Architecture & UML analysis

How to develop your SOA to empower your IT strategy ?

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Who am I ?

- Frédéric Vermaut
- 41 years
- IT Architecture Director
- Architecture & Methodology specialist
- Project Manager
- IT Experience since 17 years
  - Ducroire, ING, Fortis, TUC Rail, AXA, Dexia…
- Civil Engineer

What is Architecture ?

What is Architecture ?

- What is IT architecture ?
  - « set of significant decisions about the organization of a software system »(Booch, Rumbaugh, Jacobson)
  - « Set of statements describing software components and assigning the functionality of the system to them »
  - "Breakdown of a system into its parts & decisions that are hard to change" (Fowler)
  - Blueprint for a system, the implicit high level plan for its construction
  - "set of design decisions which, if made incorrectly, may cause your project to be cancelled." (Eoin Woods)

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What is Architecture ?

- The software architecture of a program is the structure of the system, which comprises
  - software elements
  - the externally visible properties of those elements
  - and the relationships among them.

What is SOA ?

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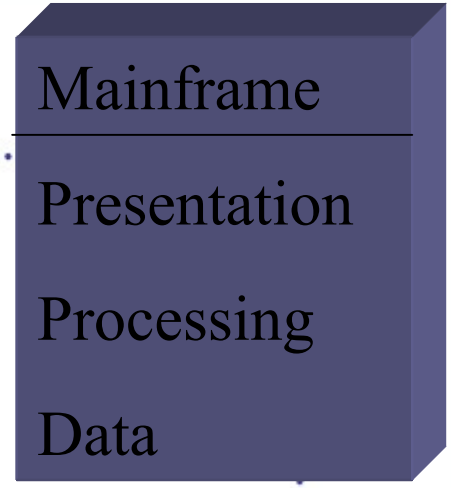
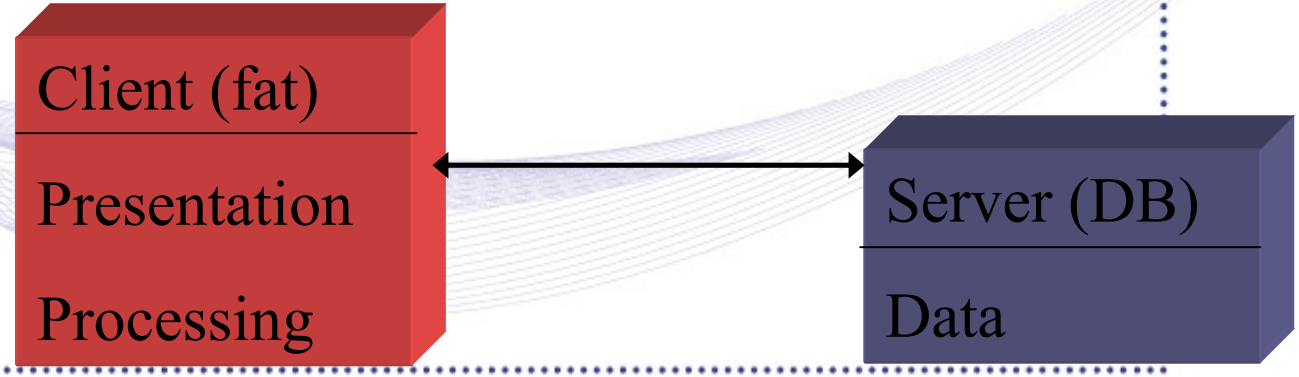
Architectures : historics

- Central systems : mainframes
  dumb terminals ...



- Client-server (2-tier) (screenscraping)

PB, Natstar,
VB, TFM,
Delphi

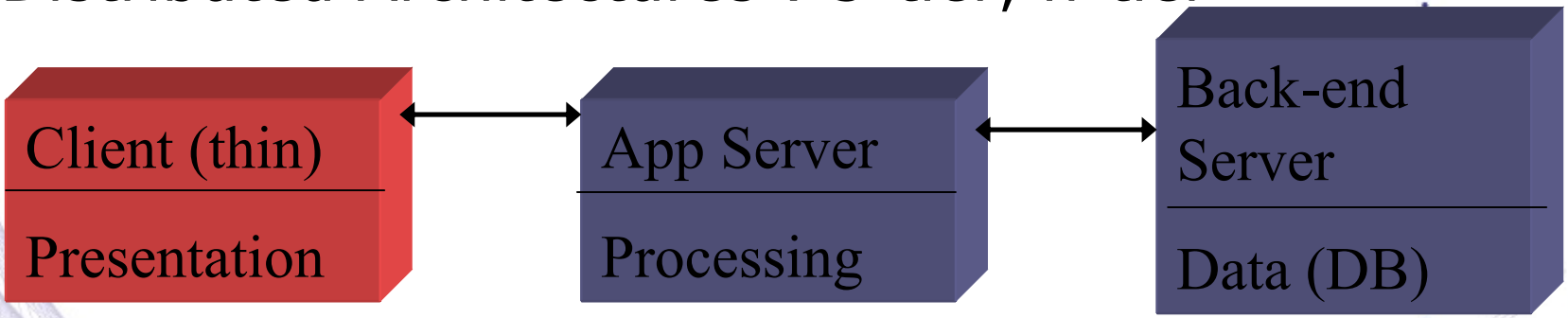


Architectures : historics

- 2-tier client-server : many problems
  - PCs must be regularly replaced
  - Maintaining PCs
  - Software distribution + updates
  - Hell if installation at the clients : support, multitude of configs to support, soft distribution ...
  - Security : everybody has access to the DB, ex : homebank software
  - Network traffic
  - Integration after merges
  - …

Architectures : historics

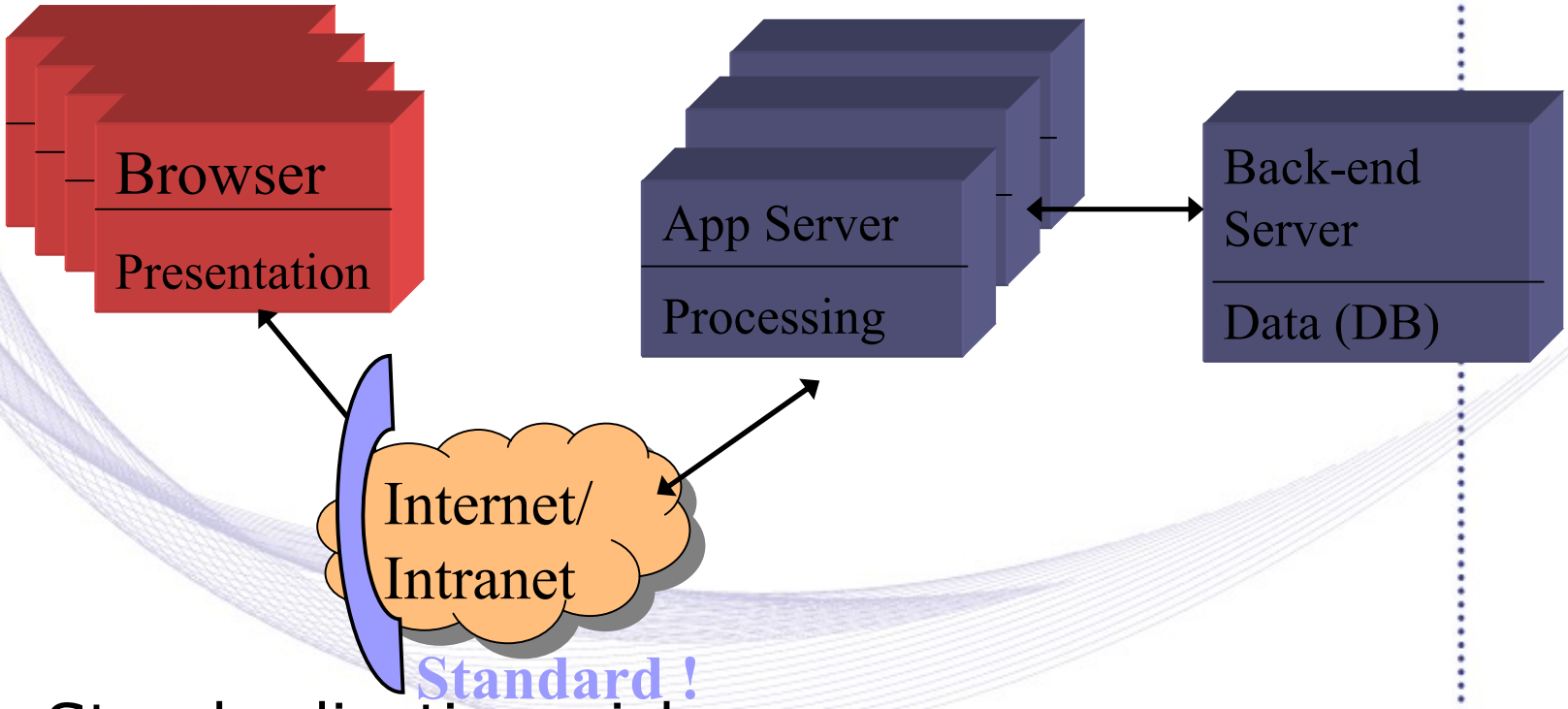
- Distributed Architectures : 3-tier, n-tier



- Components approach : n-tier
- Thin client : well adapted for internet, e-commerce... But not only

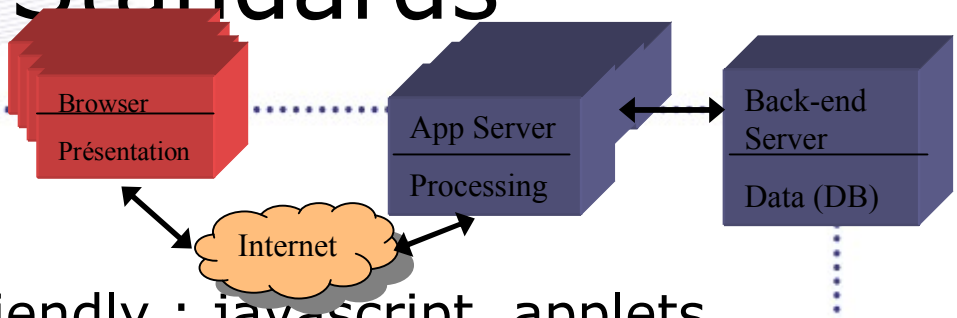
Architectures : historics

- Typical internet architecture



- Standardisation wish

Inter/Intra-net Standards



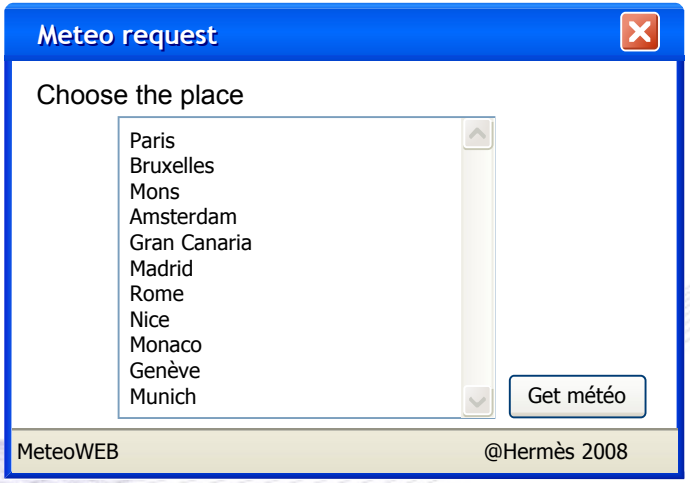
- Client
  - HTML browser
  - Add-ons for + user-friendly : javascript, applets (+/- std) + to reduce network traffic (local ctrls before sending to the server)
- Internet : Http on TCP/IP protocol
- DB server : Relational DB, SQL +/- standard
- Application servers : JSP, Servlets, EJB…
- All this defines J2EE

What is SOA ?

- SOA is
  - Software architecture,
  - Based on 4 key elements
    - Application front-end (owner of the business process)
    - **Service** (business functionality, structure of SOA)
    - Service repository (catalog of services)
    - Service bus (interconnection)
  - Business services (not technical) :
    - No impact from technology on the high-level structure
    - Technology cannot cause dependencies between components

Example

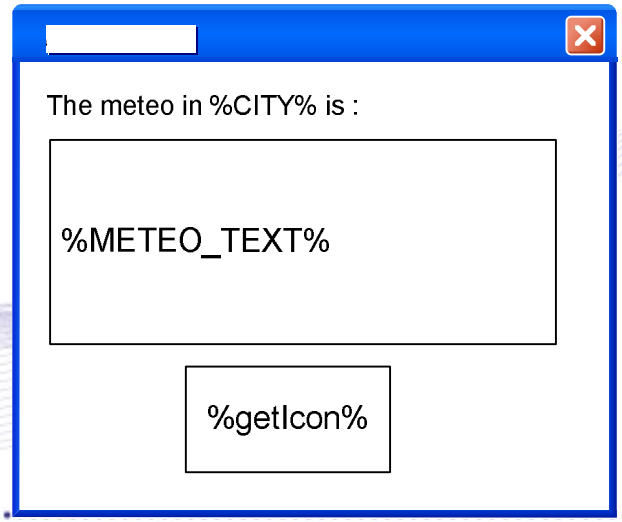
- An application which gives you the meteo.
- A first page asks you a place



- On click : http request **getMeteo(city)**

Example

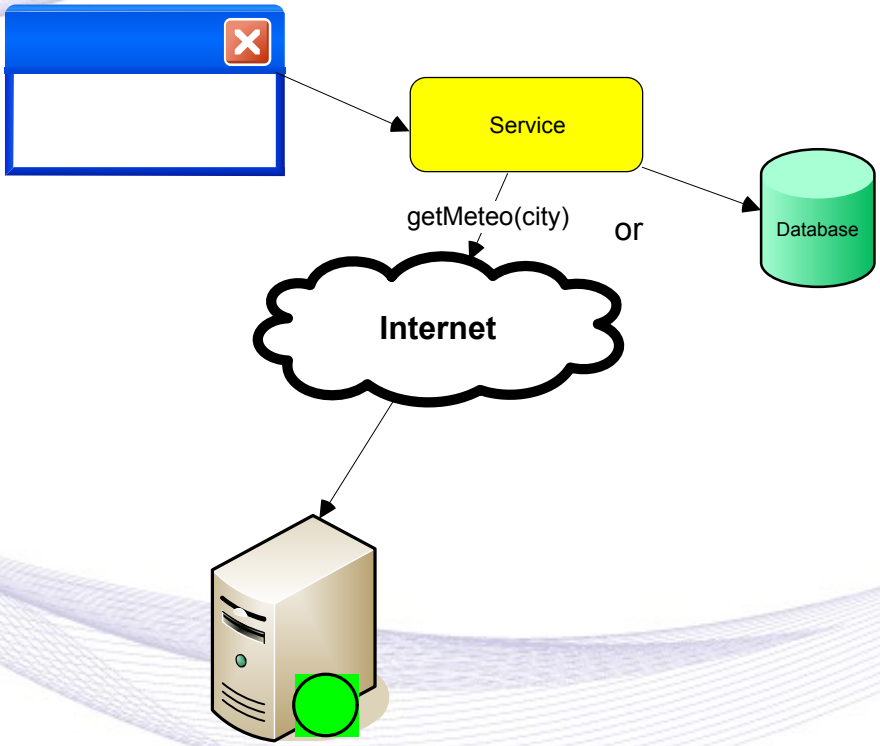
- Server
  - receives the request
  - determines which page must be built
  - calls a new (html) page and…
  - fills it



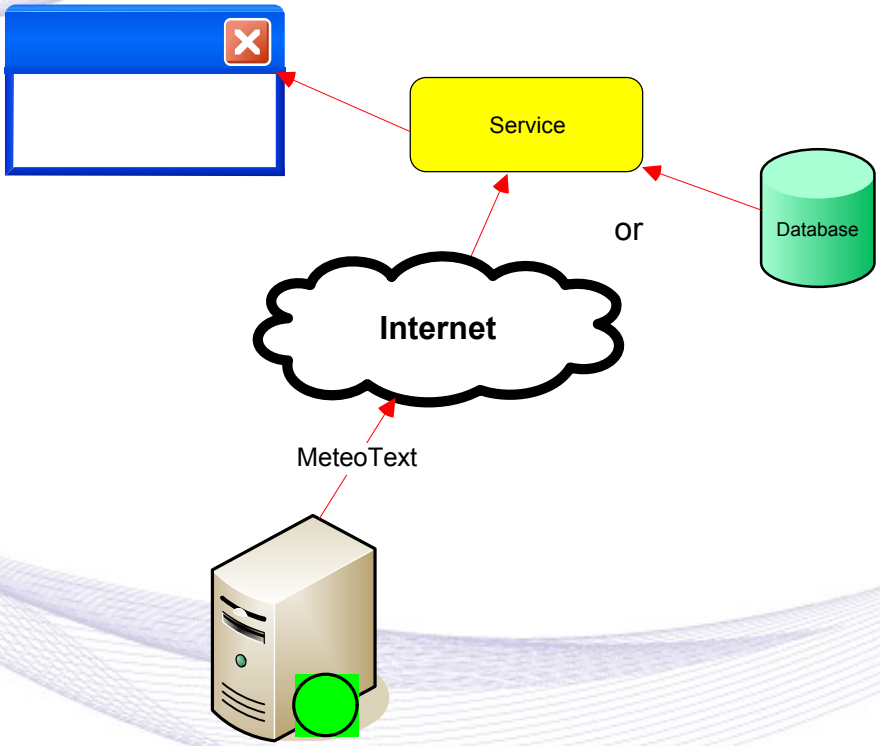
Example

- Meteo_text can come from whatever other specialized site
- Mix GUI and business code : BAD !
- Create a “service” to obtain the information

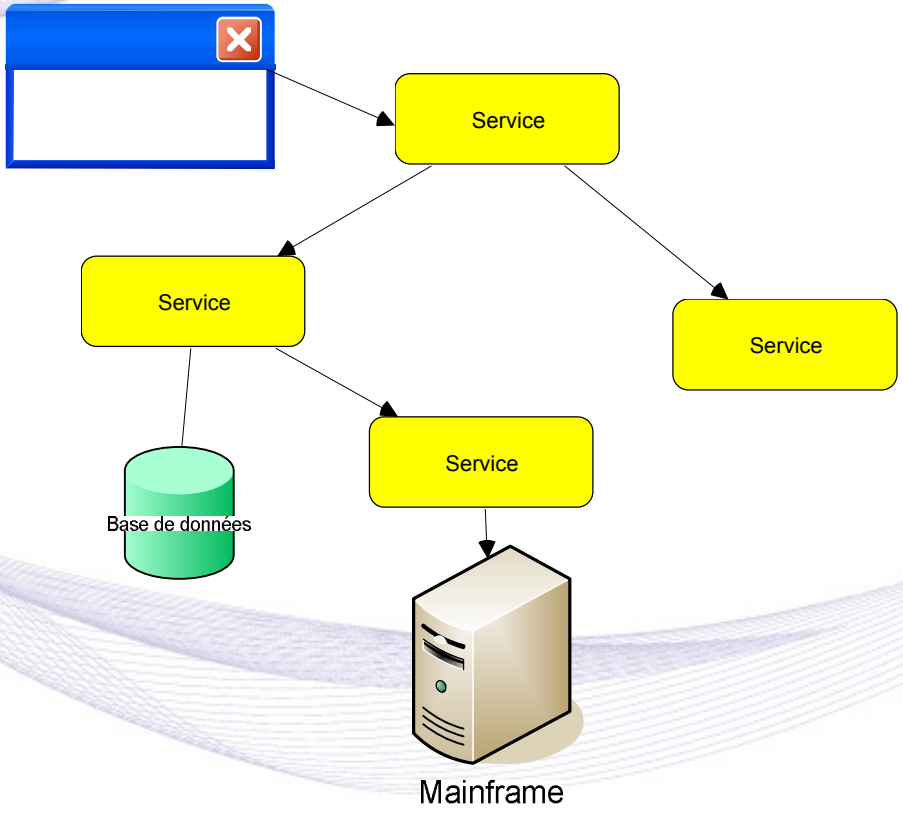
Example



Example



Generalizing example



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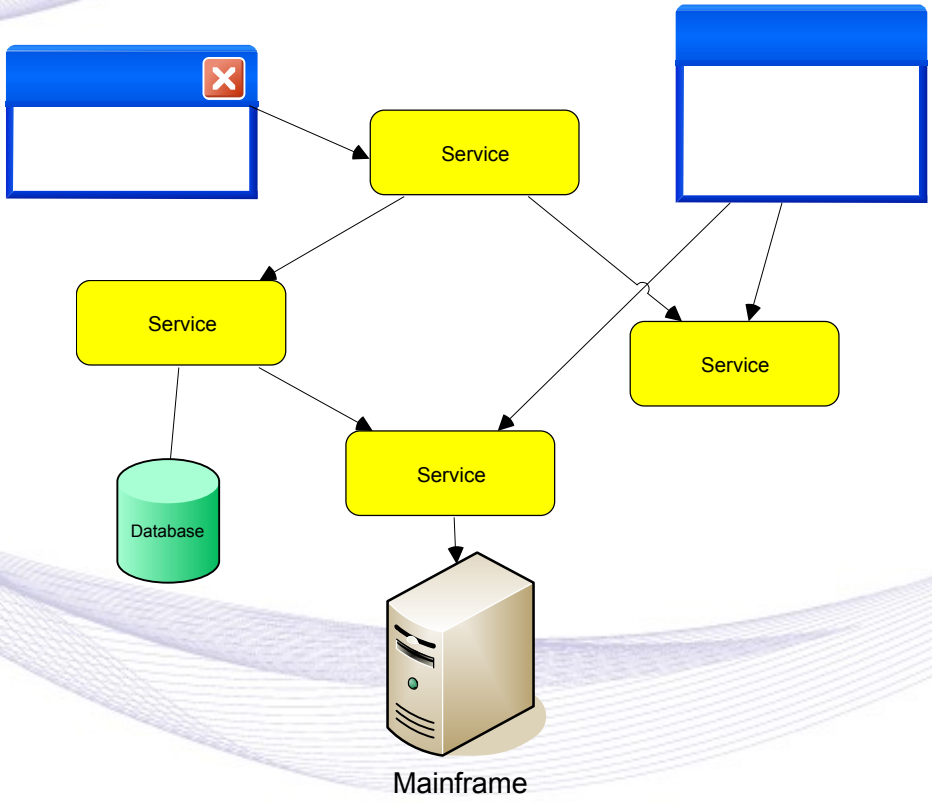
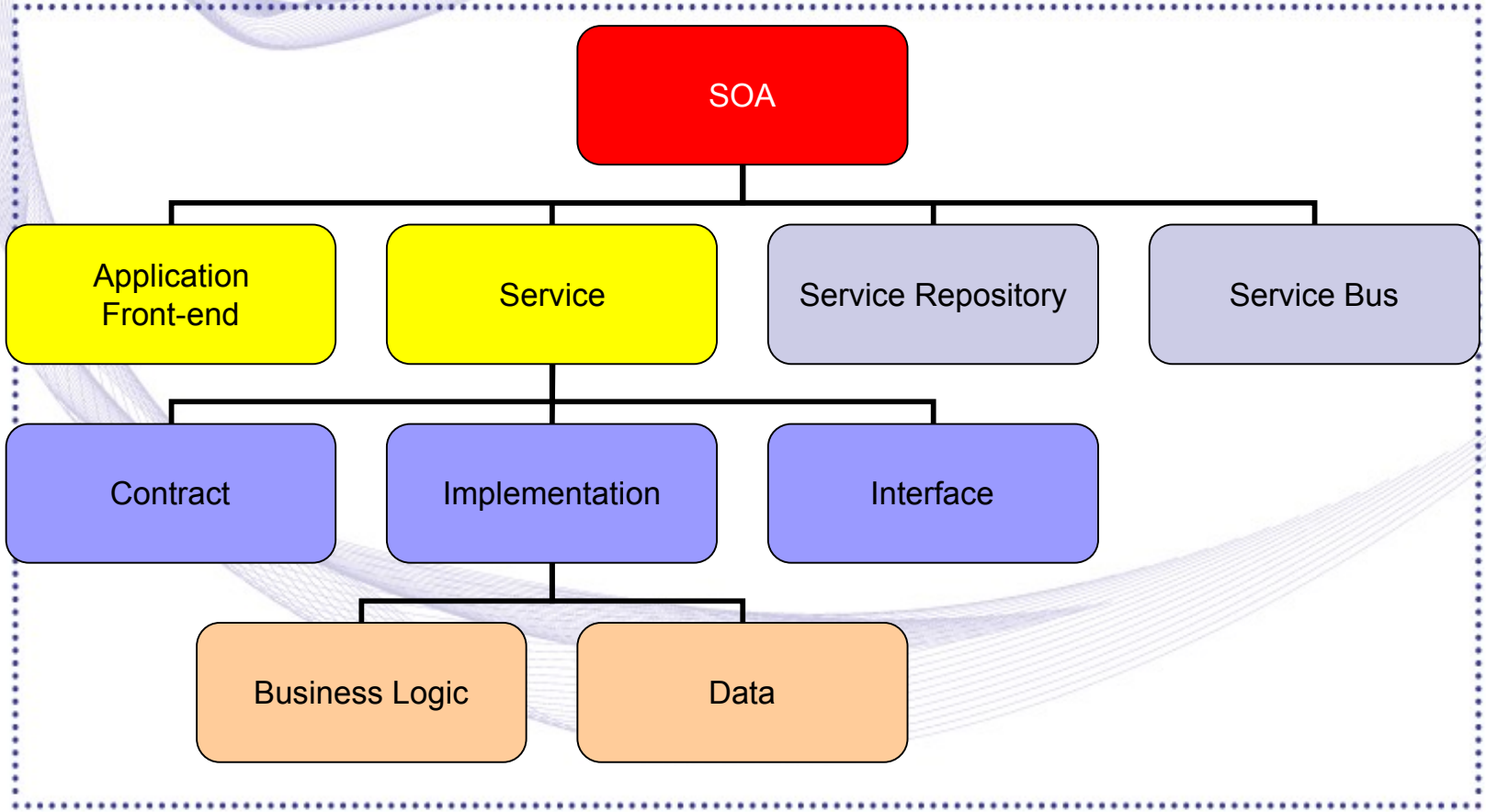
Why is it bad to mix GUI and business ?

- Gui can change due to :
  - Process reengineering
  - Restructuration, acquisition…
  - Relooking, revamping
- Business process will change over time
- But the business services do not change !
- Ex : approval of mortgage credits in banks

Other advantage : reusable services

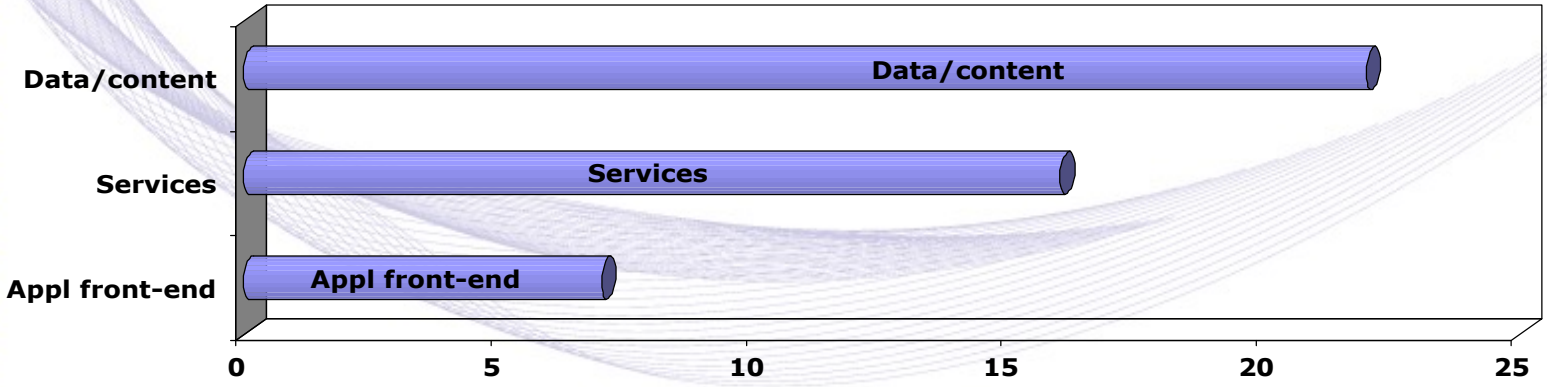


SOA concepts



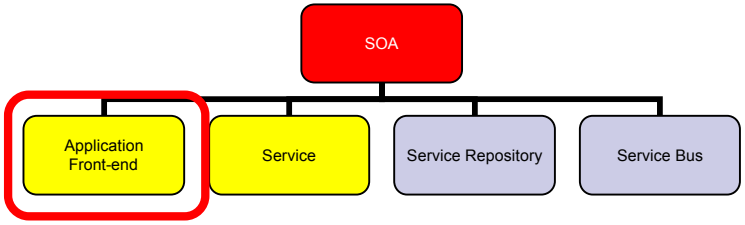
Services

- Software component of functional meaning
- Encapsulates a high-level business concept
- Much more stable than processes or applications
- does not depend on the context or state of other services (stateless, as much as possible)

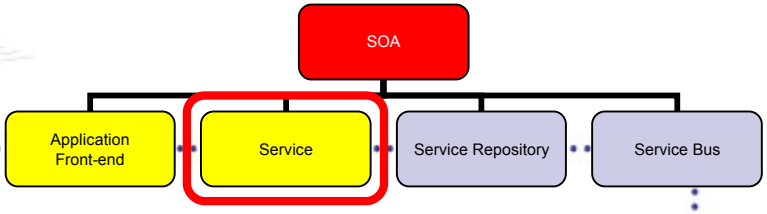


Application Front-ends

- Web applications
- Rich clients
- But also batch
- Delegate the functionality to Services
- Initiate the business process
- Receive the results



Services



Before

System

Data | Functionality

Now

System

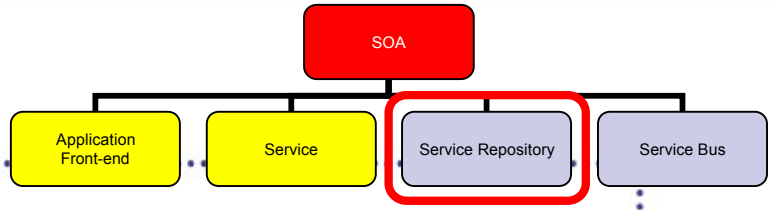
Application Front-end | Service

Data | Functionality | Data | Functionality

OR

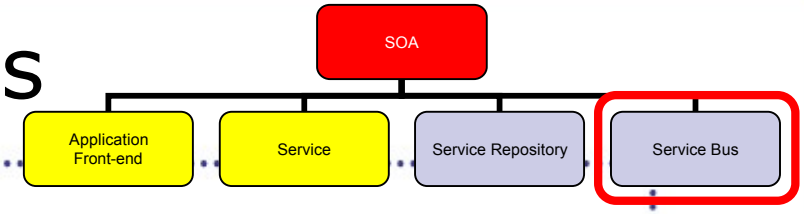
Object | Component | Object | Component

Service Repository



- Facility to discover services and acquire information to use them
- Contains the content of the contract
- May also contain informations as
  - Physical location
  - Contact persons
  - SLA
  - Security issue
  - Special constraints…
- Necessary for long term enterprise SOA
- Organization : under responsibility of an architecture board

Enterprise Service Bus



- Connects
  - Services
  - Application front-ends
- Provides
  - Connectivity (intelligent routing)
  - Heterogeneity of technology (e.g. data transformation)
  - Heterogeneity of communication concepts (more asynchronous if possible, uncoupling is the master word)
  - Technical services : logging, auditing, security, transactions…

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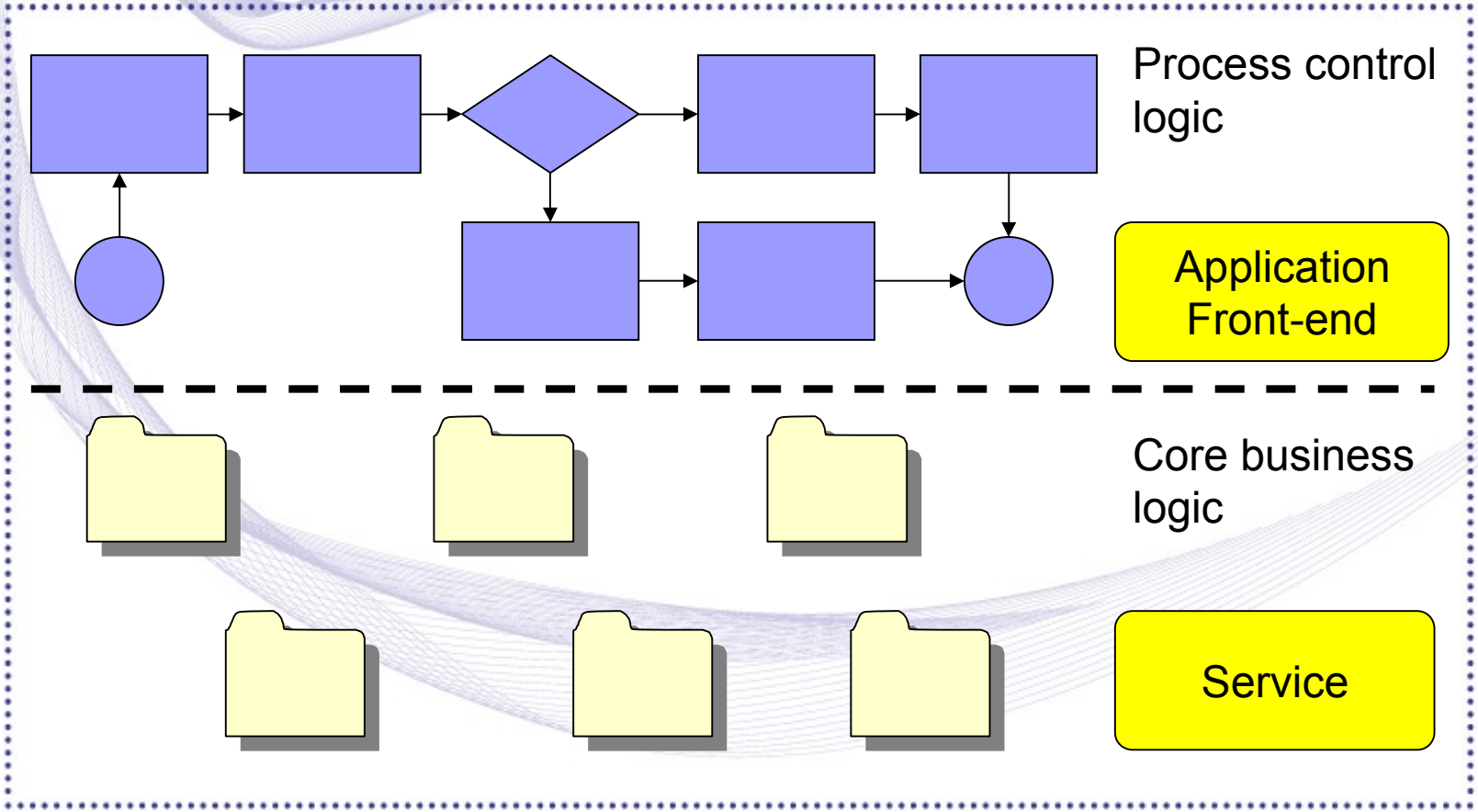
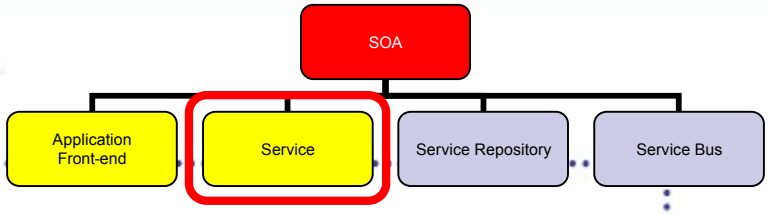
Enterprise Service Oriented Architecture



Particular case : WebServices

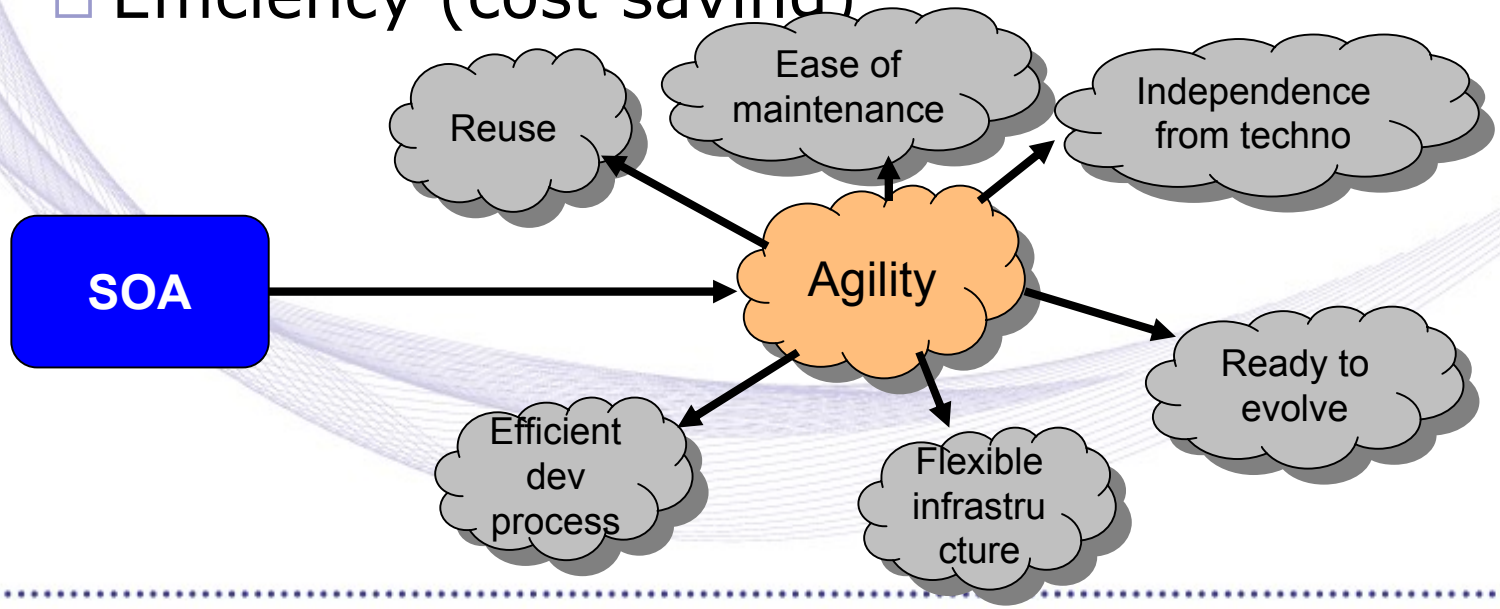


- Definition :
  - Business components
  - Self sufficient
  - Self descriptive
  - Called via internet/intranet
  - Respecting quality agreements
  - Based on XML

Why SOA ?

SOA Benefits

- SOA main drivers
  - Agility
  - Efficiency (cost saving)



SOA benefits for people

- CEO
  - Better reaction for business demands
  - Shorter term planning (step by step app.)
  - Budget : less maintenance
  - Techno independence
- CIO
  - Techno independence
  - IT becomes “enabler” to the business
  - Manageable project size
  - Manage heterogeneity

SOA benefits for people

- Architect
  - Very interesting tasks
  - Opens real opportunities to build
  - Loose coupling
  - Code reuse
- Project Manager
  - Smaller & shorter projects
  - Parallel development
  - Reduced risk
  - Easier testing & integration

SOA benefits for people

- Software developer
  - Reduction in dependency
  - Rapid prototyping
  - Better defined requirements
  - Simplified testing (loose coupling)

Implement the architecture

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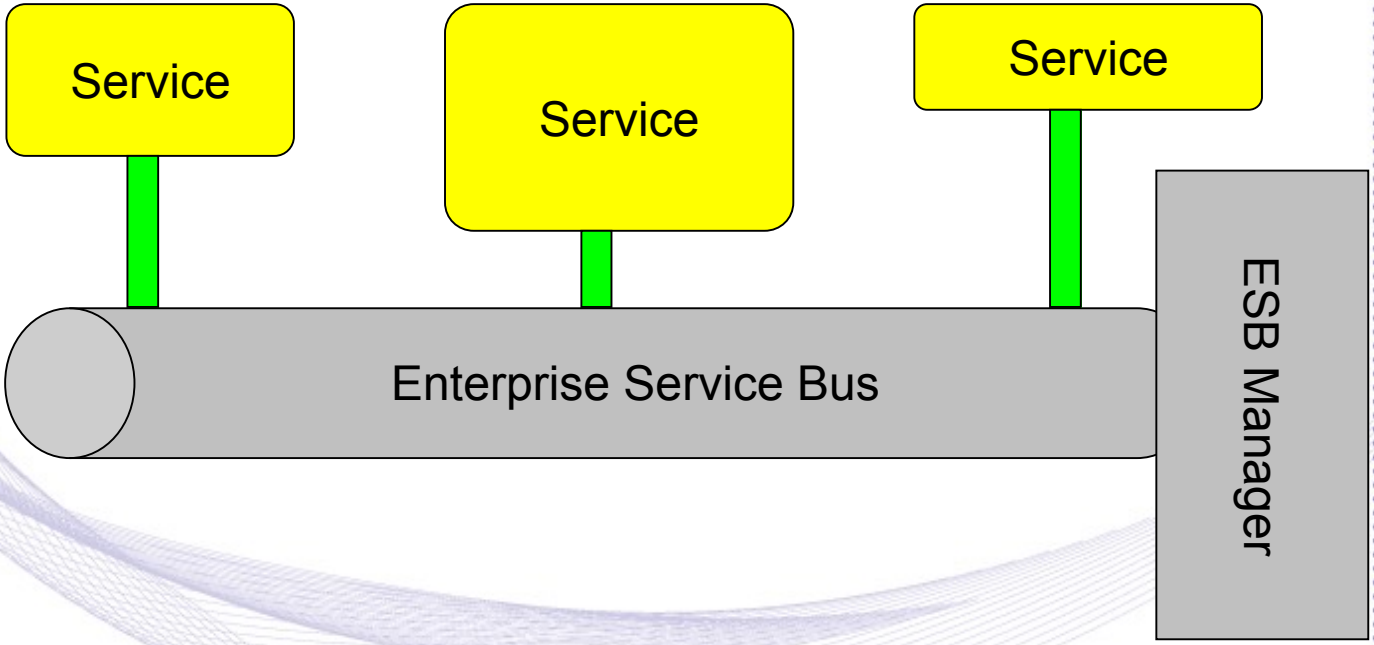
SOA Architecture : ESB



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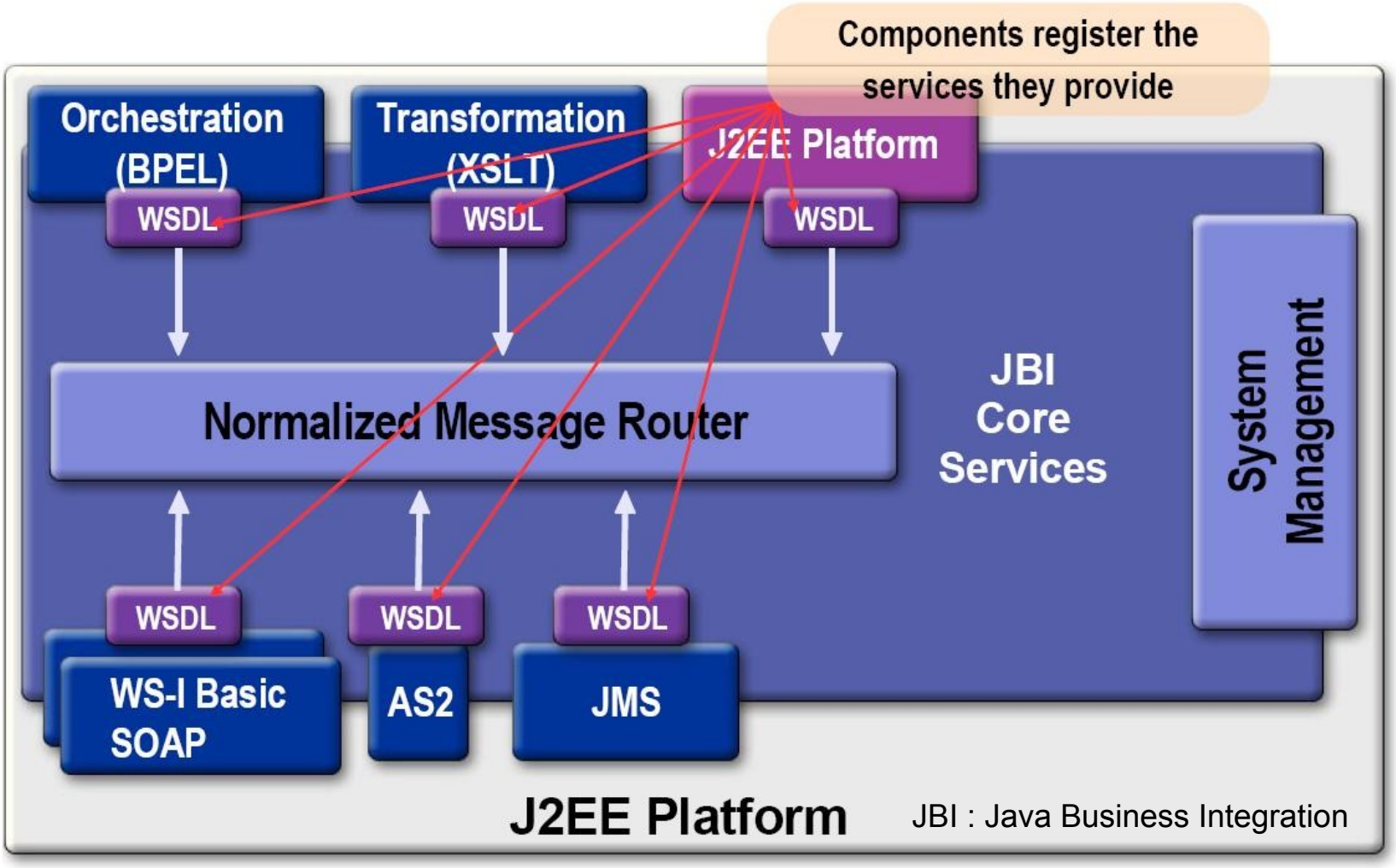
What is ESB ?

- Message broker
- Enables the implementation of SOA
- Tries to remove the coupling between the service called and the transport medium
- Brings transportation and routing
- Provides an abstraction for endpoints



JBI : Java Business Integration

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Benefits of an ESB

- Allows Pluggable Component (with data transformation)
- JBI mediator : isolates the services that don't have to know each other = **Normalized Message Router**
- Un-coupling applications to services and service to service
- Suppresses the multiple point to point connections (not scalable & hard to maintain; impact analysis easier)
- OpenSolution : vendor independent, no lock-in for small providers

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Capabilities of an ESB

Invocation	Synchronous & asynchronous, service locating
Routing	Addressing, static/content- or rules- or policy-based routing
Mediation	Adapters, protocol transformation
Messaging	Message processing, transformation
Aggregator	Multiple implementations of a service, exposed as a single one
QoS	Security (encrypt, sign), guaranteed delivery, transaction management
Management	Monitoring, auditing, logging, …

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Common characteristics of ESB

- OS & language agnostic
- Often uses XML
- Should support WebServices
- Multiple messaging patterns : synchronous & asynchronous request/reply, fire & forget, publish/subscribe…
- Transformation services : e.g. XSLT
- Message validation against “schema”
- Supports queuing, holding messages if apps unavailable

ESB = glue between services

- BPEL : Business Process Execution Language : defines the workflow of services (orchestrator)
- Services : provide the business rules and the business basic behavior, are (possibly) reusable
- BPEL + services = an application for the user

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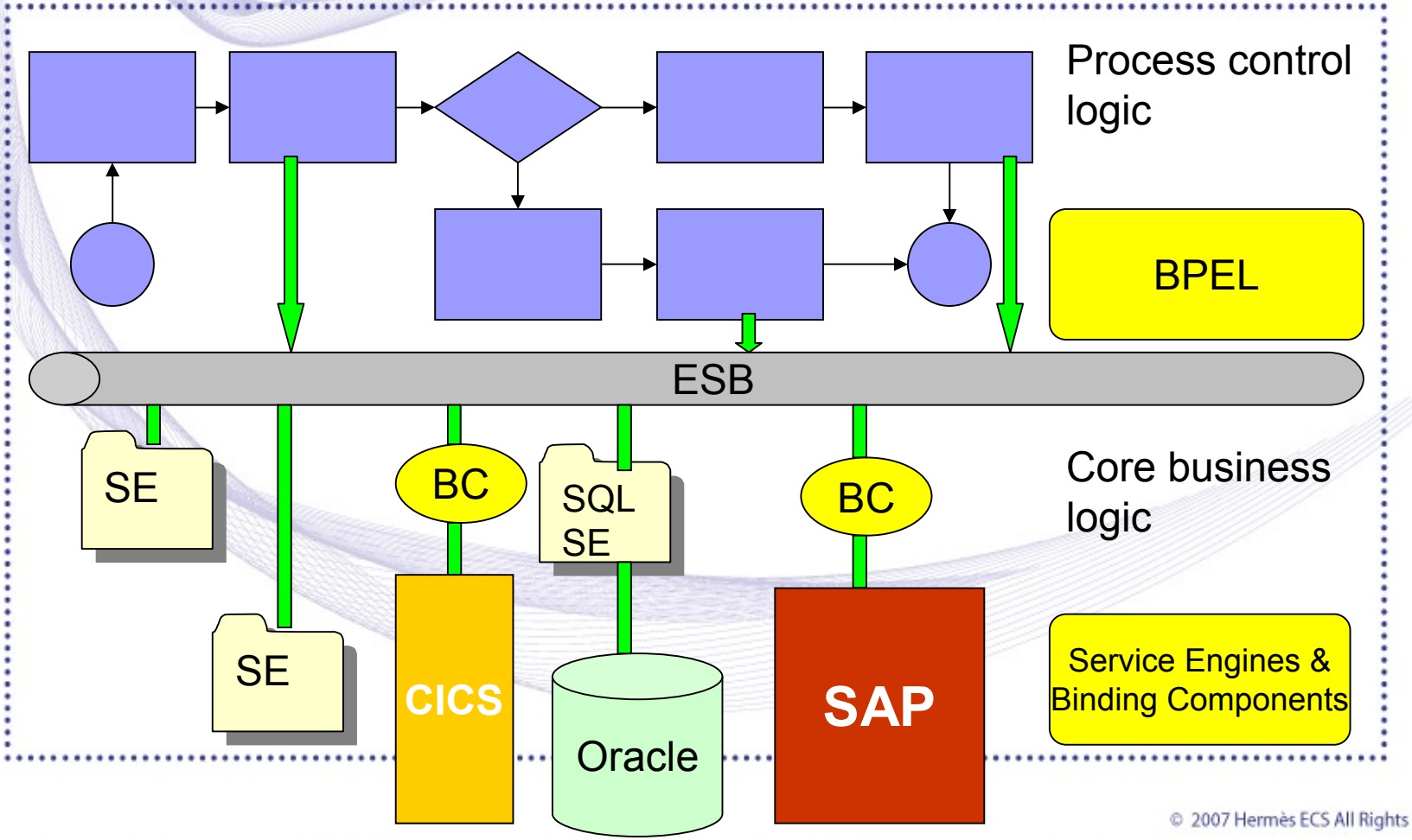

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ESB conclusions

- New technology based on **experience from the past** (Middleware, EAI, stable architectures…)
- Open products exist & are well adopted
- JBI & ESB receive **strong support from SUN**
- Based on **solid architectural principles**
- Perfect addition for a sound SOA implementation
- Facilitates the integration & future evolution by providing a very **open architecture**

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SOA Analysis

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How to analyze for SOA ?

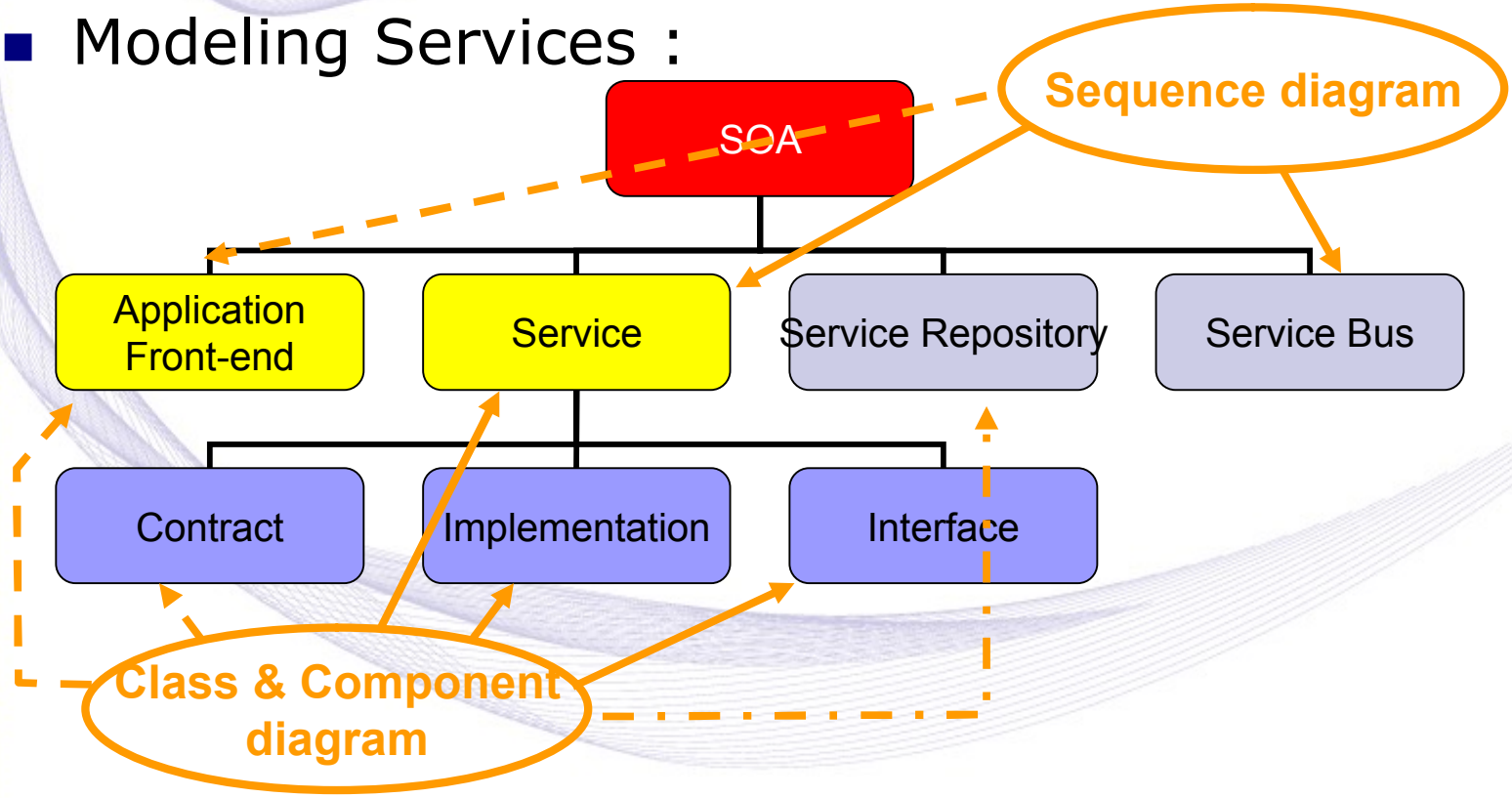
SOA Analysis

- Modeling is really important
- Analysis world : ONE standard
  - Basis for services repartition
  - Model inter-dependencies
  - Know what to develop first
  - Ensure services are reusable
  - Build the SO Architecture !

UNIFIED MODELING LANGUAGE

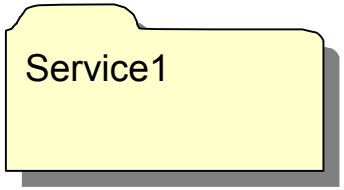
SOA and UML

- Modeling Services :

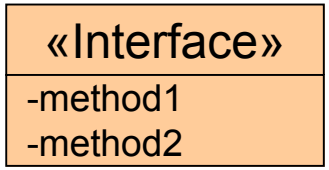


UML class & component diagram

- Services <-> UML packages

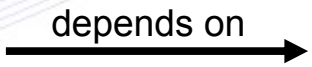


- Interfaces <-> Interface classes

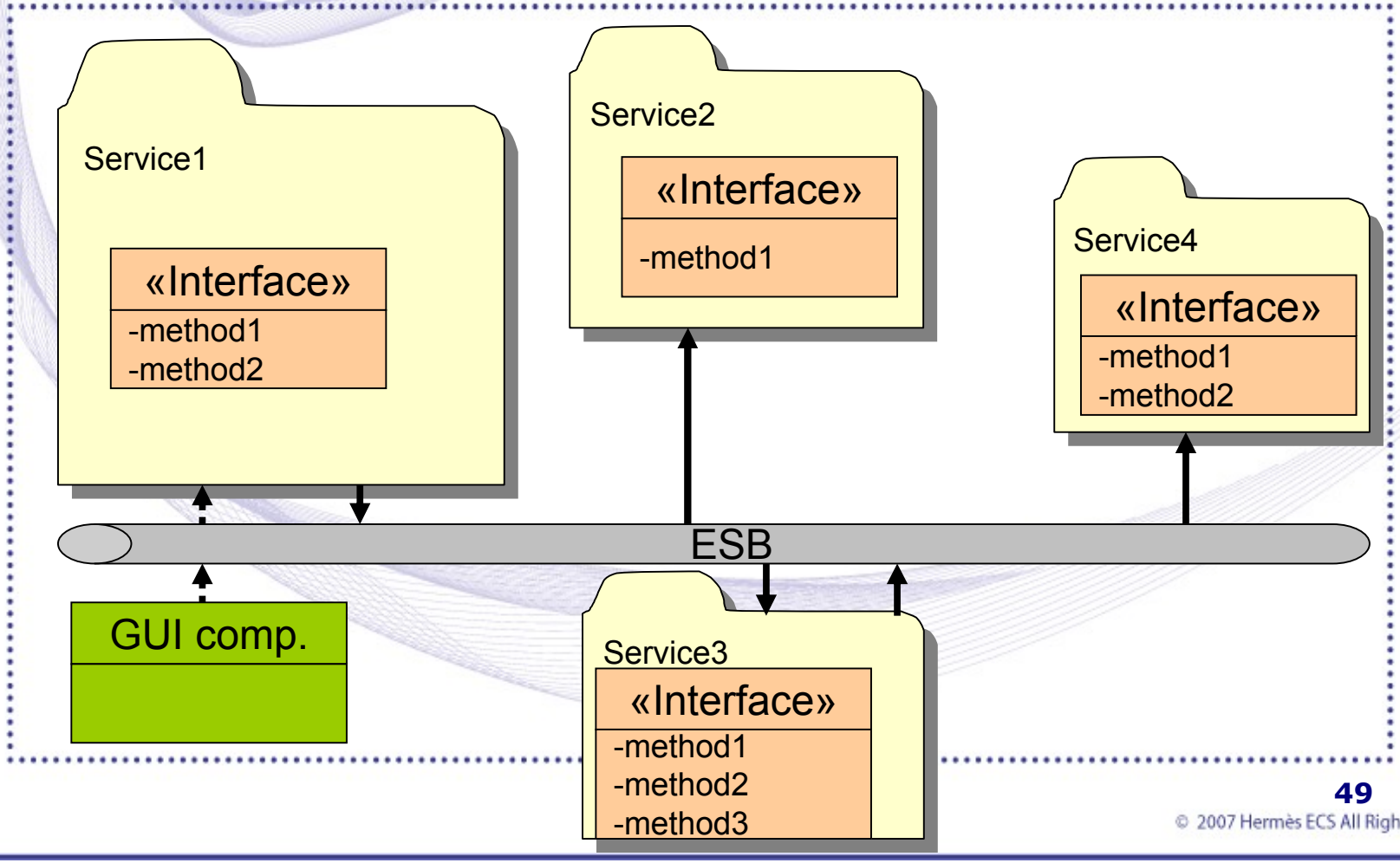


- Contracts : documentation

- Dependency betw. Services <-> UML dependency



Example

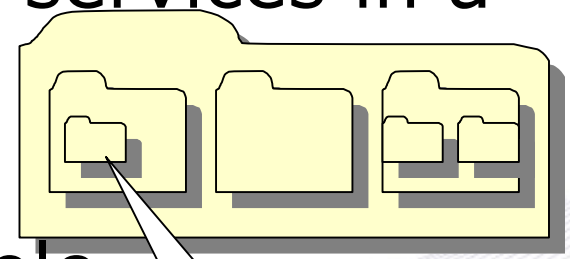


UML class & component diagram

- May also be used for the

Service Repository

- You can organize your services in a hierarchy



- In a CASEtool, the whole documentation of the services is just one-click away

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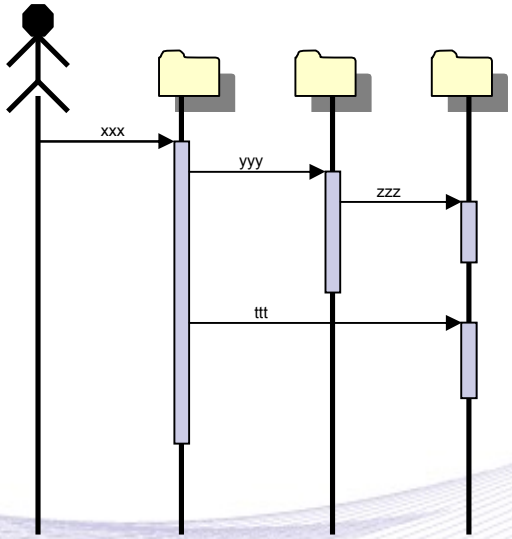
UML Sequence Diagram

- Model the dynamic part, the **interactions**



- **What will happen on the bus**

UML conclusions

- **Class & component diagrams** (static)
  - View of what services are available
  - Documentation of the interface
  - Shows the dependencies between services
- **Sequence diagrams** (dynamic)
  - View on how the services communicate
  - View on how the appl. uses the services
- UML analysis is very well suited to SOA

Conclusions

Conclusions

- SOA can bring BENEFITS
- SOA is an evolution, not a **R**evolution
- SOA does not require technology change !
- SOA adapts to all technologies (including legacy)
- You can transition smoothly to SOA

- … but SOA needs a clear decision & management support !

Conclusions

- To implement SOA, you need good modeling :
  - Analysis
  - Architectural process
- UML is the ideal candidate to support this modeling
- SOA is **maturity** after C/S, n-tier, CBD…

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QUESTIONS ?

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