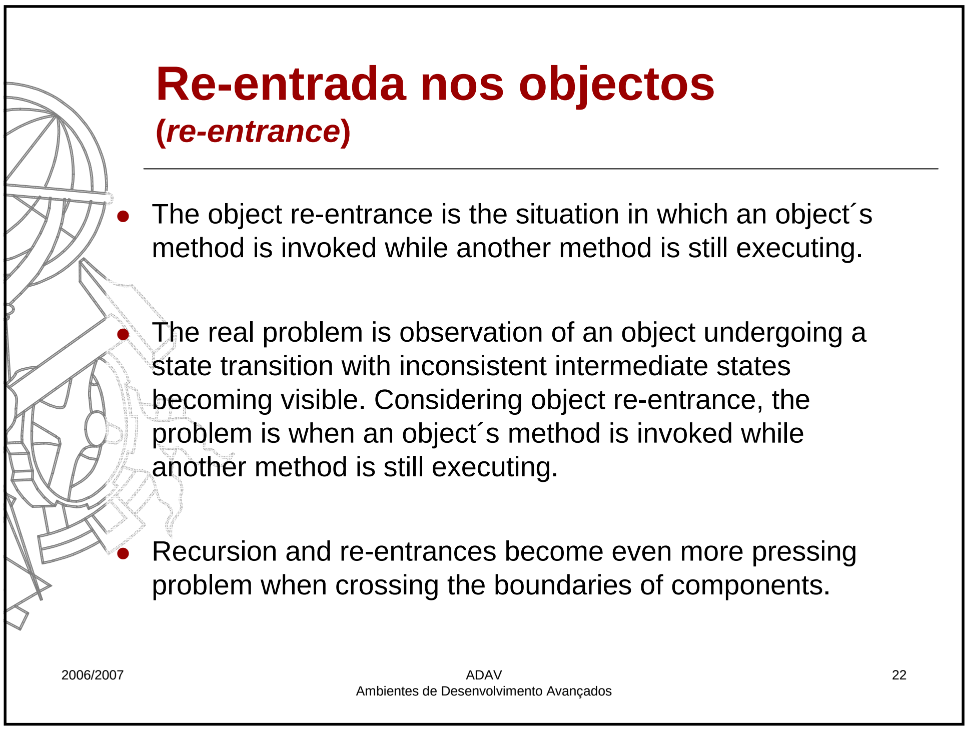
Que é têm de especial os *callbacks*?

- in layered architecture, calls originate in higher (more abstract) layer and move downwards
- library operations complete before returning to client, who cannot observe intermediate states
- callback usually reverses this flow
- intermediate state of library becomes visible
- client may observe, or even modify, library’s intermediate state
- client certainly observes identity and ordering of callbacks



O que é que se pode fazer

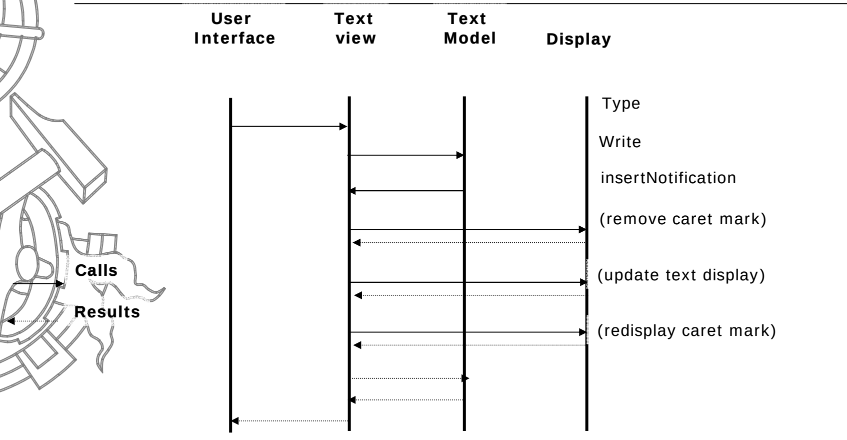
- unrealistic to restrict behavior of client during callback (most non-trivial callbacks query library for more information before taking appropriate action)
- library state must remain valid while observable
- hence must remain valid during callbacks
- no longer sufficient to give pre- and post-conditions for library



Re-entrada nos objectos
(*re-entrance*)

- The object re-entrance is the situation in which an object´s method is invoked while another method is still executing.
- The real problem is observation of an object undergoing a state transition with inconsistent intermediate states becoming visible. Considering object re-entrance, the problem is when an object´s method is invoked while another method is still executing.
- Recursion and re-entrances become even more pressing problem when crossing the boundaries of components.

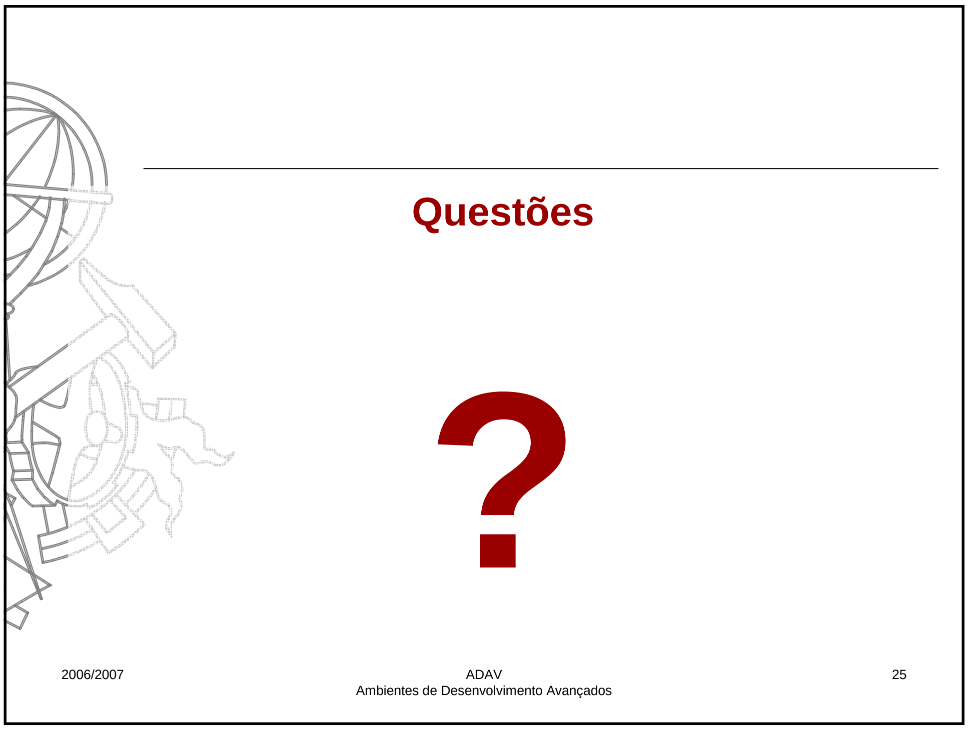
Re-entrada nos objectos
(*re-entrance*)



Message sequence caused by a request to insert a typed character

Re-entrada nos objectos

- **Multi-threading**
  - problems of recursive re-entrance similar to those of concurrent interaction
  - perhaps helps to make objects *thread-safe*? (ie protected from unwanted interference from concurrent activities)
  - no! thread safety addresses only external re-entrance
  - locking prevents other objects from invoking our methods, but cannot prevent us from invoking our own (or self-inflicted deadlocks would result)



Questões

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