



From service-oriented architecture to service- oriented enterprise

Marten van Sinderen

**Keynote lecture I-WEST 2009
Sofia, Bulgaria, 29 July 2009**



University of Twente
The Netherlands

Agenda

1. SOA

- motivation
- definition
- principles
- architectural elements

2. Web Services

3. Service-oriented enterprises

4. Summary



Agenda

1. **SOA**
2. **Web Services**
3. **Service-oriented enterprises**
4. **Summary**

Motivation for SOA

Business needs

- **dynamic and competitive marketplace** → need for business model and IT architecture that can rapidly change to support business model and its objectives
- **high IT investments** → need for increased leverage through standard integration solutions that can turn existing applications into reusable services

Motivation for SOA

IBM commissioned **global CEO survey** (2006)

- 78% of CEOs believe that integrating business and technology is fundamental for innovation
- 90% of CEOs believe that their organization does not have the ability to be very responsive to changing market conditions

Need for **rapid and flexible integration of IT systems aligned with business goals**

Motivation for SOA

Integration deficiencies of IT architectures

- **monolithic (silo) applications**
 - ▶ effective for the specific purpose they were created
 - ▶ difficult to change and integrate with other applications within and between enterprises → requires custom coded connections
- **component-based applications**
 - ▶ provide units of business logic as services
 - ▶ flow of control and transformation of data formats is bound into the business logic

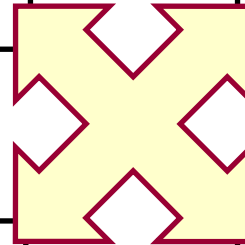
SOA – definition of terms

service?
Repeatable business task

service orientation?
Way of integrating your
business as linked
services

service oriented
architecture (SOA)?
IT architectural style that
supports service
orientation

composite
application?
Set of 'wired' services that
support a business
process



Intermezzo: what is a service?

- **repeatable business task** (IBM Redbooks 2006)
- all economic activity whose output is not a physical product or construction (Brian et al 1987)
- an activity ... provided as a solution to customer problems (Gronroos 1990)
- non-material equivalent of a good (Wikipedia 2006)

- **external** and **internal** business services
- **business** services vs **IT** services
- **application** services vs **communication** services

SOA principles

SOA is an IT architectural style that supports service orientation – integration of your business as linked services

- **loosely coupled**
- **implementation-independent**
- **protocol-independent**
- **standards-based**
- **reusable**
- **composable**
- **hierarchical**

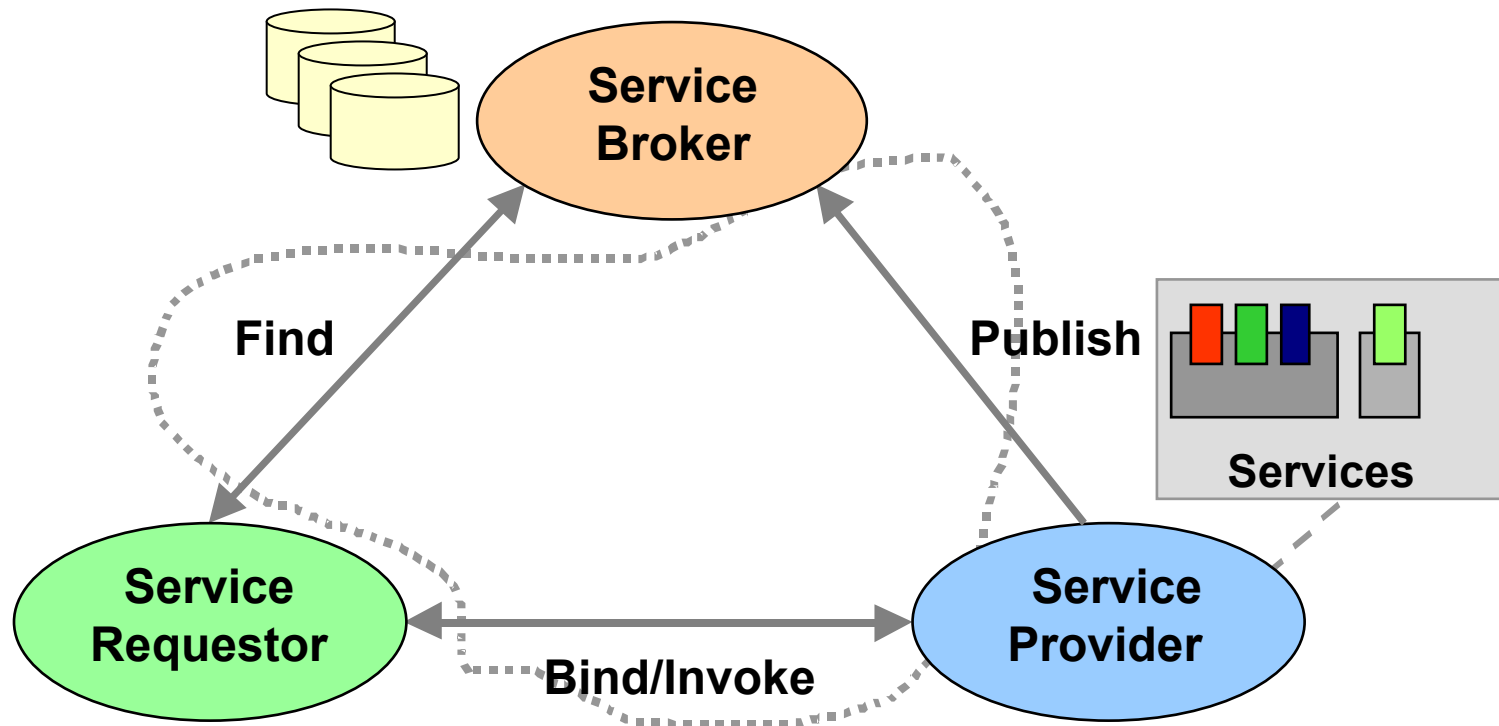
SOA principles

The SOA architectural style entails the composed and/or coordinated **interaction of services**, associated with **messages** and governed by **policies**

Focus shifted to **business processes**

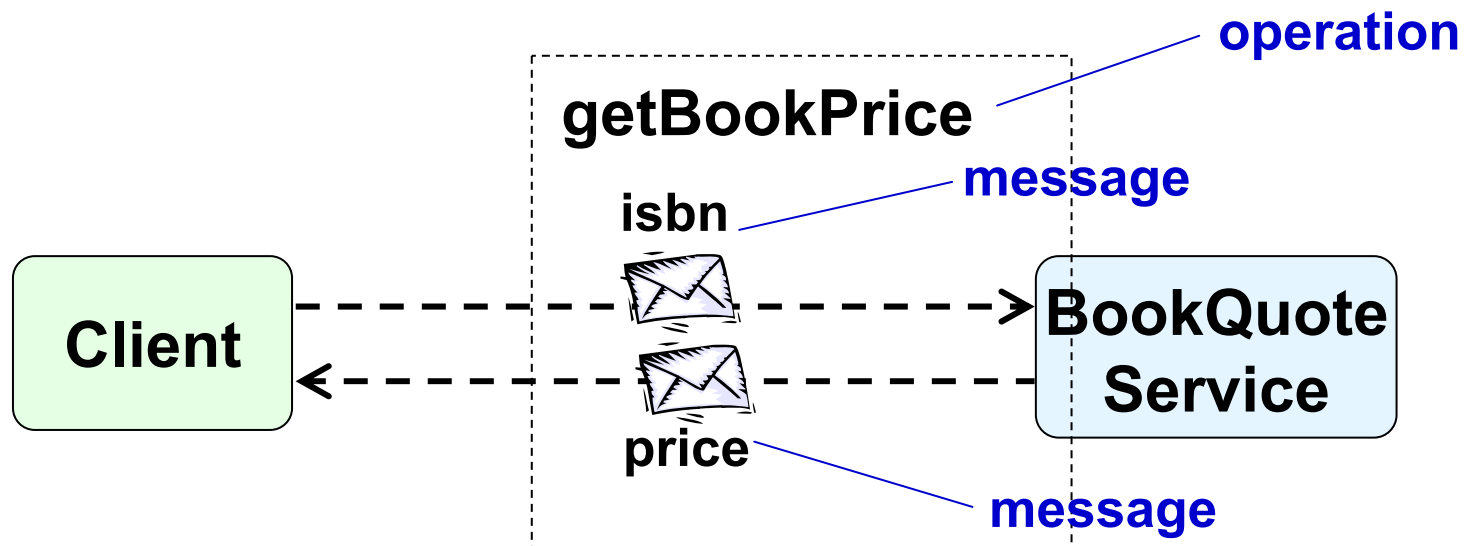
- business process as a service
- business process as a driver of collaboration through services

Basic SOA pattern



Basic message exchange

Example

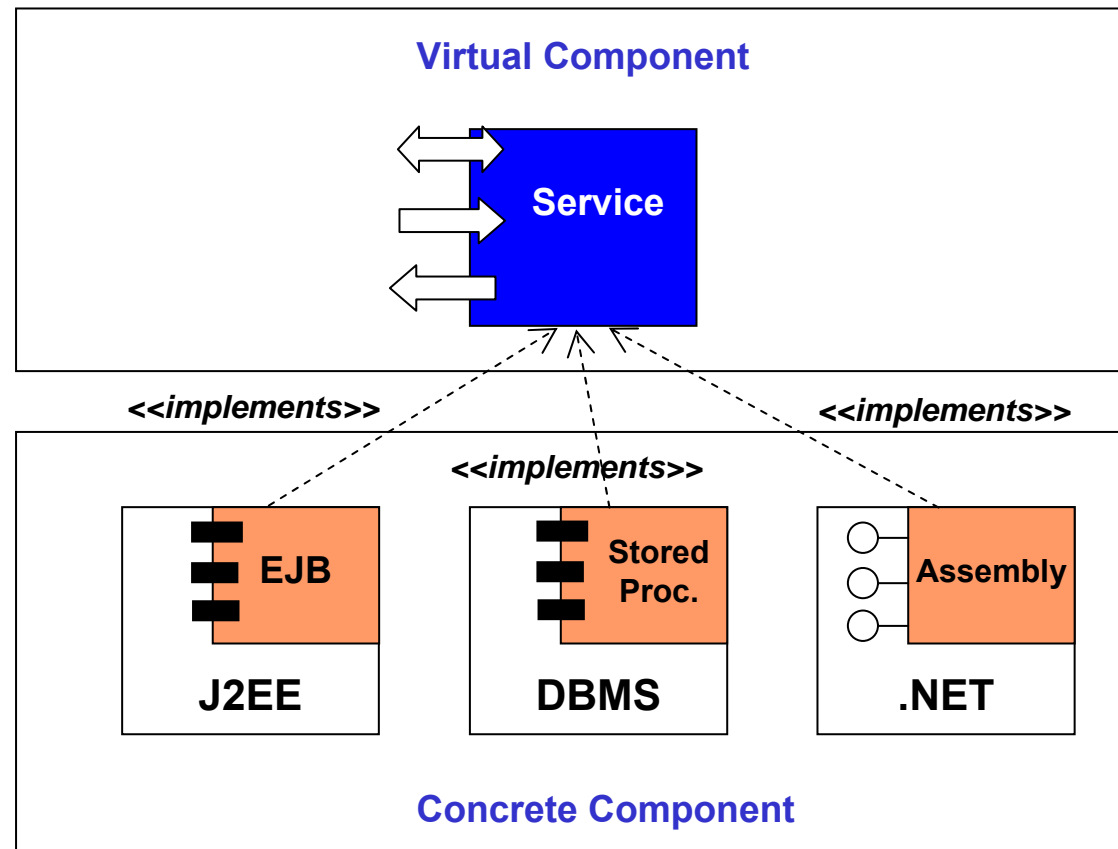


Integration with SOA

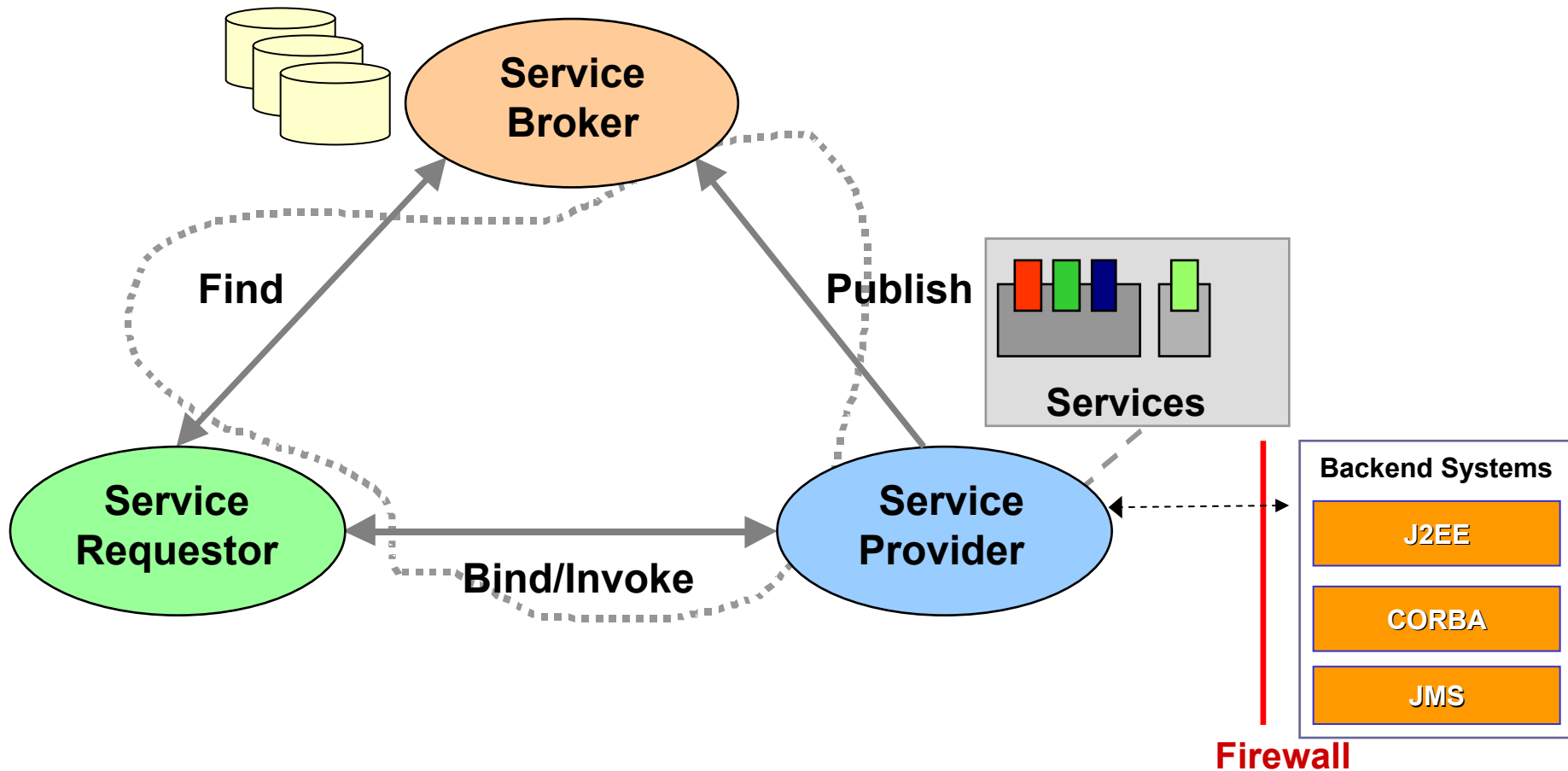
How is integration solved?

- ▶ **enterprise application integration**
- ▶ **business to business (B2B) integration**

Enterprise Application Integration

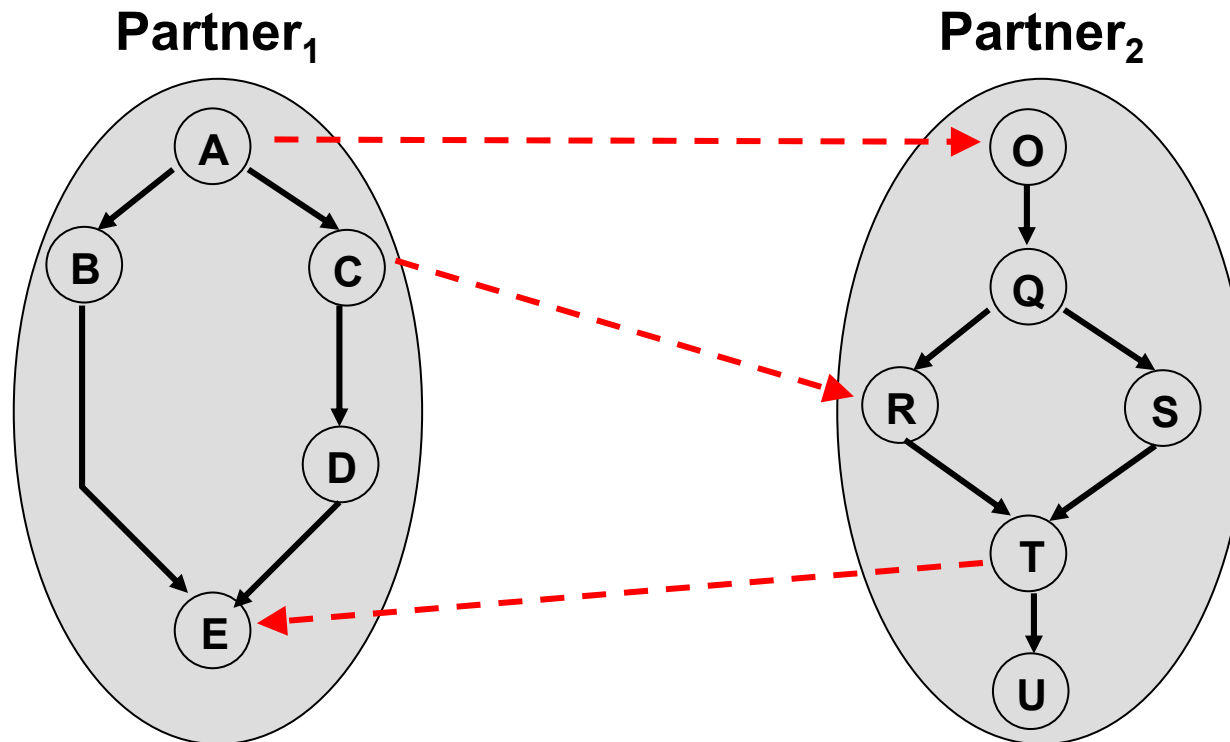


Basic SOA pattern



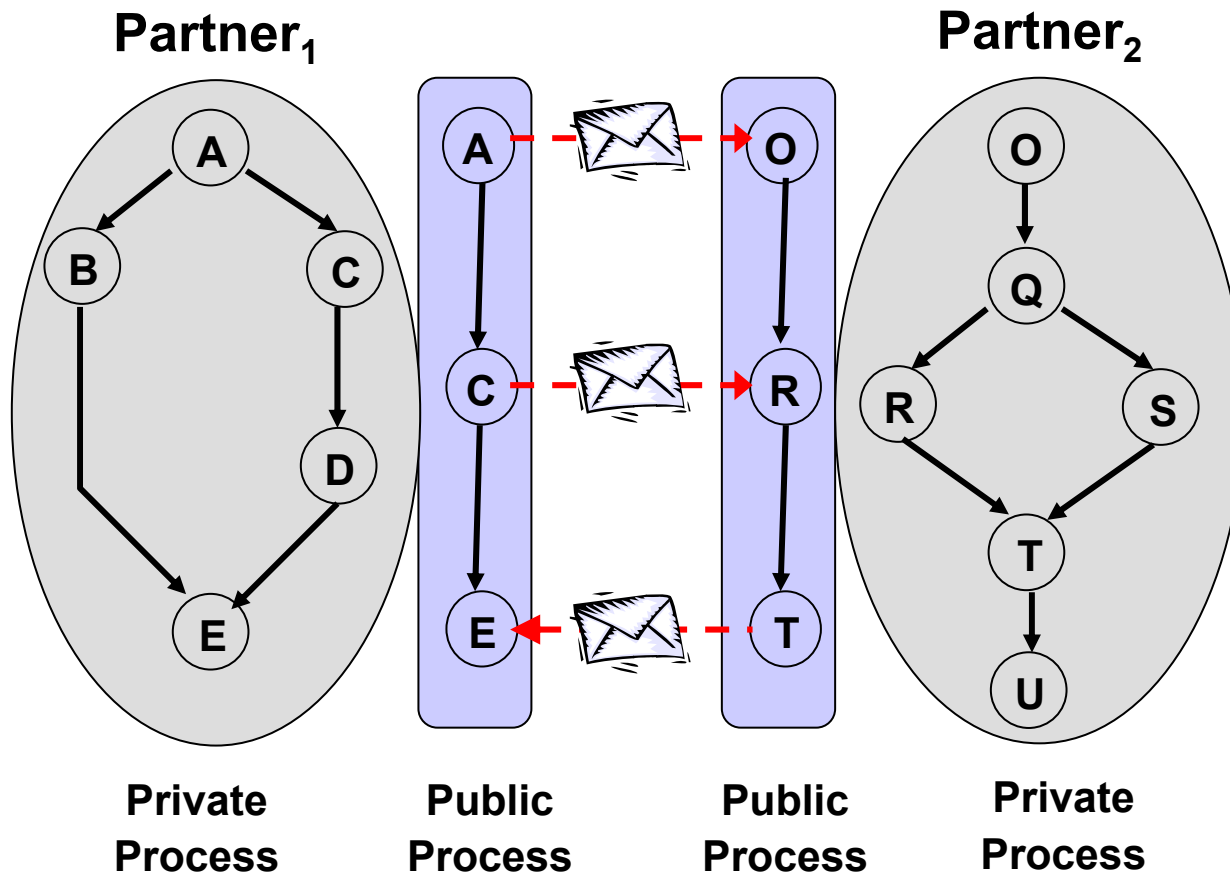
B2B Integration

Example of required peer-to-peer interaction

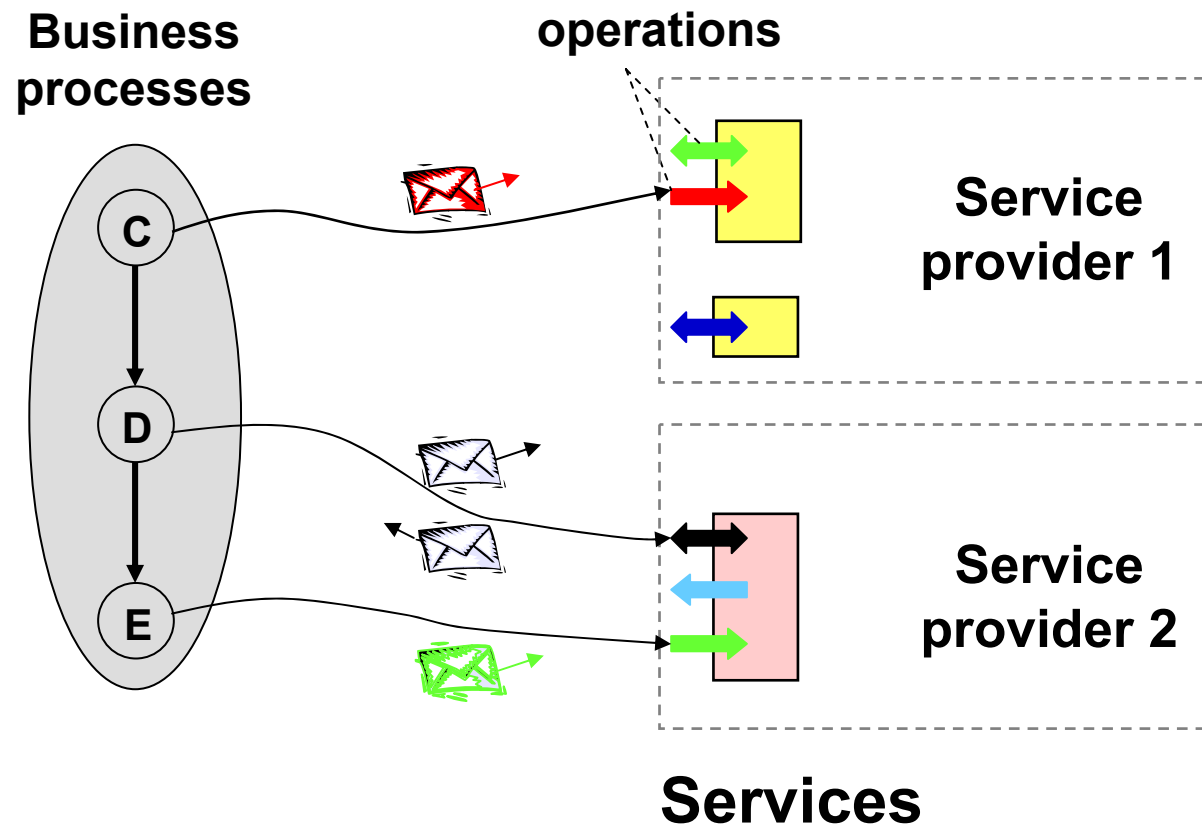


B2B Integration

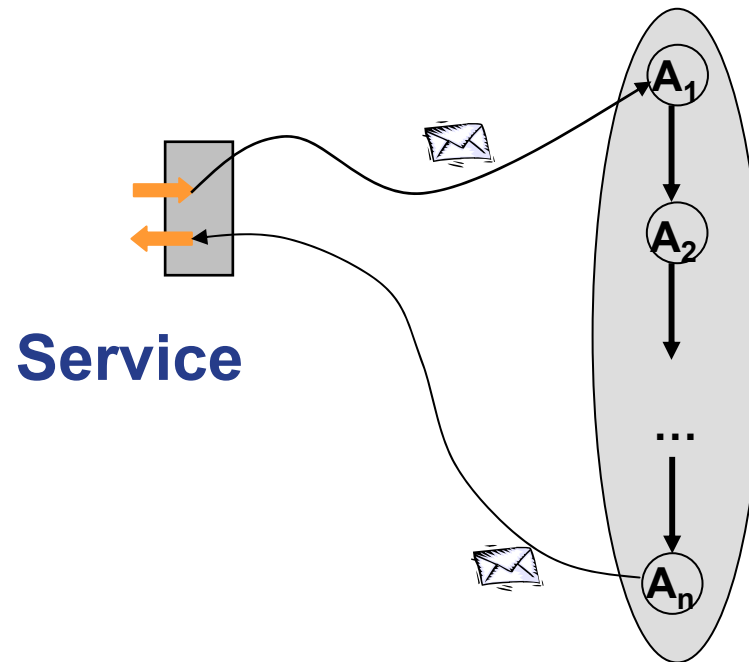
Public processes and SOA-based message exchange



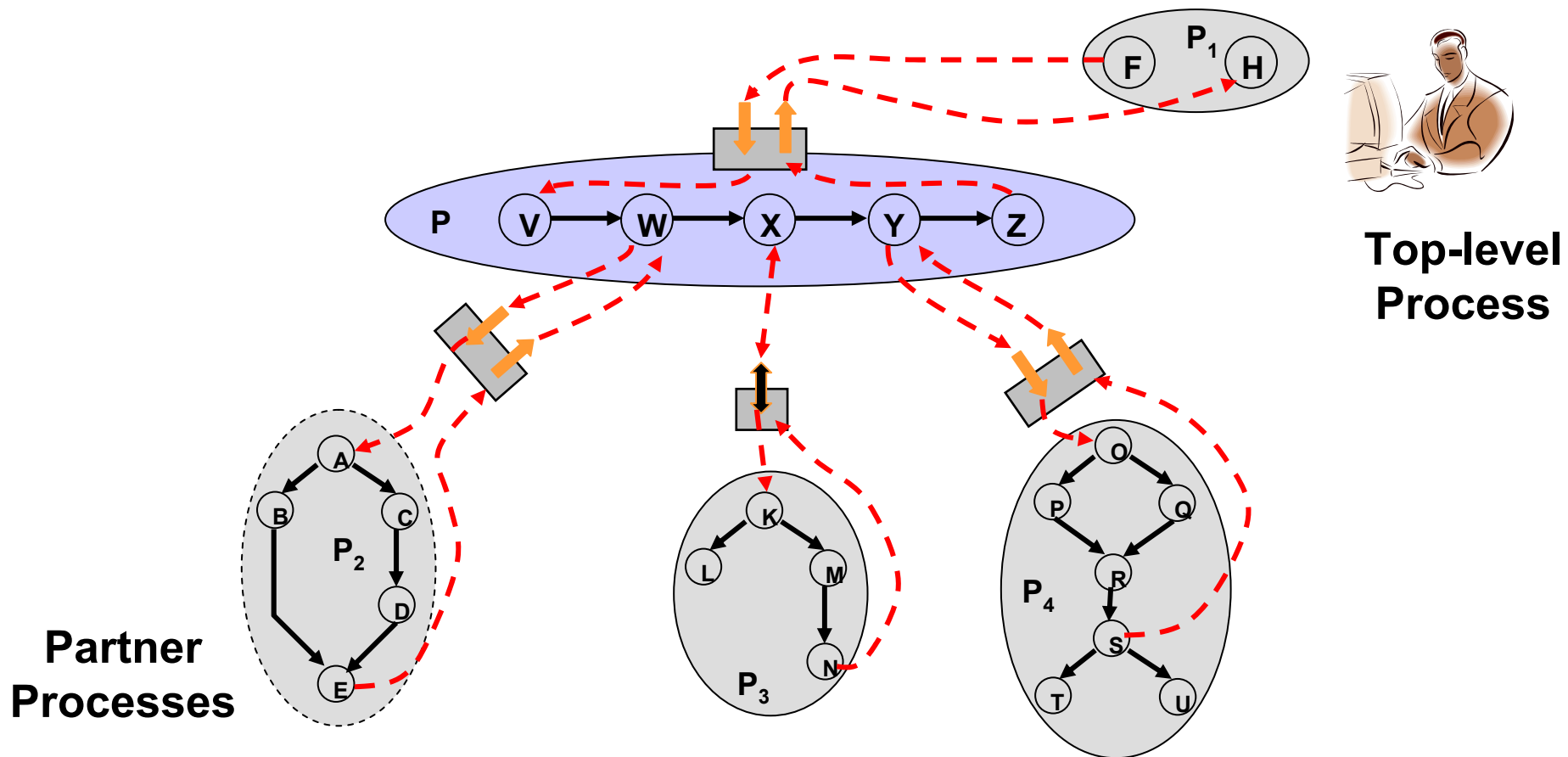
Business processes between services

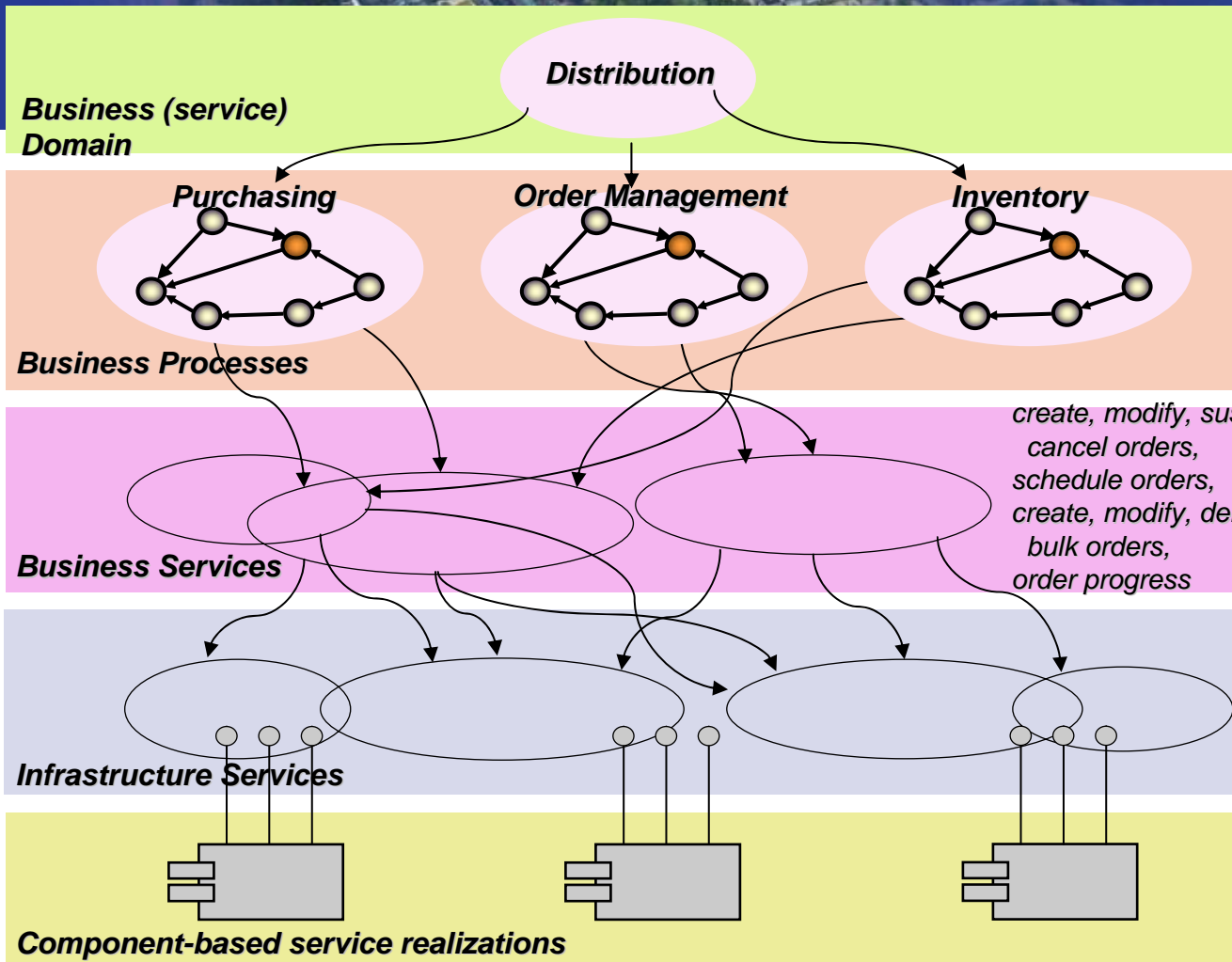


Business processes as services



Hierarchical process structures





Applying SOA to achieve business goals

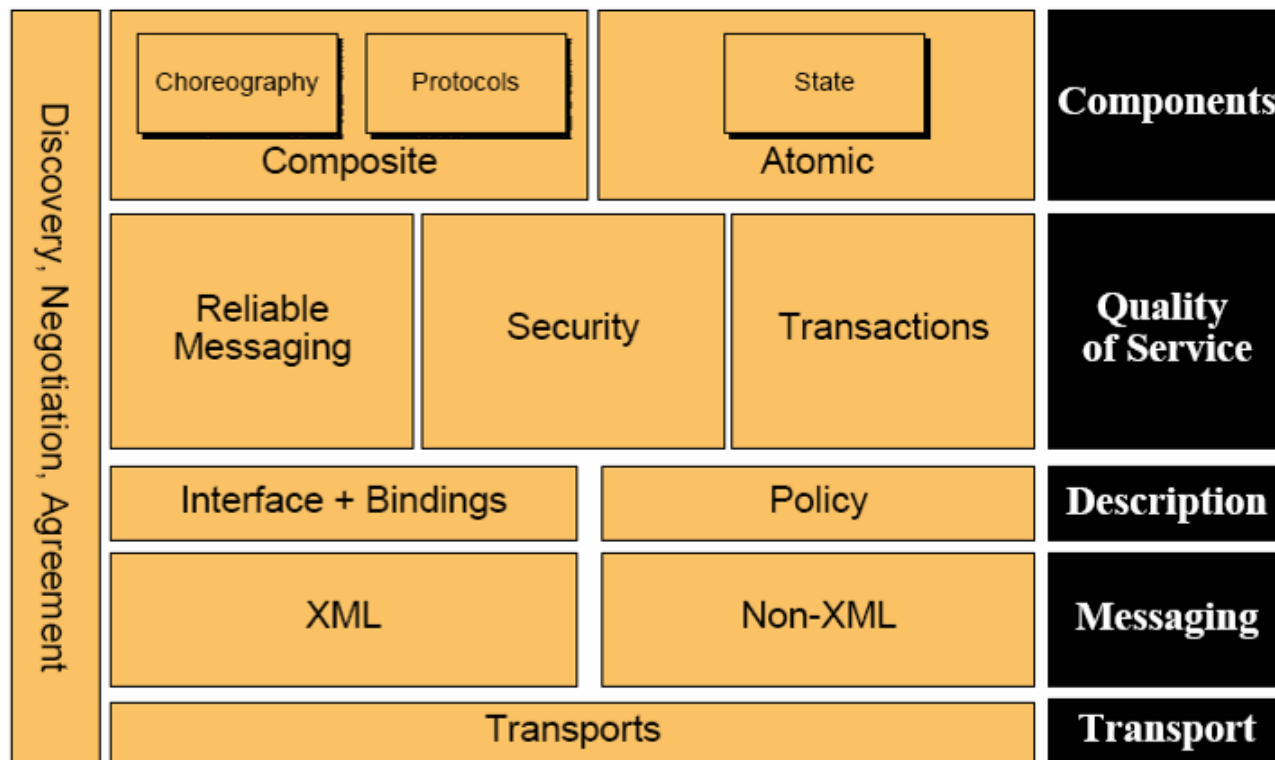


Taken from Papazoglou2008

Analysis and design with SOA

- analysis should lead to **identification and description of business processes**, and **select processes** where SOA can contribute to improvements and adding value → business services
- design must result in **definition of interfaces** for conceptual services, prior to their implementation
 - ▶ 'atomic' services
 - ▶ business services/process
 - ▶ policies
 - ▶ non-functional service characteristics

SOA elements organized in a platform





Agenda

1. SOA
2. Web Services
3. Service-oriented enterprises
4. Summary

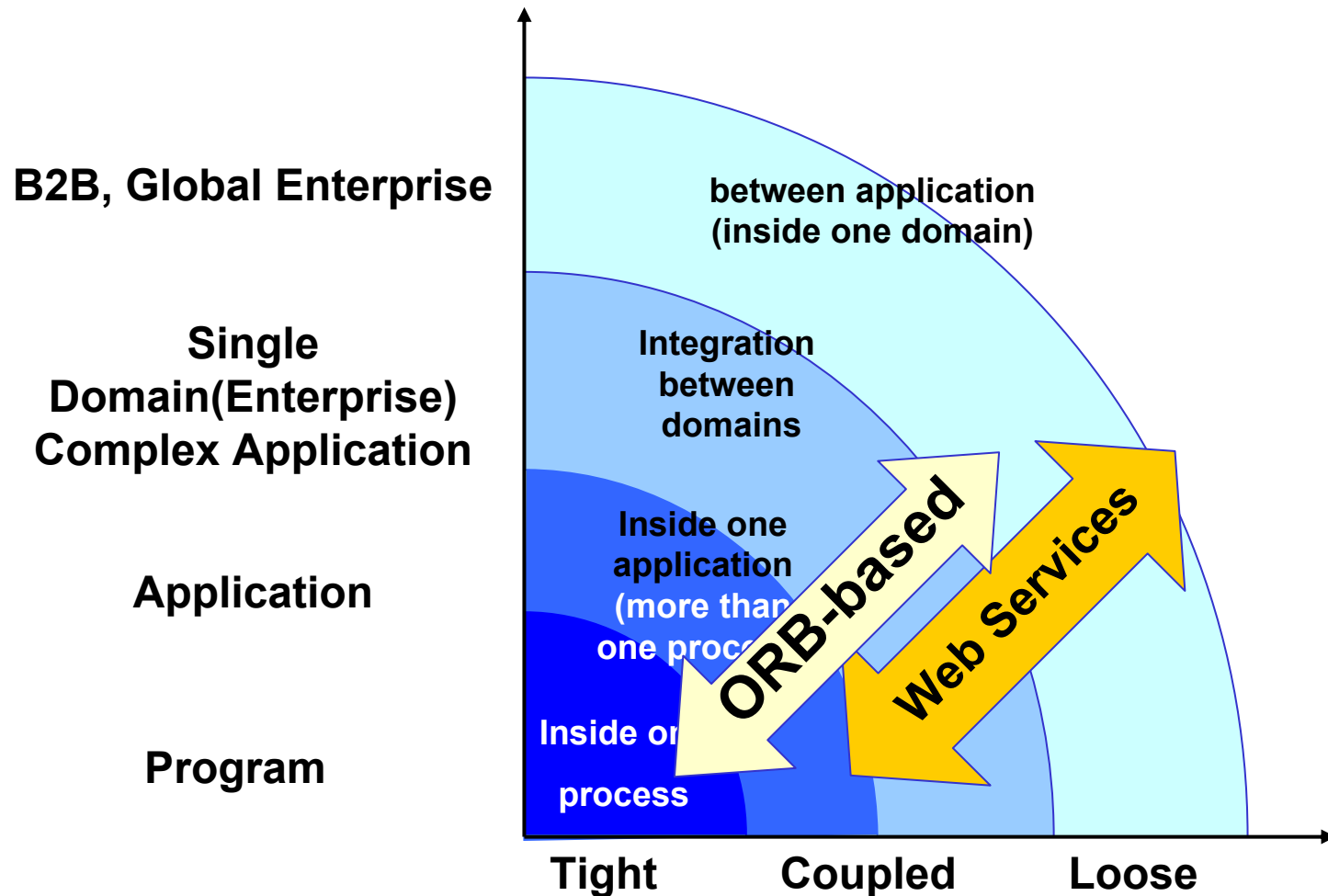
Web Services

Collection of standards that can be used to implement SOA

Self-contained, modular applications that can be described, published, located and invoked over networks

Introduced as a technology to **support B2B integration** using **standard web-based protocols**

Web services vs other middleware



Core elements

Simple Object Access Protocol (SOAP)

- internet protocol for applications to communicate

Web Service Service Description Language (WSDL)

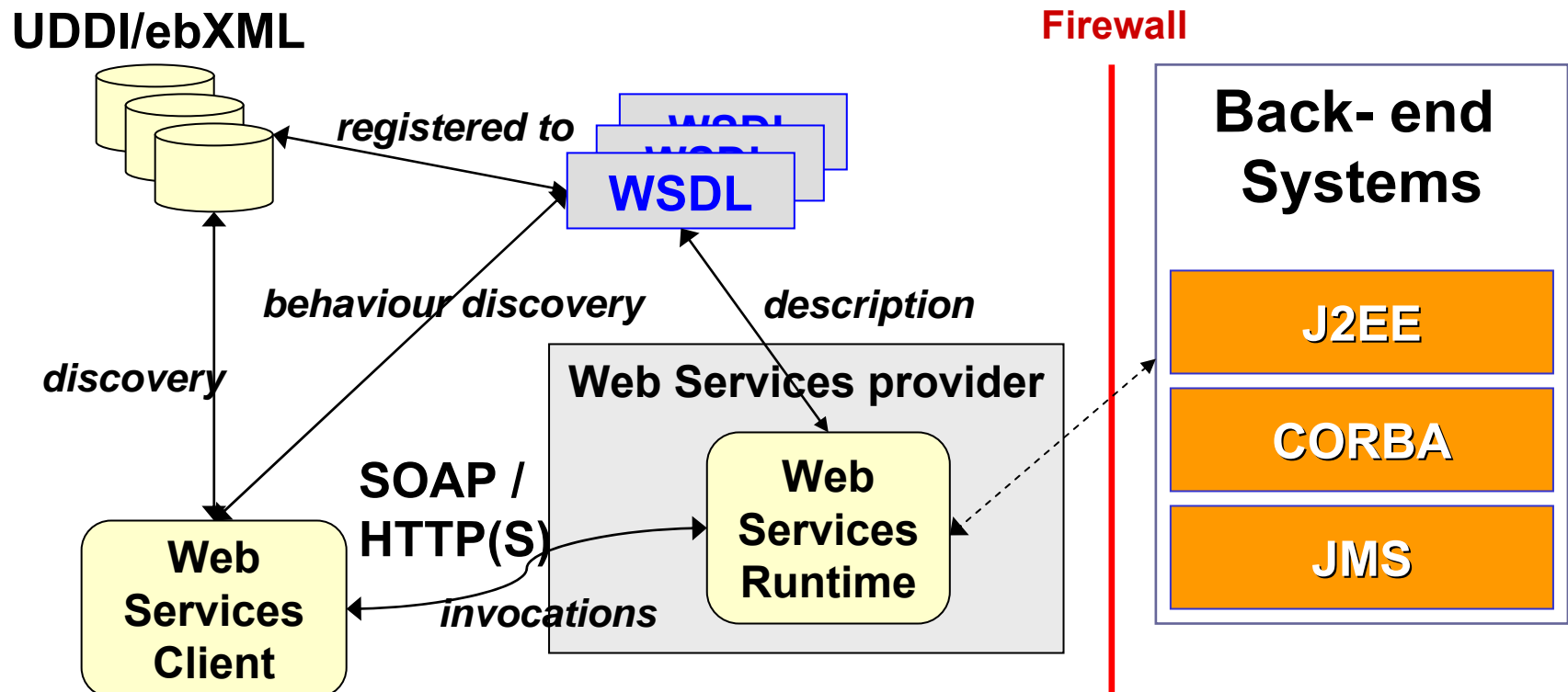
- language for specifying the interface of web services

Universal Description, Discovery and Integration (UDDI)

- framework for describing and discovering web services

Extensible Markup Language (XML) underlies most of the specifications used for web services

Basic Web Services pattern



SOAP

Internet protocol for applications to communicate

- runs on top of other **standard internet protocols** (typically HTTP)

Defines how messages are **structured and processed** in a **platform-independent way**

Two message exchange patterns

- **One-way**
- **Request-response**

WSDL

Language for specifying the interface of web services

Used to provide a **description of the service** for the (potential) clients

- ▶ Which **messages** are related to each **operation** supported by the service?
- ▶ How are these **messages related**?
e.g., **operation input and output**
- ▶ How are **SOAP messages exchanged**?

WSDL

Types

Messages

Operations

Port Types

Bindings

▶ Protocol – HTML, SMTP

▶ Encoding

Ports

Service

“interface” definition
(abstract part)

“endpoint” definition
(concrete part)

Limitations of SOAP/WSDL

- ▶ WSDL allows to define the **format and structure of the messages**
- ▶ Operations (and related messages) **can be grouped in an interface**
- ▶ WSDL **does not allow to describe the sequence and conditions of the operations** of such an interface
 - ▶ WSDL geared towards a **stateless C/S-model** of interaction
 - ▶ **no mechanism for correlating exchanged messages**
 - ▶ **no notion of instance** regarding service invocation

Composition and coordination

Orchestration (composition)

- ▶ An **executable business process** describing an **execution flow** from the perspective and under control of a single endpoint (commonly: **Workflow**)

Choreography (coordination)

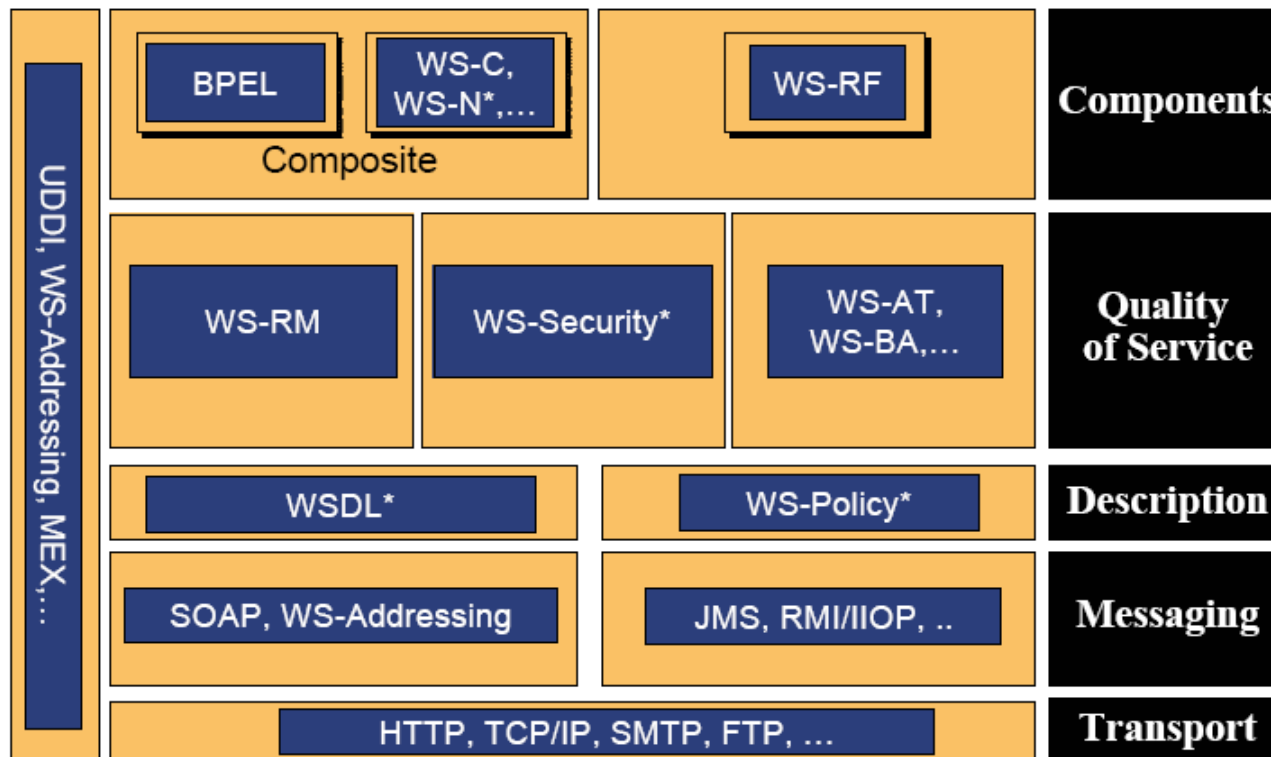
- ▶ The **observable public exchange of messages, rules of interaction and agreements** between two or more business process endpoints

WS-BPEL

WS-BPEL: Business Process Execution Language for Web Services

- supports the specification of **composition schemas** as well as **coordination protocols**
- composition schemas are **executable process specifications**
 - ▶ implementation logic of a (composite) service that can invoke or be invoked by other services

... and many other WS standards





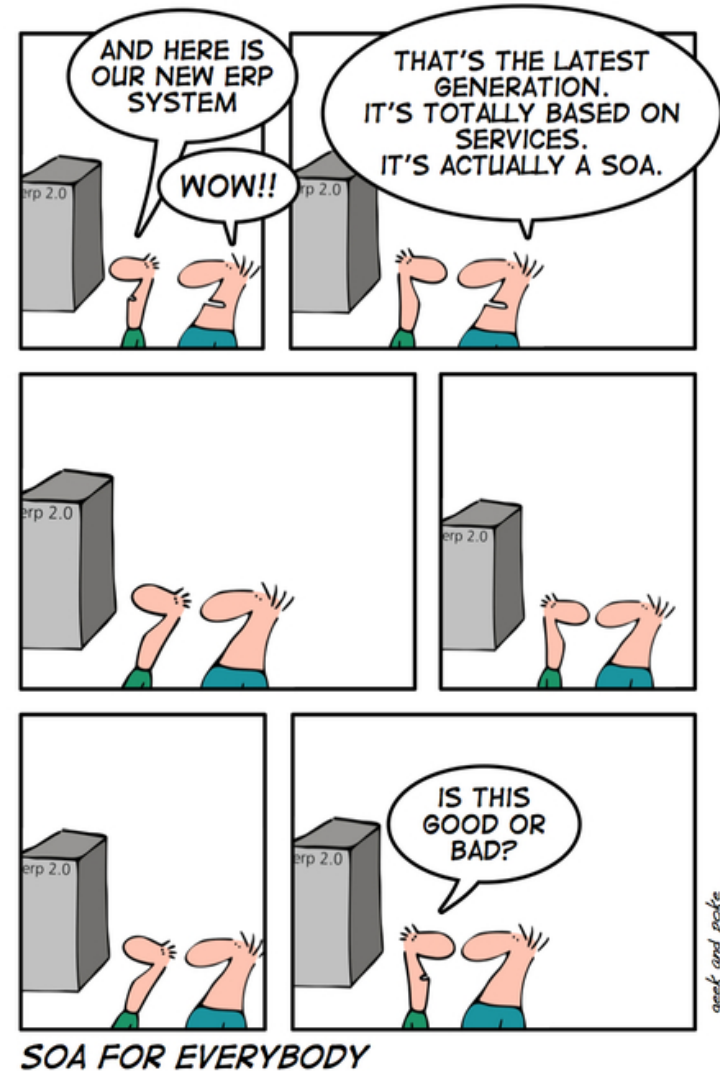
Agenda

1. SOA
2. Web Services
3. Service-oriented enterprises
4. Summary

Service-oriented enterprises

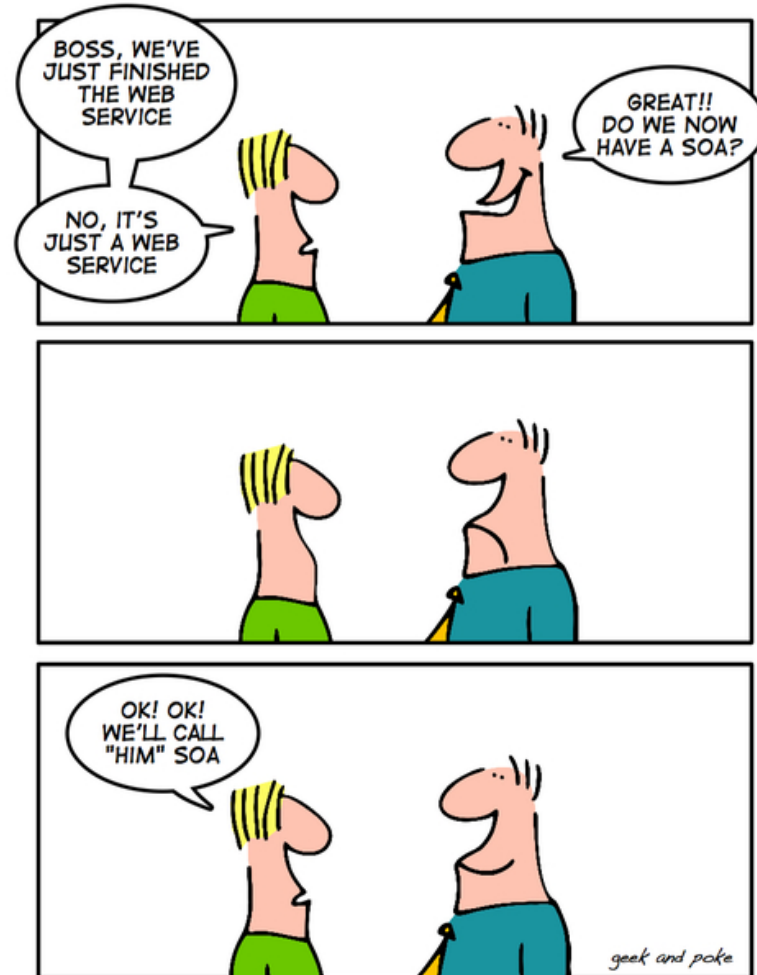
- major technology vendors have invested significant effort in supporting and promoting SOA (WS)
- over time lack of SOA adoption will become a **competitive disadvantage** for most enterprises (Gartner 2003)
- adoption of SOA for developing business systems will **impact organization** as a whole (Luthria & Rabhi 2009) → **service-oriented enterprises**

Little knowledge about impact on business



Focus on technical challenges, rather than organizational ones

Needed: Shift to business-involved service design and engineering



HOW TO GET A SOA

Practical problems and limitations

- **scalability**: millions of services to register, search ...
- **governance**: compliance of evolving services
- **trust/security/privacy**:
 - ▶ can I trust my service, what is behind its facade?
 - ▶ who can access my info, is it well-protected?
 - ▶ what happens if I stop using the service?
- **contracts**: incorporation of legal aspects
- **quality**: definition and management of SLAs
- **monitoring**: do services behave as promised?
- **control**: what if not: reconfigure, sanction, compensate?

Important developments

- **context awareness**: use location and other context of business entities to align services to needs
- **semantic services**: ontology-based techniques to allow automated reasoning for automated handling of services, e.g. in discovery and ...
- **on-demand/dynamic composition**: given a service request and a collection of semantically annotated services, develop a service composition that fulfils the service request

Important developments

- **business-IT aligned modelling**: hand-in-hand development of business models and IT models using consistency rules or transformations
- **cloud computing**: scalable services delivery platform based on SOA and virtualization and targeted to sharing of resources (business-centric)
- **internet of services**: delivery platform for open market services with contractually guaranteed rights and obligations (consumer-centric)

Agenda

1. SOA
2. Web Services
3. Service-oriented enterprises
4. Summary

Summary

- SOA was motivated by business needs: **flexibility** and **reusability**
- WS is the current **de-facto implementation** of SOA
 - ▶ widely supported by technology vendors
 - ▶ significant awareness in IT community
- little knowledge about **impact on business**
- focus shift from technology to **business-involved design and engineering**
- several **practical barriers** still exist
- new developments to fill gaps: **cloud computing** and **internet of services**

Summary

Future vision:

SOA provides a **toolbox** that allows **rapid and flexible assembly of IT solution**, without intimate knowledge of IT, **aligned with business goals**

References

- [Fynes & Lally 2008] Brian Fynes and Ann Marie Lally (2008) Innovation in services: from service concepts to service experiences. In Service Science, Springer US.
- [Gronroos 1990] Christian Gronroos (1990) Service management and marketing. Lexington Books.
- [Luthria & Rabhi 2009] Haresh Luthria and Fethi Rabhi (2009) Service oriented computing in practice. J. of Theoretical and Applied Electronic Commerce Research.
- [Meyer Goldstein et al 2002] Susan Meyer Goldstein et al. (2002) The service concept: the missing link in service design research? J. of Operations Management.
- [Minaei-Bidgoli & Rafati 2004] Behrouz Minaei-Bidgoli and Laleh Rafati (2004) Business service modeling in service-oriented enterprises. NCM 2004 Conference
- [Papazoglou 2008] Mike P. Papazoglou (2008) What's in a service? Invited keynote. ICSOFT 2008 Conference.
- [Papazoglou et al 2006] Mike P. Papazoglou et al. (2006) Service-oriented computing: a research roadmap. Int. J. Cooperative Information Systems.
- [Vissers & Logrippo 1985] Chris A. Vissers and Luigi Logrippo (1985) The importance of the service concept in the design of data communications protocols. PSTV 1985 Conference.



Thank you!

Questions?