A Strategic Comparison of Component Standards

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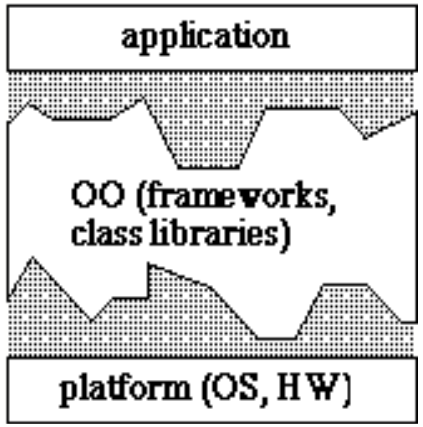
What is a component?

Remember: What is missing in OO?



visual/interactive configuration

interoperability

What is a component?

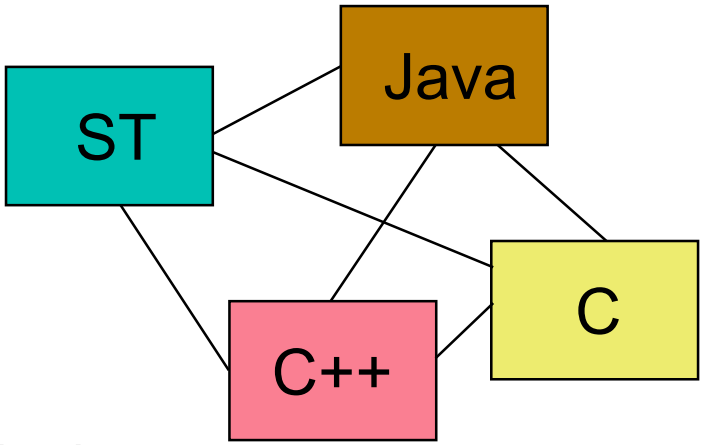
- Not yet clearly defined
- Is everything a component?
  - macros, mixins, functions, procedures, modules, classes, etc.
- Conventional, heavy-weight components:
  - operating systems
  - database systems

Our definition of the term (software) component

A piece of software with a programming interface

Wiring standards (I)

Interoperability problem:



=> wiring standards

Wiring standards (II)

Product-driven definition

Microsoft's **Component Object Model (COM)**

- evolutionary / incrementally
- originally targeted at the desktop
  => had to be extended for Internet/Intranet and *Enterprise Computing*
- carries some legacy
- de facto standardization through the market dominance of Microsoft

Wiring standards (III)

Consortium standardization (OMG)

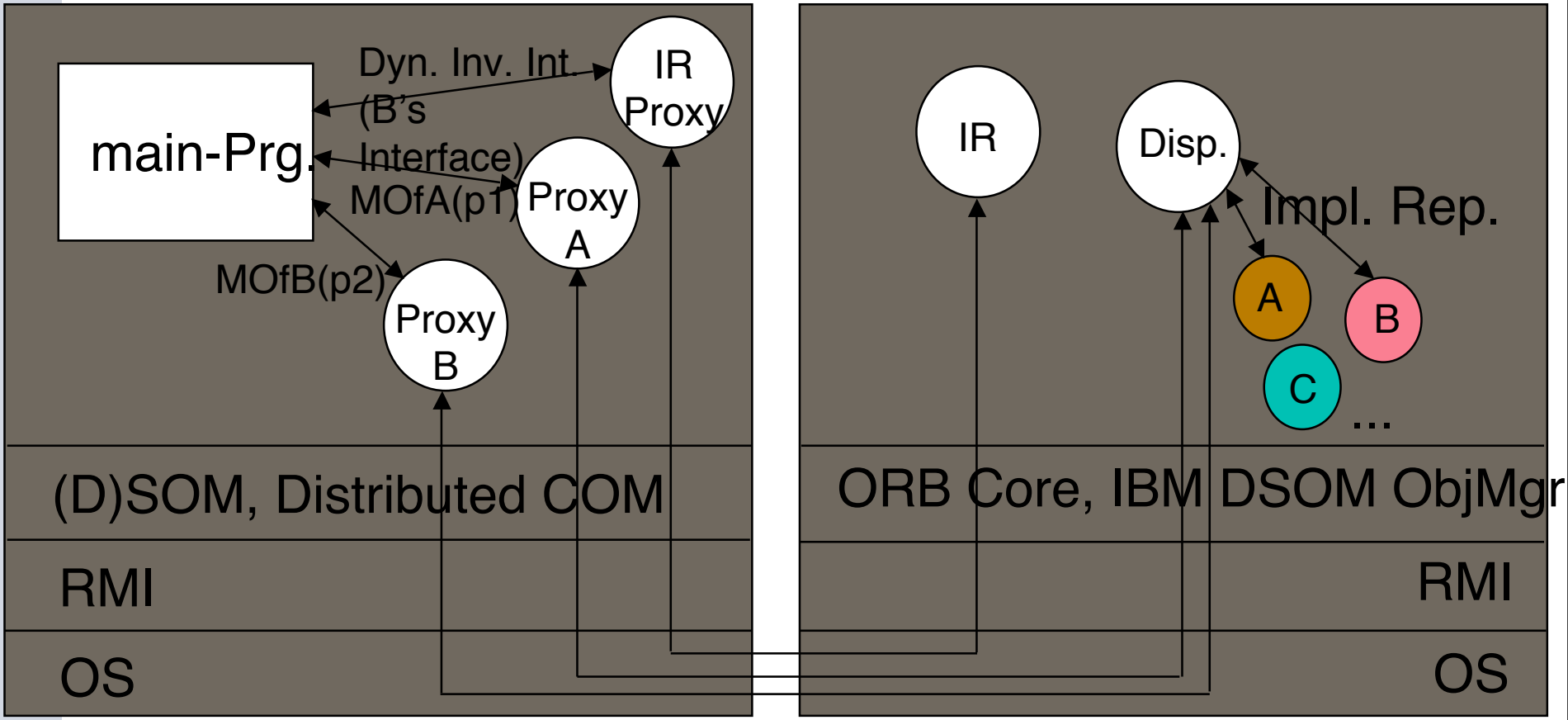
CORBA

- slow progress (compared to COM and SunSoft's JavaBeans)

JavaBeans

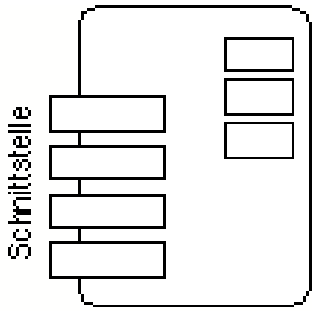
- based on 100% pure Java
- standards for integrating other components are under development(EJB, ÆCORBA

CORBA model of distributed applications



Characteristics of components

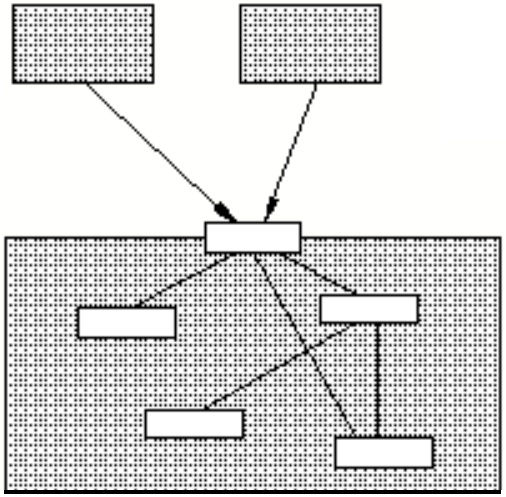
- *Information Hiding*
  - interface described in IDL
  - implementation in any language (Java, ST, C++, C, ...)



- components as binary units (machine-independent byte code is also OK)
- components can be made persistent

Component = Class ?

Usually, a component (large-grained component) comprises a couple of classes (fine-grained components):



client components

Beyond Wiring

- meta-level informationen
  - components can ask others about offered features
  - dynamic loading and linking
- semantic aspects

CORBA:	wiring
JavaBeans:	meta-level (*reflection*), semantics; for *pure Java* wiring becomes irrelevant
COM:	all three aspects

Characteristics of component standards

Component Object Model (I)

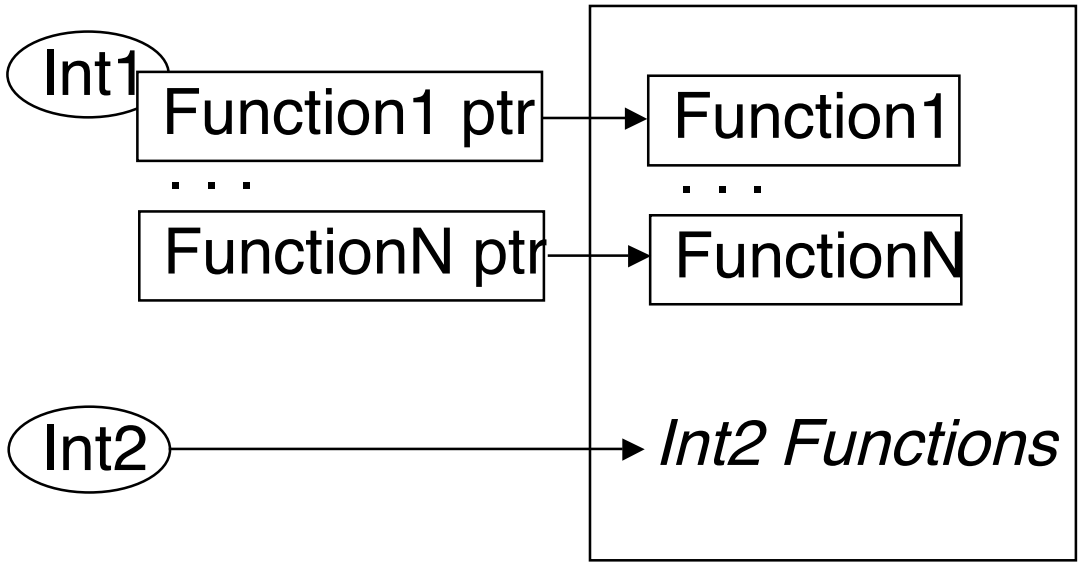
COM concepts:

- interfaces and components (= COM classes) have a unique (128-Bit) ID
- each COM-Objekt can be asked, which features are supported:

  interface IUnknown; method QueryInterface

Component Object Model (II)

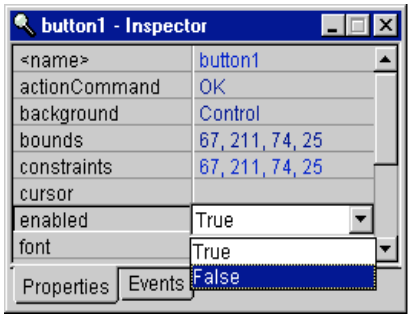
A component can have any number of interfaces:



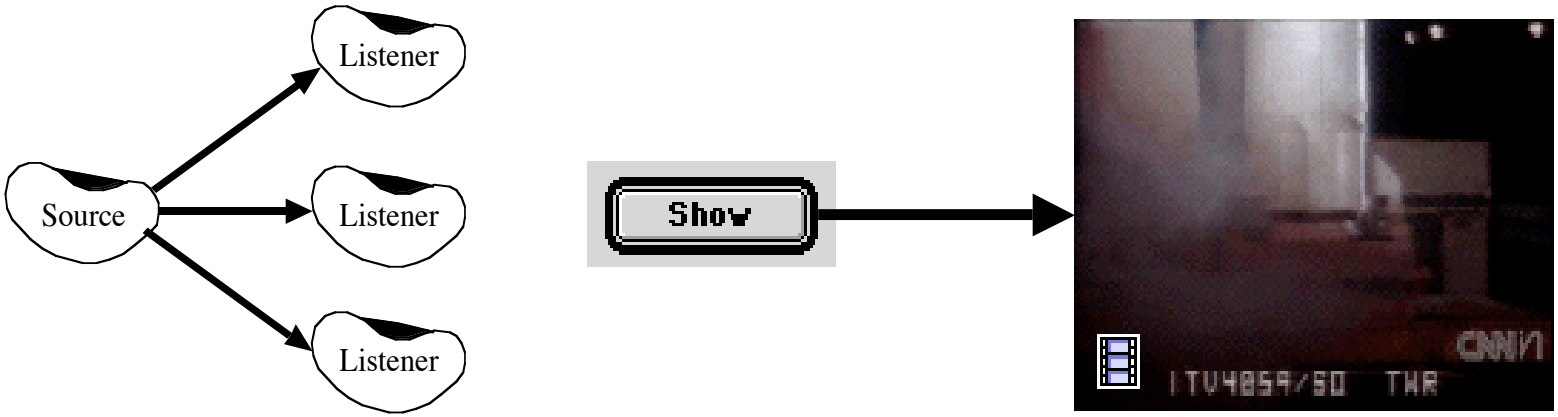
Extension by adding interfaces; existing interfaces remain untouched.

JavaBeans

- **Properties** (→ Setter/Getter methods) are defined interactively in a Beans environment:



- **Events** form the communication mechanism:



Commonalities and differences

Commonalities

- OO (*Information Hiding, late Binding, Subtyping*)
- *Compound Documents* (original meaning of OLE, idea of OpenDoc)
- component transfer mechanism
  - eg JAR files, COM Structured Storage
- coupling based on events
- meta-information
- persistence

Differences

- memory management
- binary standards
- development environments
- versioning
- application domains
- supported platforms and languages

Memory management

- COM: tedious reference counting; should be automated in COM+
- Java: garbage collection; distributed GC not compatible to Java-CORBA integration
- CORBA: no general solution

Binary standards

- core aspect of COM
- in Java: byte code; partially through Java Native Interface (JNI)
- CORBA provides no binary standard (compatibility based on language bindings)

Development environments

- COM: solid environments
- Java/JavaBeans: have to grow up
- CORBA: quite unsatisfying

Versioning

- COM: solved via freezing of interfaces
- Java: based on binary compatibility; tedious rules
- CORBA: not directly supported; unsatisfying version numbers

Applications

- COM: focus on the desktop
- Java: focus on the Web
- CORBA: focus on server/Enterprise Computing

- DCOM and EJB aim at server/Enterprise Computing
- ActiveX-components for Windows-Web-Clients

Languages and platforms (I)

- COM: Due to the binary standard, almost any language can be supported efficiently on any platform (DCOM):

  Visual Basic, C, C++, C#, Java, Smalltalk, Object Pascal, Lightning Oberon, Object Cobol, ML, etc.

- Java: binary standard based on Java byte code
  + platform independent (VM per platform)
  – too much biased towards Java
  not well suited for Ada95, REXX, Oberon;
  impossible for C++

Languages and platforms (II)

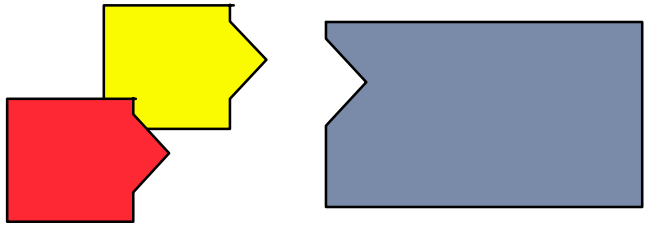
- CORBA: ORB developers have to provide language bindings for particular languages

  Thus, only a few languages are supported: C++, (Smalltalk), Java

Visions

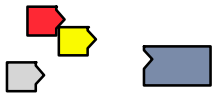
Filling the gap

Mega components (SAP, DB systems, operating systems)



only a few medium-sized components exist so far

very small components (GUI components, etc.)



Mechanistic view

Currently software components assembly requires exact matching of interfaces:

Adaptive architectures

Alternative: components configure themselves automatically through testing & fitting.

?

Sources of inspiration:

- Sun's Jini, Microsoft's .NET
- agent technology
- ontologies