



# Ambientes de Desenvolvimento Avançados

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<http://www.dei.isep.ipp.pt/~jtavares/ADAV/ADAV.htm>

## Aula 18

### Engenharia Informática

2005/2006

José António Tavares  
jrt@isep.ipp.pt

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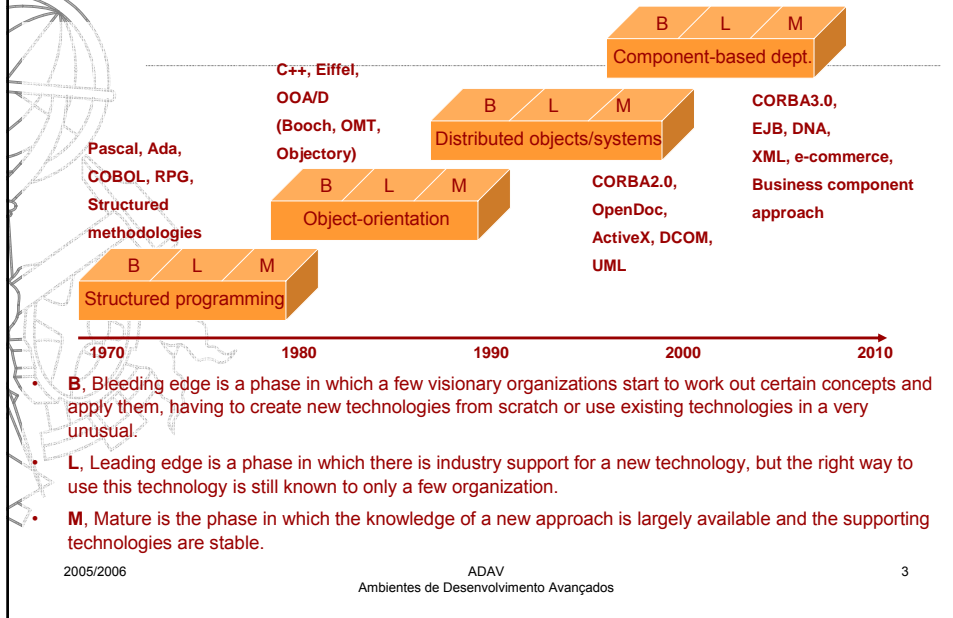
# SOA

## Service Oriented Architecture

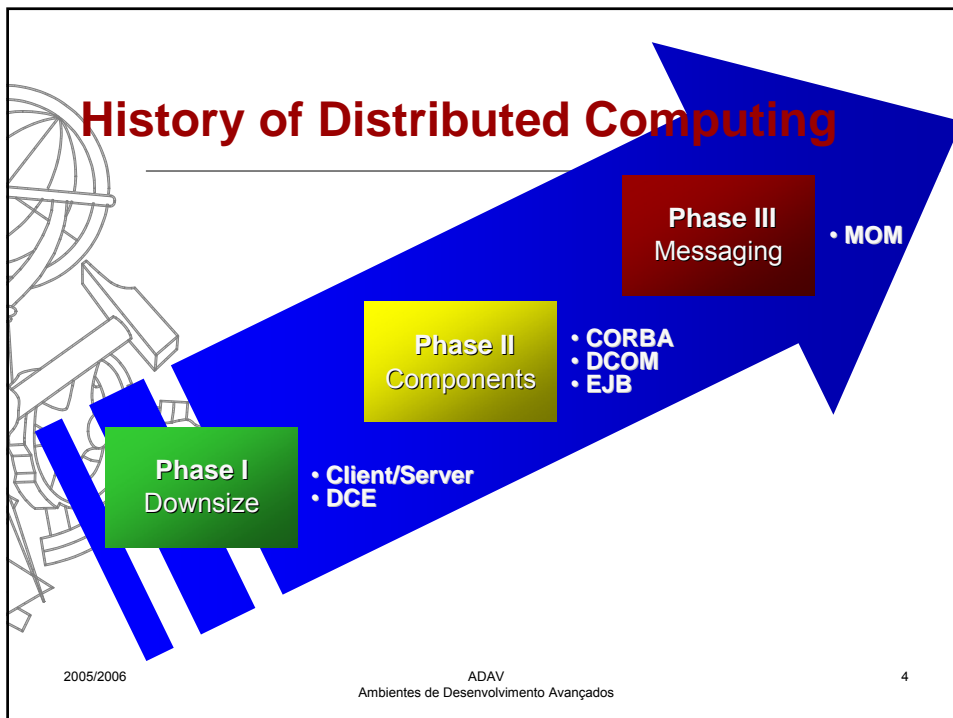
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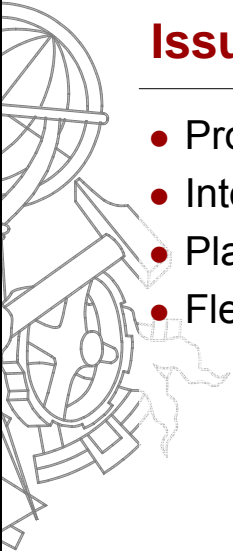
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## Evolução para os Componentes na Industria



## History of Distributed Computing



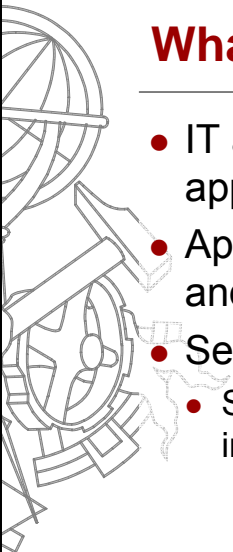


## Issues with Existing Models

- Proprietary protocols
- Interoperability
- Platform lock-in
- Flexibility

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## What is SOA?

- IT architecture for request - reply applications
- Application functions are modularized and presented as services
- Services are loosely coupled
- Service interface is independent of the implementation

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## Terminology

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- **Message**
  - Data exchanged between services
  - Not Objects. Code doesn't travel
- **Context**
  - Defines scope of action, conversation
  - Clothes-line for state and infrastructure
- **Destinations**
  - Target service or service class.
  - Not "http://somewhere/"

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## Service Orientated Architecture

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- An architectural approach to creating systems built from autonomous services
  - Integration as a fore-thought rather than an after-thought
- A service is a program you interact with via message exchanges
  - Services are built to last
  - Availability and stability are critical
- A system is a set of deployed services cooperating in a given task
  - Systems are built to change
  - Adapt to new services after deployment

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## Four Tenets of Service Orientation

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1. Boundaries Are Explicit
2. Services Are Autonomous
3. Services Share Schema And Contract, Not Class
4. Service Compatibility Is Determined By Policy

**ten-et** [ténnet]  
(plural **ten-ets**)  
noun

**something accepted as an important truth:** any of a set of established and fundamental beliefs, especially one relating to religion or politics (*formal*)  
*a tenet of Christianity*

[Late 16th century. From Latin, literally "he or she holds," the 3rd person present singular form of *tenere* "to hold."]

Microsoft® Encarta® Reference Library 2005. © 1993-2004 Microsoft Corporation. All rights reserved.



## Examples of Services

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- Storage service
- Data transfer
- Troubleshooting service
- Common theme is monitoring service, storage services and query services.

## Technology Agnostic Interaction

- SOAP / XML is the only hope
- COM, CORBA, RMI assume platform
- Anything binary assumes platform
- Any transport assumes platform
- XML InfoSet is the focal point

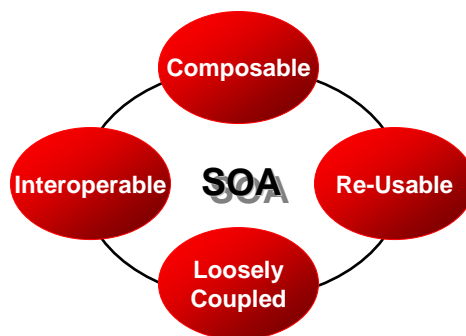
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## Characteristics of SOA

- Services have platform independent, self describing interfaces (XML)
- Messages are formally defined
- Services can be discovered
- Services have quality of service characteristics defined in policies
- Services can be provided on any platform

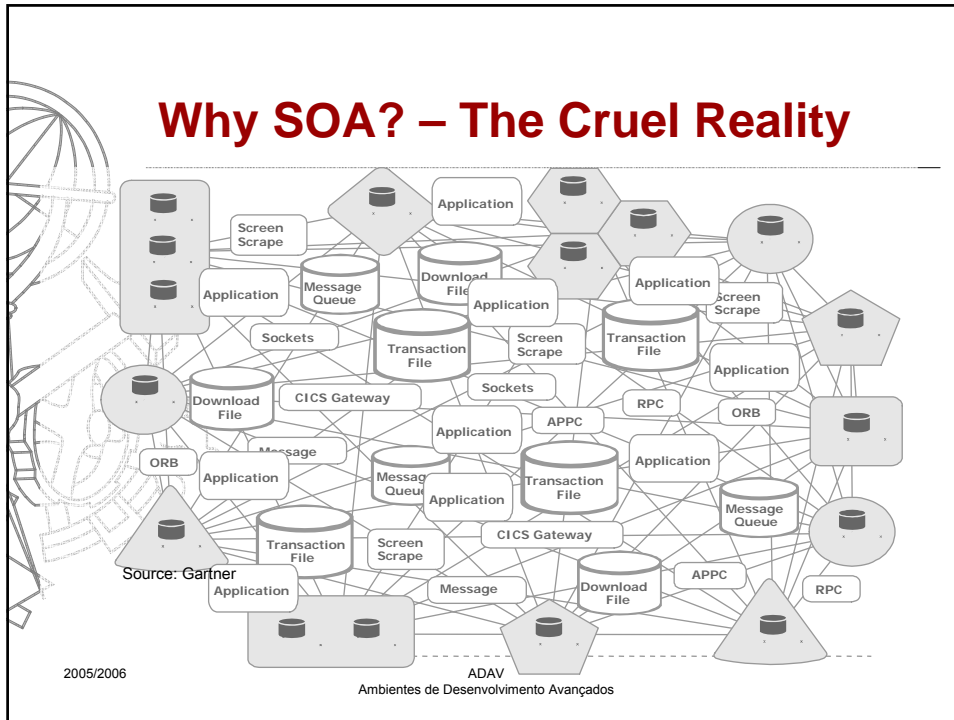


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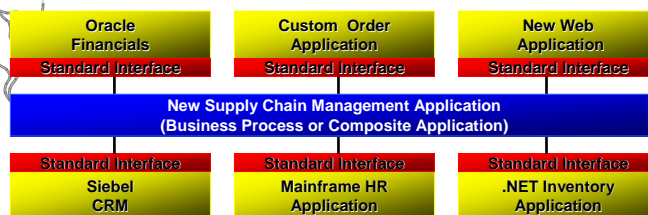
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## Why SOA? – The Cruel Reality



## Why SOA?

- Respond to business changes
- Address new needs with existing applications
- Unlock existing application investments
- Support new channels & complex interactions
- Support organic business

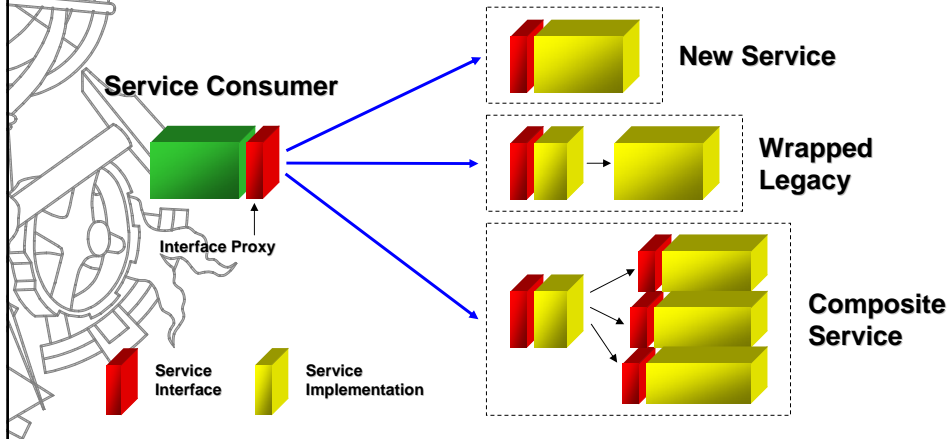


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## Anatomy of a Service



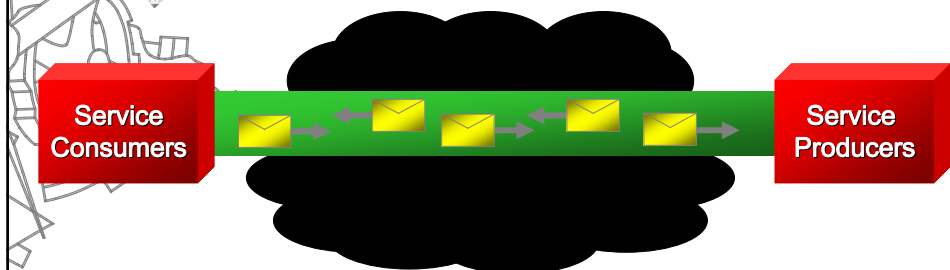
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## Service Communication

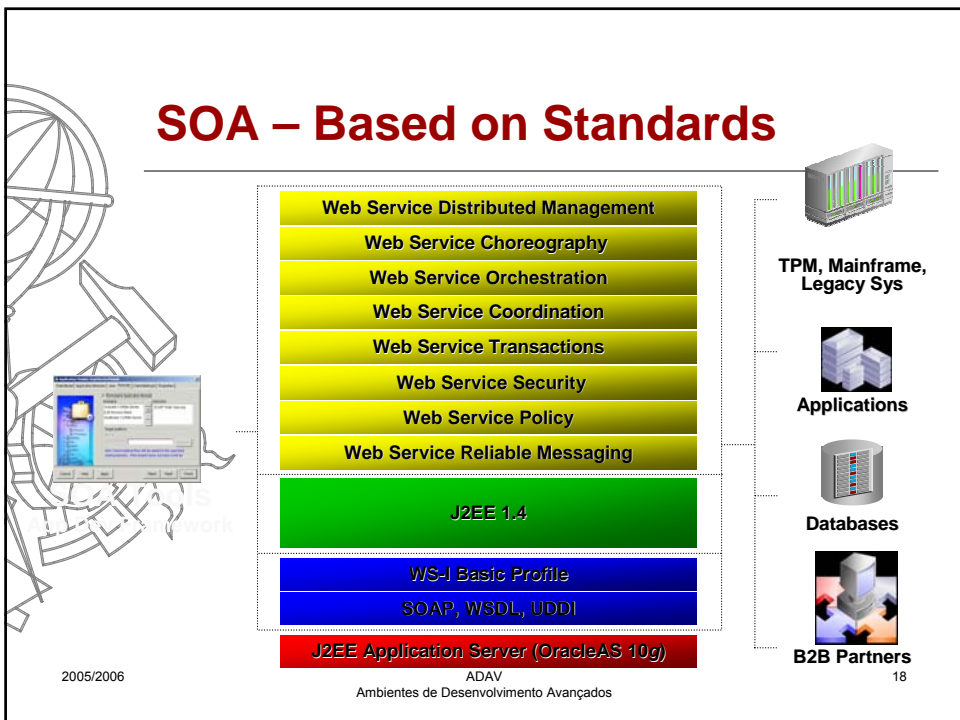
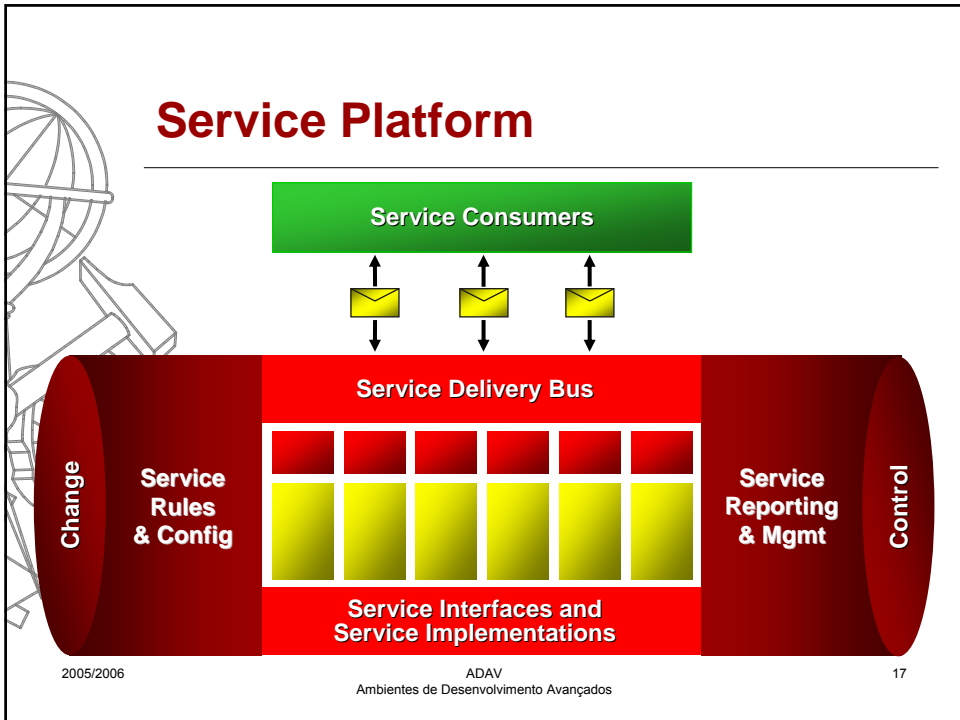
- Communicate with messages
- No knowledge about partner
- Likely heterogeneous

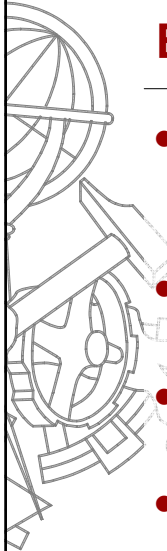


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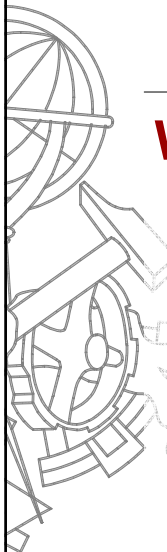





## Benefits of SOA

- Better reuse
  - Build new client functionality on top of existing Business Services
- Well defined interfaces
  - Make changes without affecting clients
- Easier to maintain
  - Changes/Versions are not all-or-nothing
- Better flexibility

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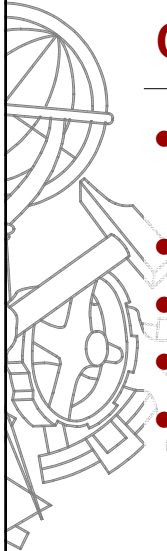


## Web Services



Web Services

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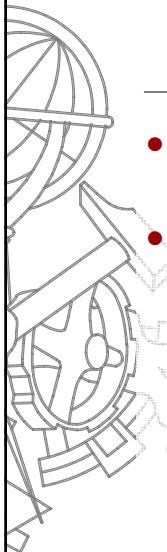


## Conteúdo

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- Introdução
  - história da computação distribuída
- Arquitecturas
- SOAP
- WSDL
- UDDI

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## Web Services

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- A **Web Service** is a method that is callable remotely across a network
- **The Service Web will be the backbone of functionality for the coming generation of distributed applications**

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## Web Services

- **Web services** são serviços oferecidos via Web.
- **Web services** são aplicações modulares que são autodescritas e podem ser publicadas, localizadas e invocadas de qualquer local na Web (ou numa LAN).



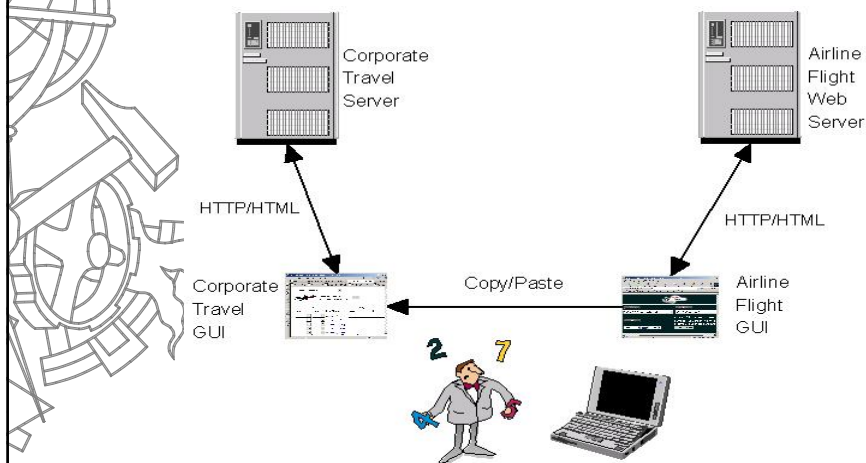
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let stock_value = apli2.get_stock("IBM")
```

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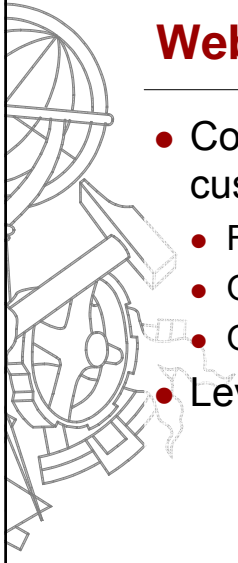
## Web Services



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## Web Services

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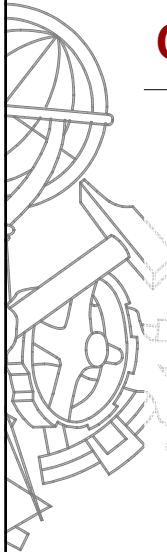
- Companies, suppliers, partners, and customers must be able to work together
  - Faster than ever before
  - Over the Internet
  - Or risk “death by isolation”
- Leverage Internet cost structure



## Web Services

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- **Possible Solutions**
  - Distributed computing
  - Web sites (portals)
  - Web Services



## Computação Distribuída

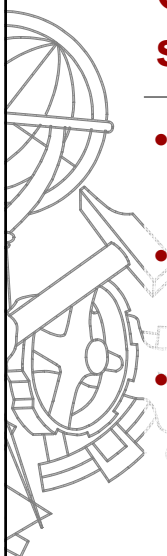
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- CORBA/IIOP (OMG) [www.corba.org/](http://www.corba.org/)
  - Common Object Request Broker Architecture
  - Internet Inter-ORB Protocol
- especialização TCP/IP de GIOP (General ...)
  - *Statefull Programming Model*
- Modelo orientado à ligação (*overheads* de sessão)
- COM e DCOM (MS) [www.microsoft.com/com/](http://www.microsoft.com/com/)
  - Complexo
  - Orientado à ligação (*overheads* de sessão)
- RMI (SUN) [java.sun.com/products/jdk/rmi/](http://java.sun.com/products/jdk/rmi/)
  - Bom desempenho
  - Apenas para a linguagem JAVA

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## Comunicação síncrona/assíncrona

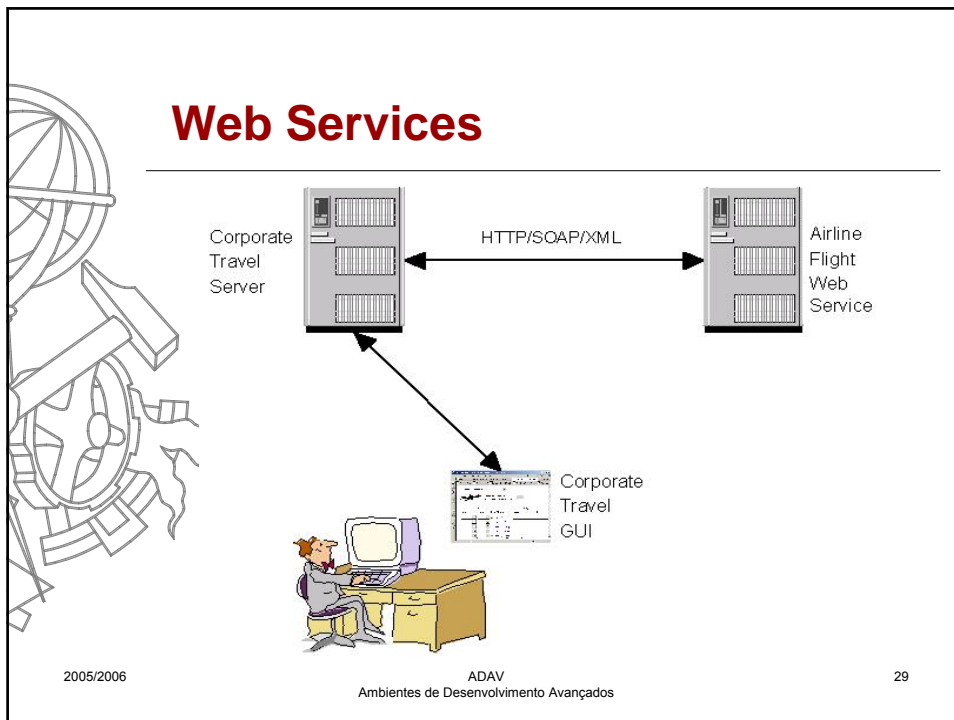
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- DCOM e RMI são orientados ao pedido/resposta
  - Síncronos; não permitem envio de mensagens só num sentido
- JMS (Java) [java.sun.com/products/jms/](http://java.sun.com/products/jms/)
  - *Java Message Service*
  - Suporta filas de mensagens e o modelo editor/subscritor
- MSMQ (MS) [www.microsoft.com/msmq/default.htm](http://www.microsoft.com/msmq/default.htm)
  - *Microsoft Message Queueing*
  - Suporta trocas segura e fiável de mensagens, suporte para transacções, etc.

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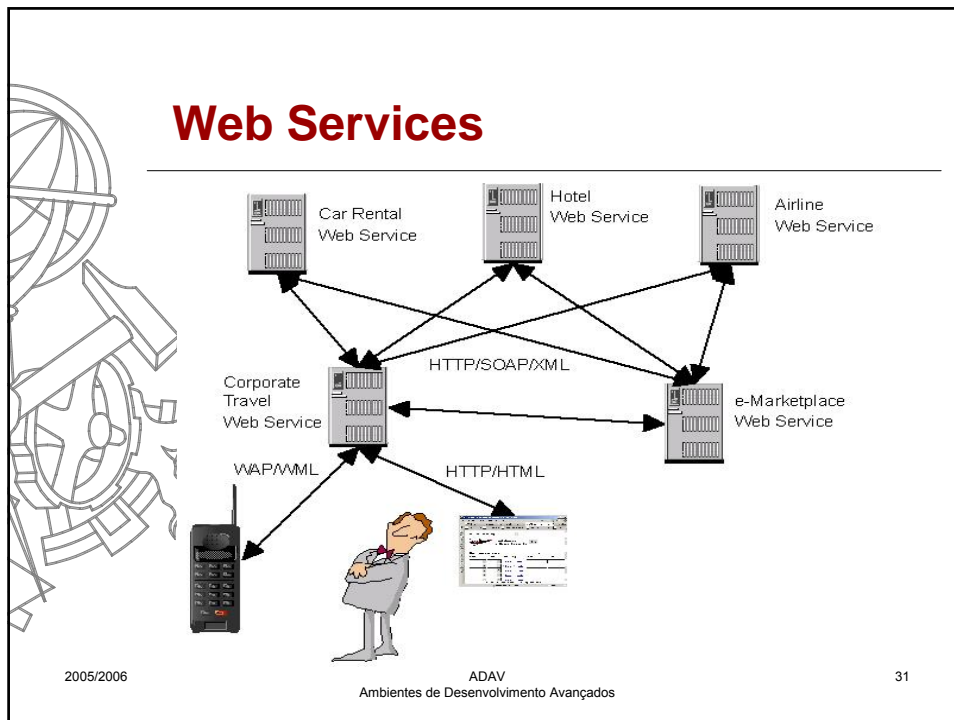
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- ## Web Services
- ### Portal Limitations
- No standard way to expose functionality
  - Integration is expensive and error-prone
  - Hard to outsource
  - Not designed to be used outside original scope
  - The problem?
    - HTML is designed for presentation to people
    - Can't repurpose it in a general, reliable way
    - Don't even think about screen scraping
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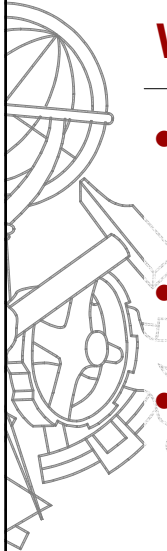
## Web Services



## What Is a Web Service?

- The solution? Web Services!
- A Web Service exposes functionality to a consumer
  - Over the Internet or intranet
  - A programmable URL
  - Functions you can call over the Internet

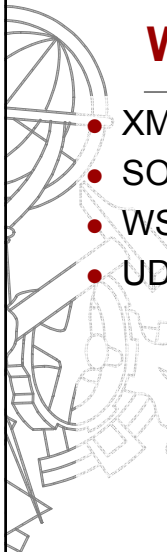




## What Is a Web Service?

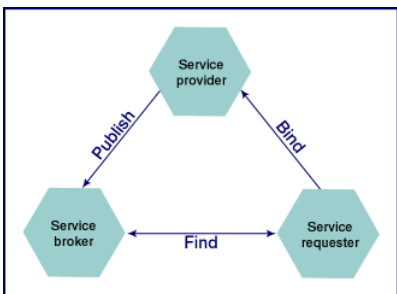
- Based on Web standards
  - HTTP, XML, SOAP, WSDL, UDDI, with more to come
- Can be implemented in any language on any platform
- Black boxes
  - Component-like, reusable

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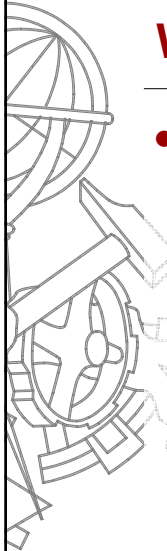
## Web Services Standards

- XML is the “lingua franca”
- SOAP (Message format and protocol)
- WSDL (Web Services Description Language)
- UDDI (Directory)



```
graph TD; SP[Service provider]; SB[Service broker]; SR[Service requester]; SP -- Publish --> SB; SB -- Find --> SR; SR -- Bind --> SP;
```

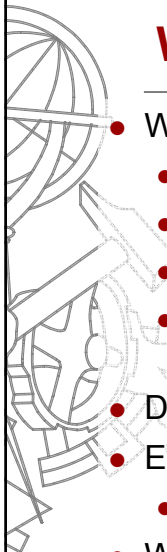
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## What Is a Web Service?

- A Web Service combines the best features of distributed computing and portals and eliminates the worst
  - Provides a mechanism for invoking methods remotely
  - Uses Web standards (e.g. HTTP, XML) to do so

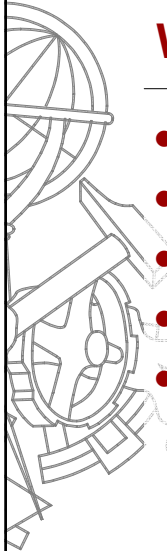
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## What is a Web Service?

- Web Services allow you to interconnect:
  - Different companies
  - Many/any devices
  - Applications
  - Different clients
    - Not just browsers
  - Distribution and integration of application logic
  - Enable the programmable Web
    - Not just the purely interactive Web
  - Web Services are loosely coupled


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## What is a Web Service?

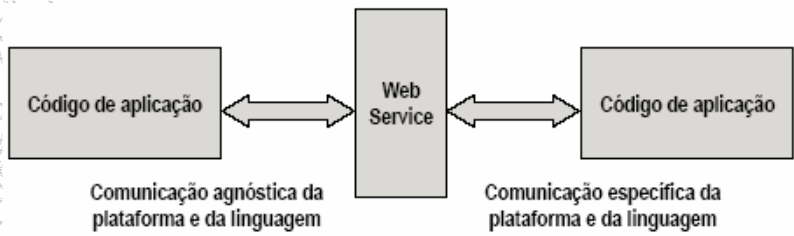
- New paradigm for Internet development
- Deliver applications as services
- Richer, customer-driven experience
- Continuous delivery of value/bits
- Third-generation Internet

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## What is a Web Service?

- *Web Services* fornecem uma abstracção entre o código da aplicação cliente e o código da aplicação servidor



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## What Is a Web Service?

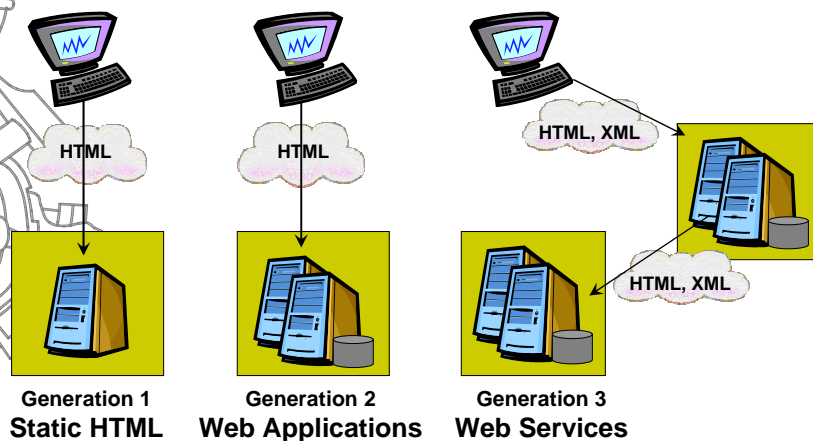
- *"Web services are modular, self-describing applications that can be published, located and invoked from just about anywhere on the Web or a local Network. The provider and the consumer of the XML Web Service do not have to worry about the Operating System, language environment or component model used to create or access the XML Web Service, as they are based on ubiquitous and Open Internet standards, such as XML, HTTP and SMTP."*

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## Evolution of the Web



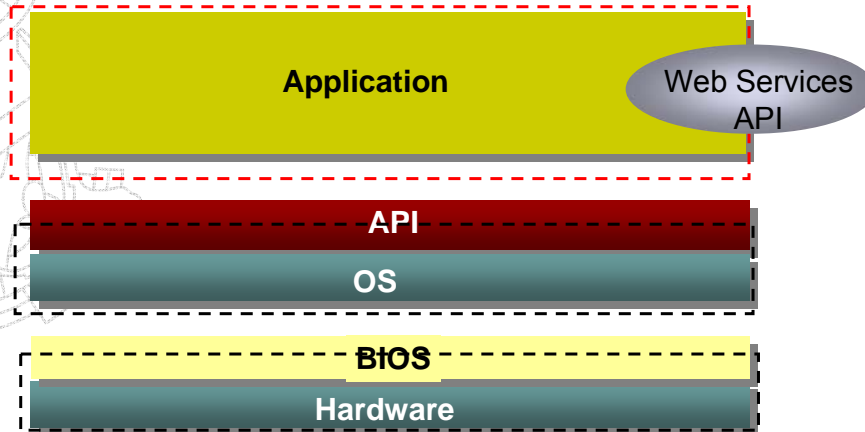
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# What is a Web Service?

## Web Service as an API



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## Benefits

- Everyone
  - Leverage existing infrastructure
  - “Build or buy” development decisions
  - Minimize development time/costs
- Enterprises
  - Integration imperative
  - Dynamic, easy B2B relationships
- New Web-based businesses
  - Greater personalization
  - New services/new revenue streams
  - Be “everywhere” vs. single destination

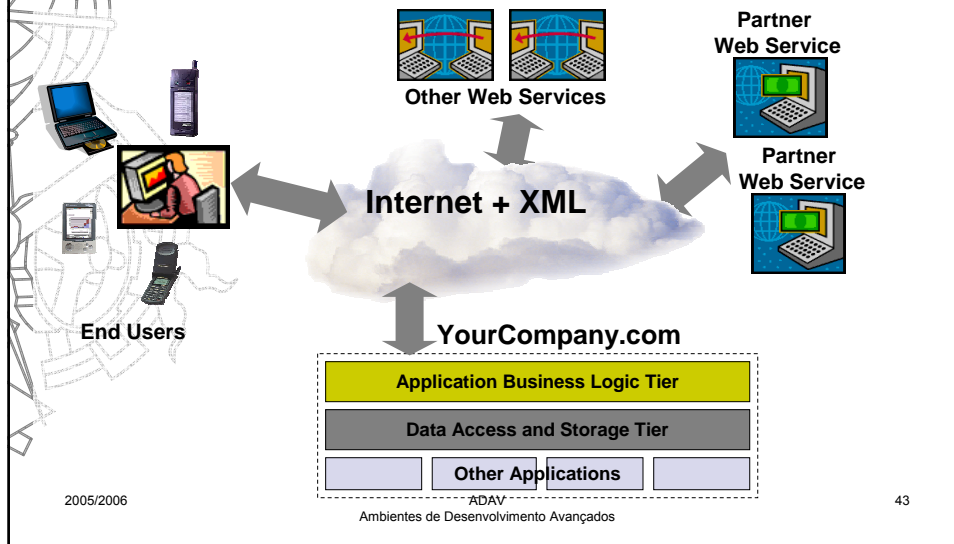
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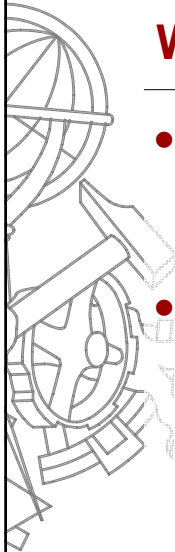
# Web Services Overview

## Application Model



# The Components of Web Services

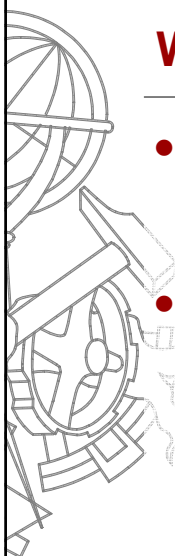
- Web services are comprised of six fundamental components:
  1. **Delivery medium:** Internet
  2. **Delivery protocol:** HTTP
  3. **Message format/encoding:** SOAP
  4. **Service descriptions:** WSDL
  5. **Web Service Publication:** UDDI
  6. **Web Service Discovery:** WS-Discovery



## Web Services – Delivery Medium

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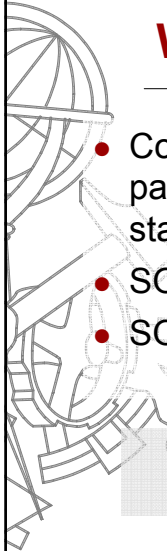
- Web services use the **Internet** as the medium for service delivery.
- Therefore, only computers connected to the Internet can provide or consume a Web service.  
(Of course, what computers *aren't* connected to the Internet nowadays?)



## Web Services – Delivery Protocol

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- Web services use **HTTP – HyperText Transfer Protocol** – as the delivery protocol.
- HTTP is a well-known, simple, open standard that is supported by Web servers, programming libraries, and common client applications, like Web browsers.

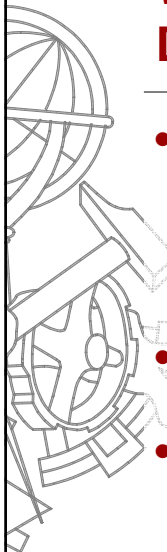


## Web Services – Message Format

- Communications to and from a Web service are packaged in messages formatted in **SOAP**, which stands for **S**imple **O**bject **A**ccess **P**rotocol.
- SOAP defines a protocol for formatting a message.
- SOAP messages are XML-formatted.

*We'll be examining SOAP extensively in future lectures!*

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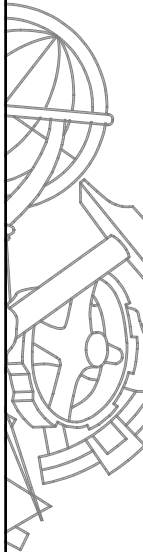


## Web Services – Service Description

- Web services need to be self-describing. That is, a Web service needs to be able to spell out precisely what services it offers, how the services can be invoked, and the service interface.
- This description is accomplished with **WSDL**, or **W**eb **S**ervice **D**escription **L**anguage.
- **WSDL** is an XML-formatted file that provides this information vital to those who wish to consume the Web service.

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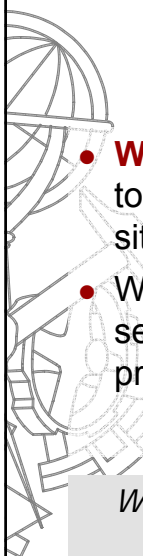




## Web Services – Publication

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- In order for others to be able to find out about the Web services a company offers, there is a public directory of Web services.
- **UDDI**, or **U**niversal **D**escription, **D**iscovery, and **I**ntegration, is an online directory of Web services.
- This directory is jointly managed by IBM, SAP, SUN, Microsoft, and other major players.




## Web Services - Discovery

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- **WS-Discovery** specifies a protocol for developers to discover the Web services a particular Web site/company offers.
- WS-Discovery is useful for learning about the Web services a particular company or department provides.

*We'll talk about WS-Discovery in more detail in future lectures!*

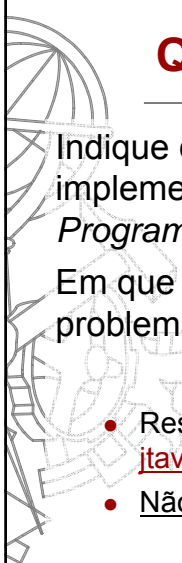


## Two Views of Web Services

- Keep in mind that when working with Web services you will be taking one of two approaches:
  - You will be a **producer**. This means you will be creating a Web service for others to utilize.
  - You will be a **consumer**. This means you know of some Web service that you wish to utilize via a desktop application or Web page.

*As we will see throughout this class, both producing and consuming Web services with .NET is a breeze!*

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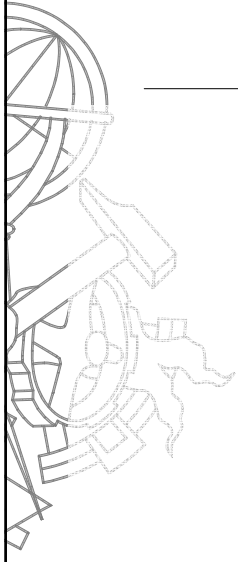
## Questionário

Indique quais os problemas da herança por implementação na COP (*Component Oriented Programming*).

Em que medida a composição tenta resolver esses problemas?

- Resposta por email até 06/12/2005 para [jtavares@dei.isep.ipp.pt](mailto:jtavares@dei.isep.ipp.pt) no corpo da mensagem.
- Não são admitidos ficheiros em anexo.

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**Questões**

**?**

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