Web Services and Service Oriented Architectures

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Overview

- The Garching Supercomputing Center - RZG
- Diving into the world of Web Services
- Service Oriented Architectures
- And beyond

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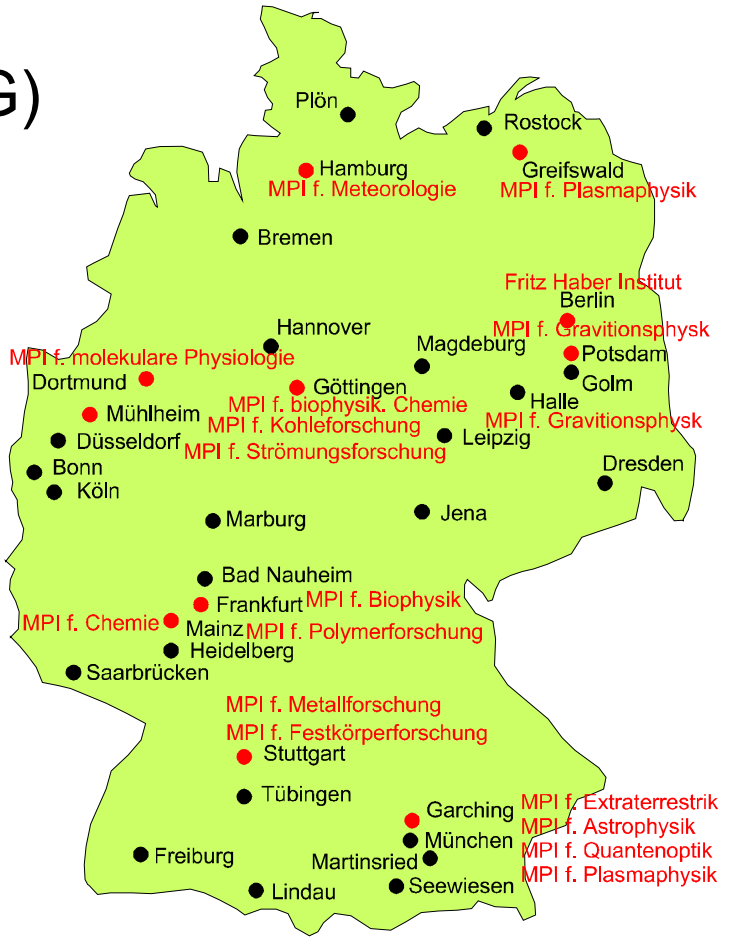
Supercomputing Center for the Max Planck Society (MPG)

Services and involvements:

- Supercomputing facility with a 5 TFlop IBM Regatta system
- Linux compute farms
- Data Storage

- DEISA
- MiGenAS
- D-Grid – German Grid initiative
- Data Acquisition for ASDEX Upgrade and Wendelstein 7X (Plasma Physics)



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Machine Room

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DEISA – Distributed European Infrastructure for Supercomputing Applications

- Consortium of leading national supercomputing centers
- focuses in deploying an Grid empowered infrastructure
- to build a distributed terascale supercomputing facility

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Web Services and more

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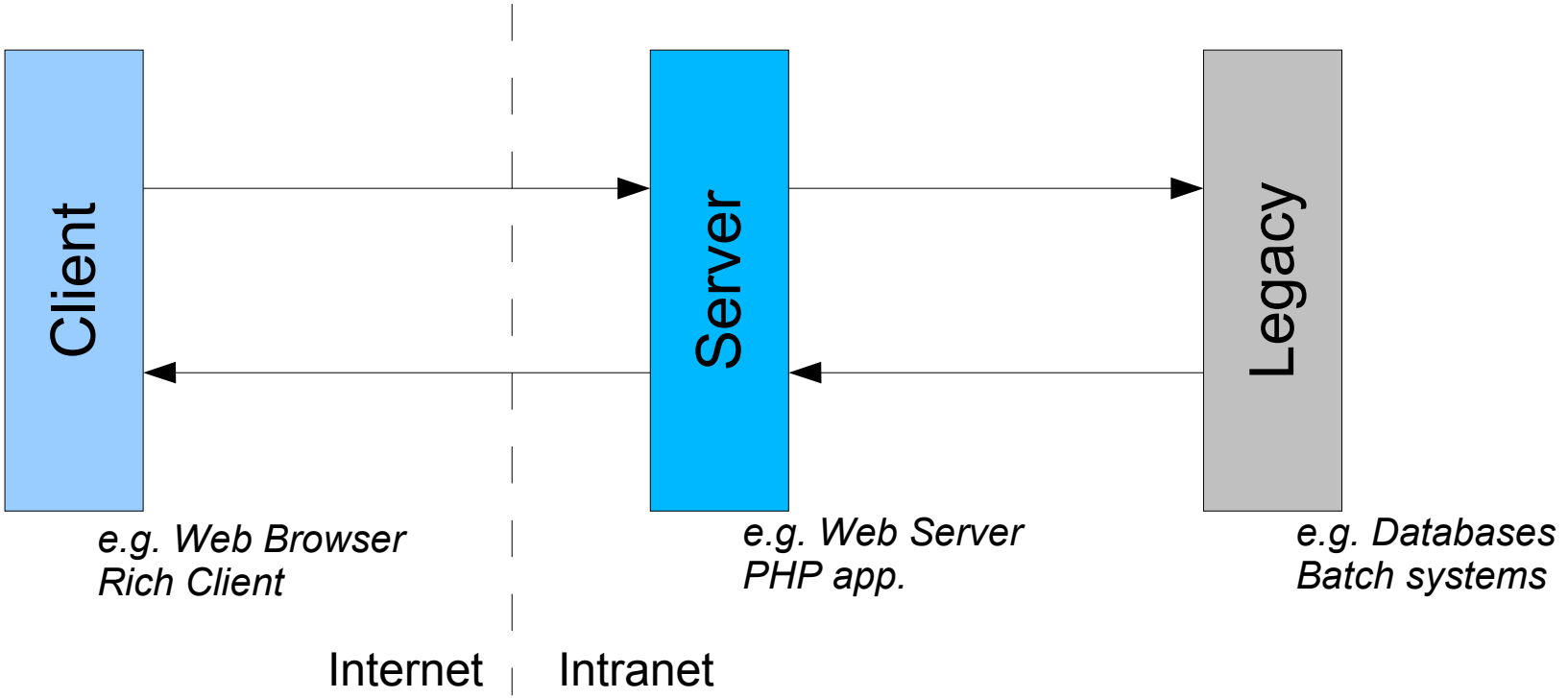
Client Server Architectures

- 2-Server Side Tier Applications

integrated Controller/View/Business logic,
legacy applications and databases



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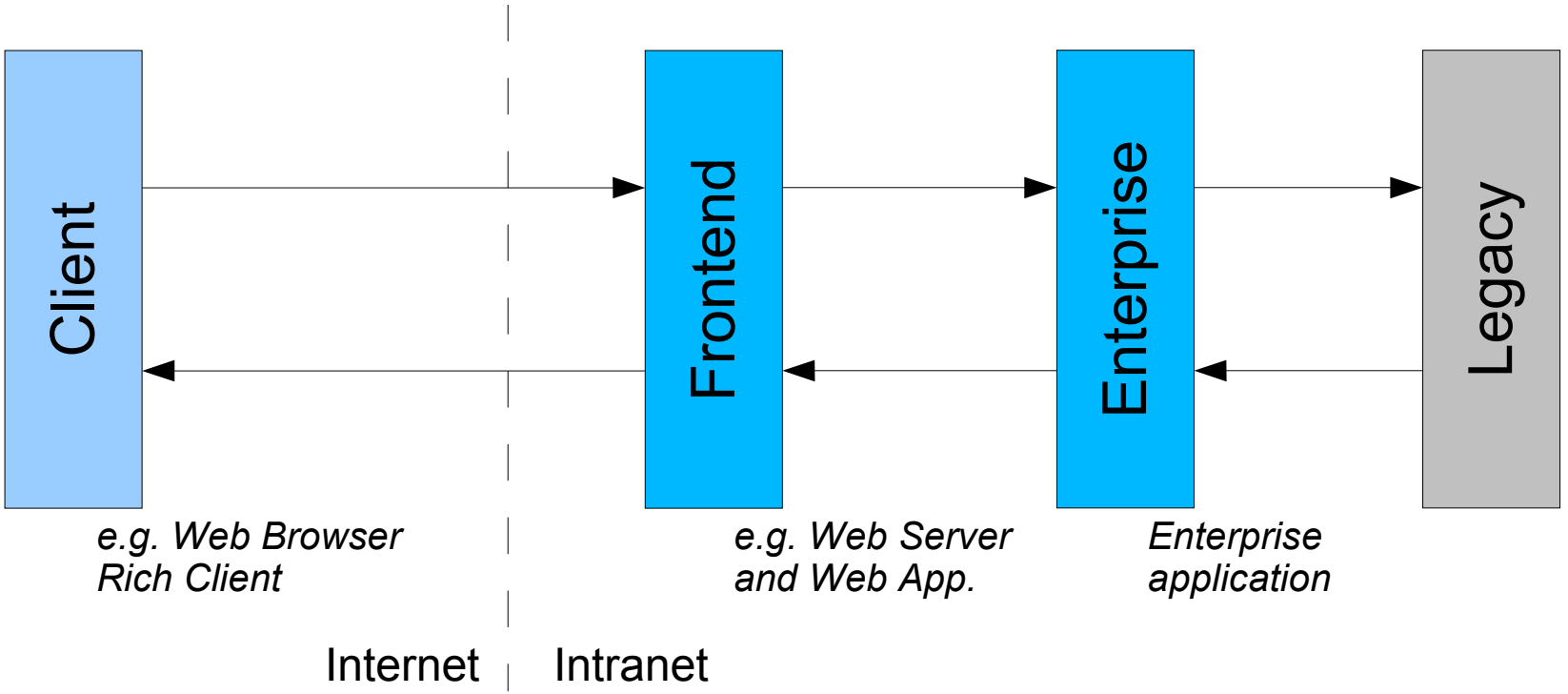
Client Server Architectures

- 3-Server Side Tier Applications



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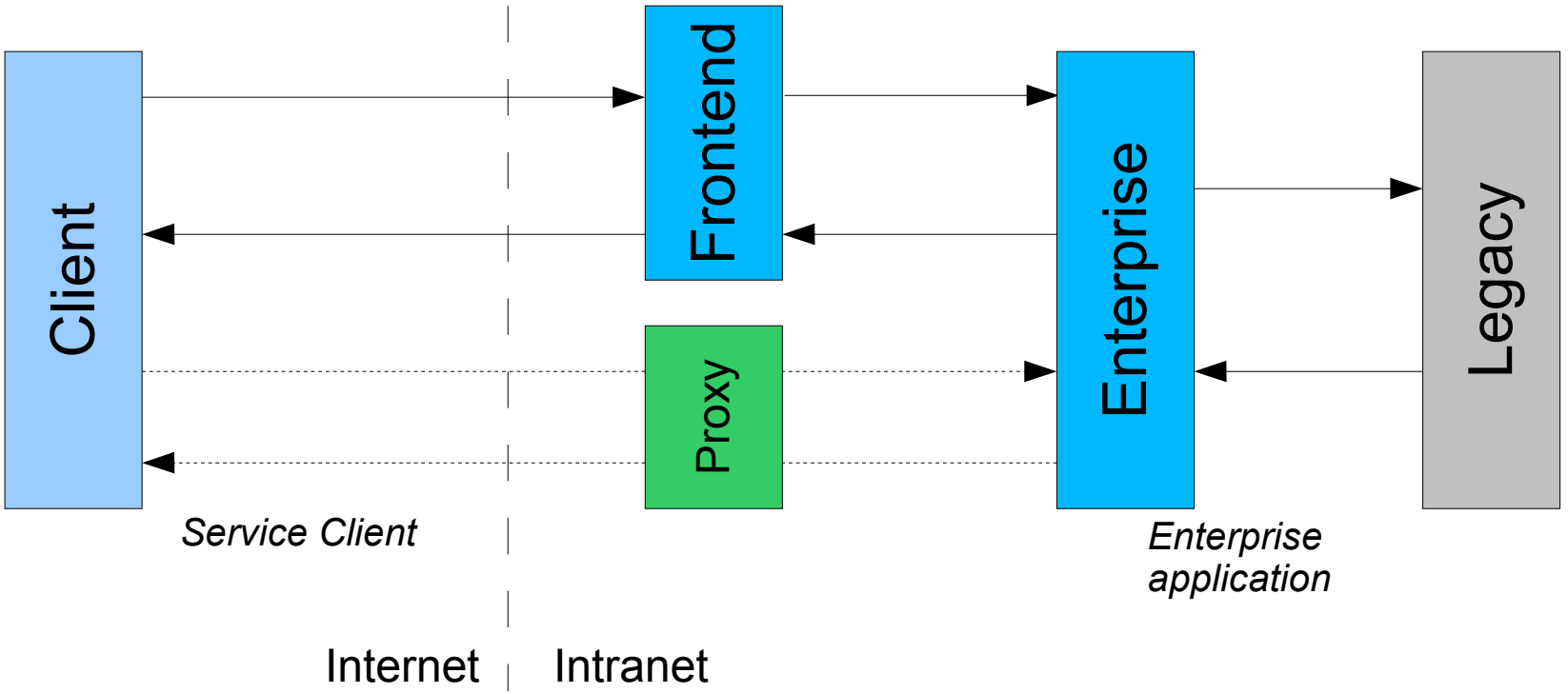
Client Server Architectures

- 3-Server Side Tier Applications with explicit services



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Service

A service ...

- *... can be discovered & dynamically bound.*
- *... is self-contained & modular.*
- *... exhibits a coarse grained service interface.*
- *... is based on a loose coupling between provider & consumer.*
- *... is interoperable.*
- *... is addressable and locatable via a network.*
- *... can be composed out of other services.*

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Web Service Definition

W3C, Web Services Architecture, http://www.w3.org/TR/ws-arch

*A Web Service is a software system designed to support **interoperable** machine-to-machine interaction over a **network**. It has an **interface** described in a machine-processable format (specifically WSDL). Other systems interact with the Web service in a manner prescribed by its description using SOAP messages, typically conveyed using HTTP with an XML serialization in conjunction with other Web-related standards.*

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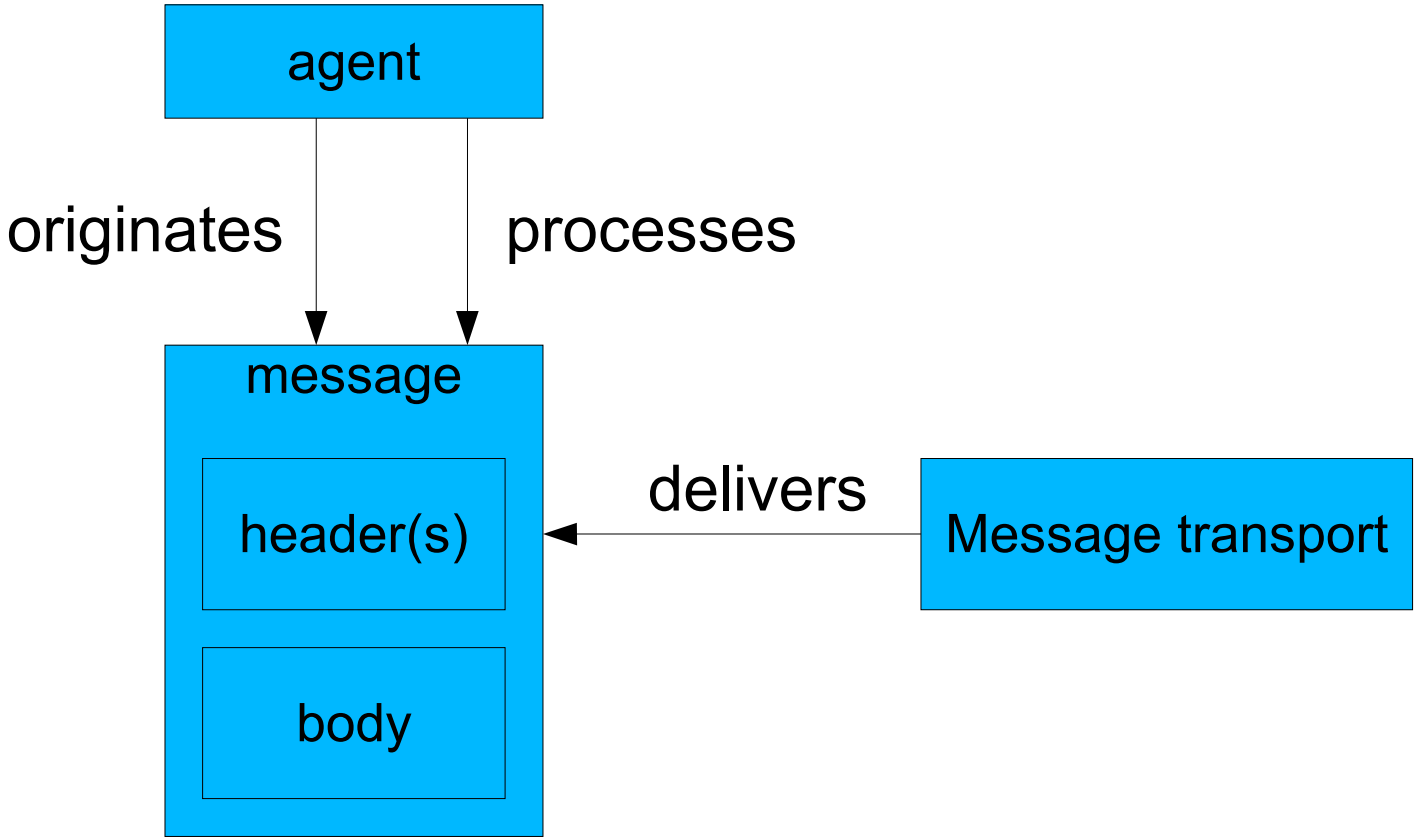
Message Oriented Model View



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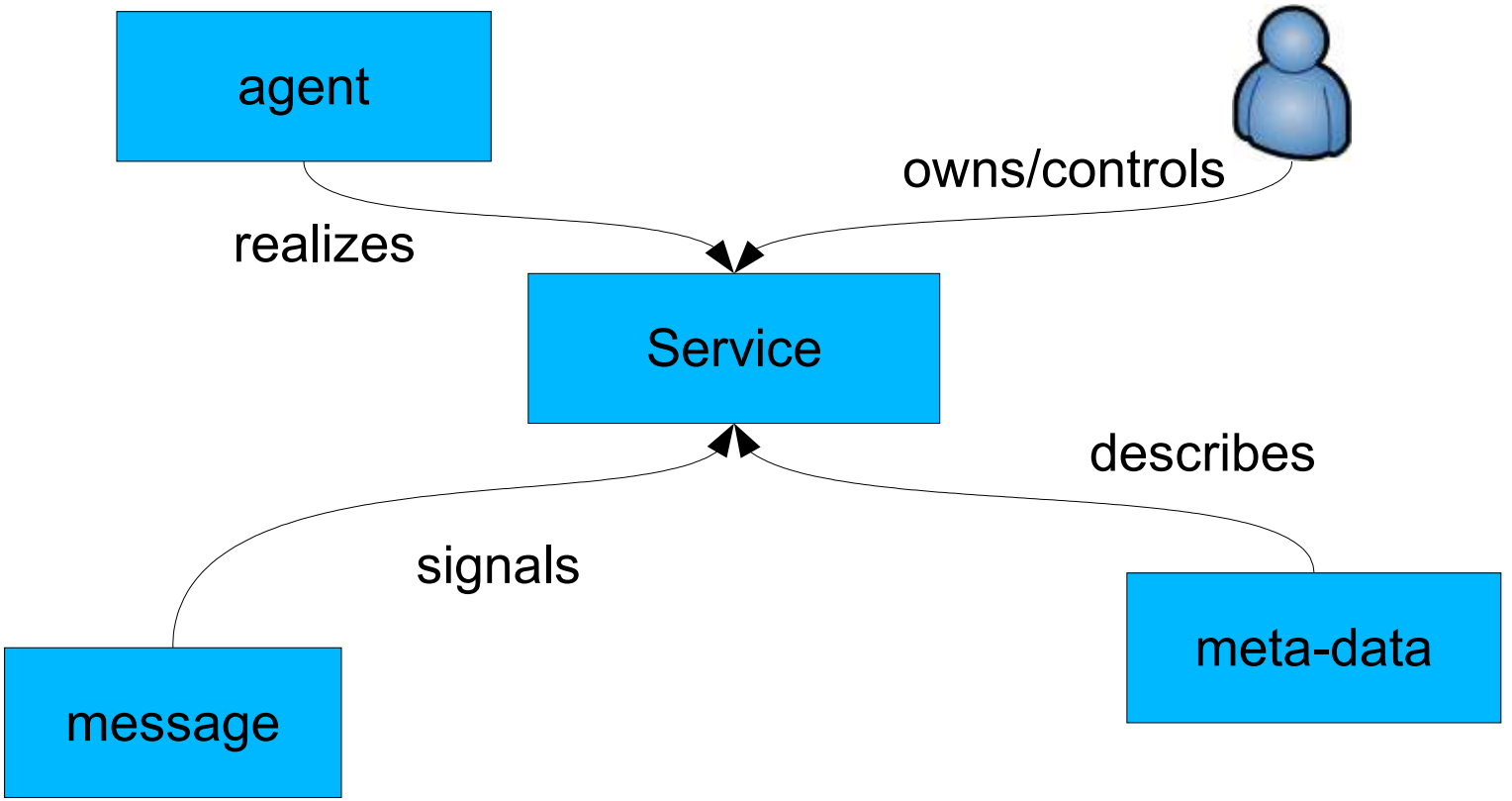
Service Oriented View



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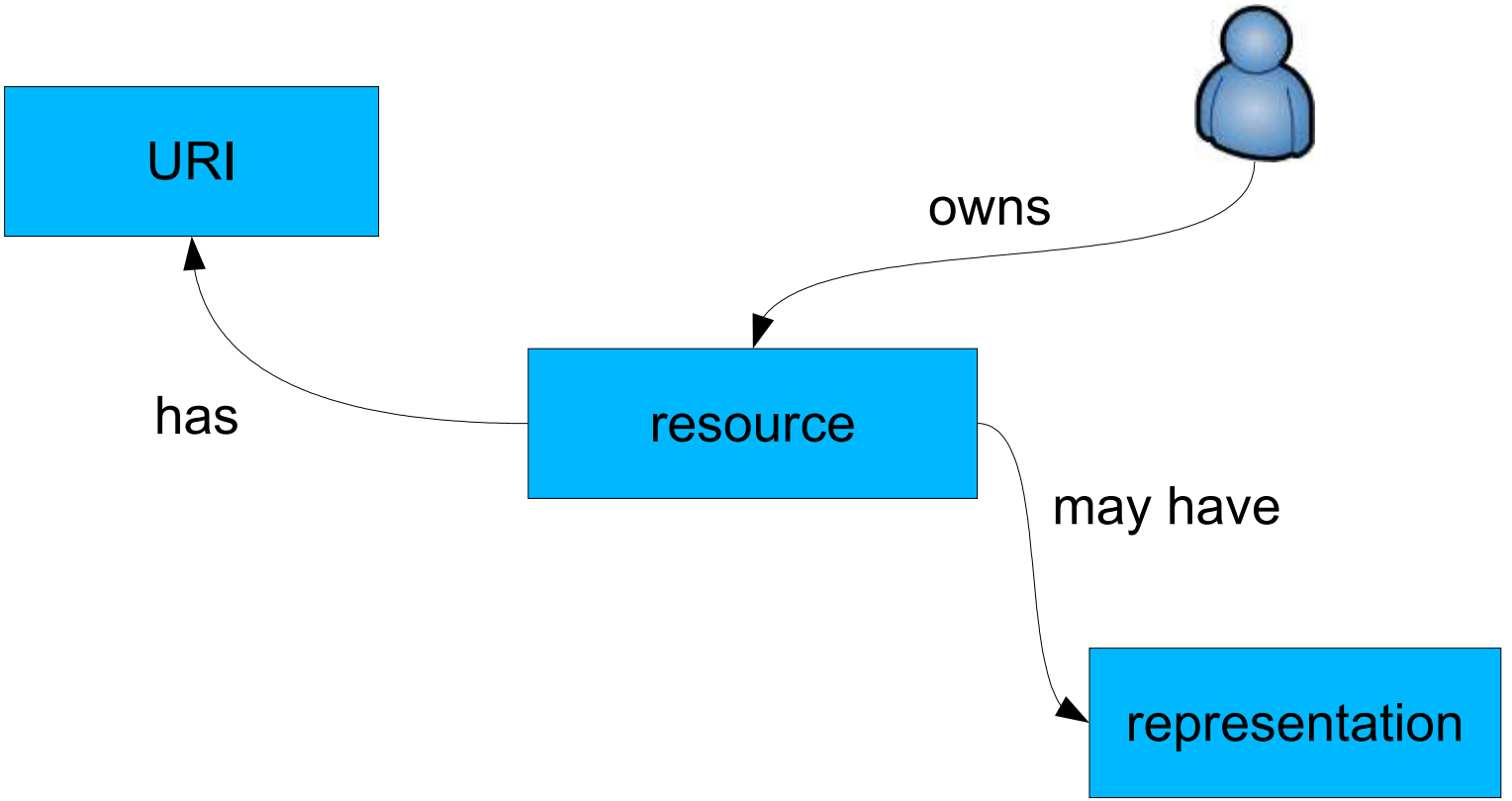
Resource Oriented View



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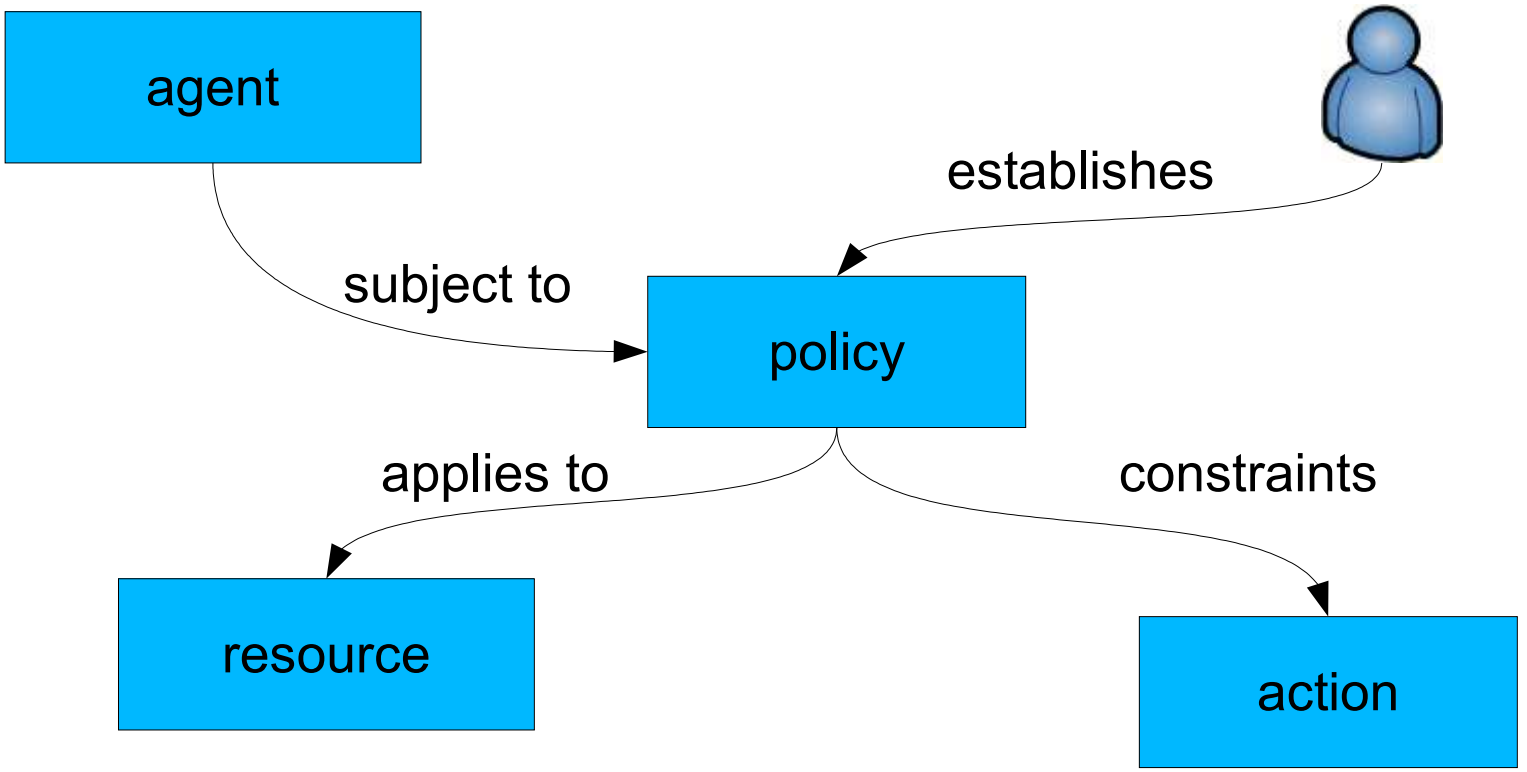
Policy Model View



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Web Services Examples

Web service
http://live.capescience.com/ccx/GlobalWeather

- Provides airport and flight weather information

Amazon Web Services (AWS & ECS)
http://www.amazon.com/webservices

- Provide e-commerce services such as lookup of books

Google Web API
http://www.google.com/apis/

- *Guess* ...

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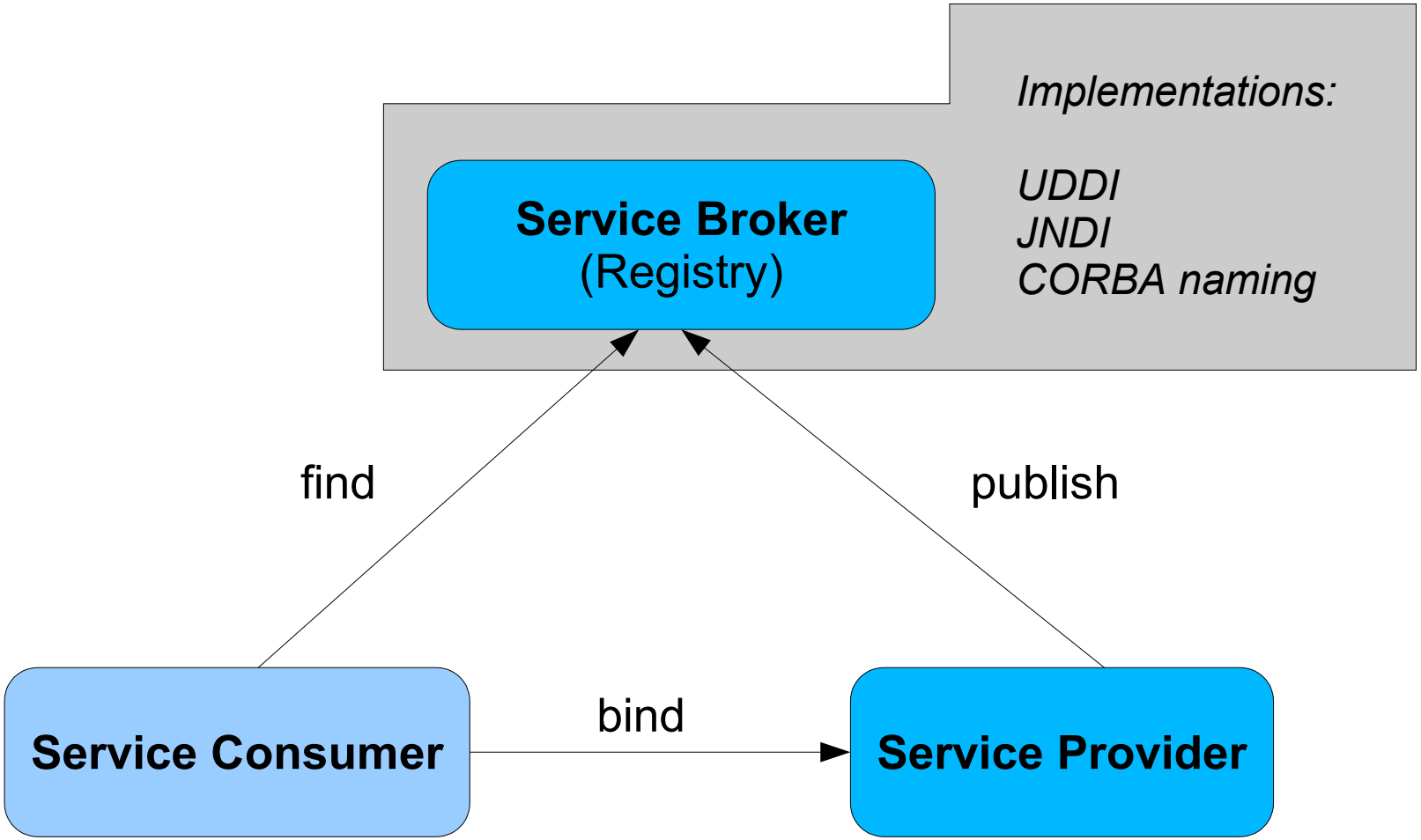
Services: Roles and Interaction



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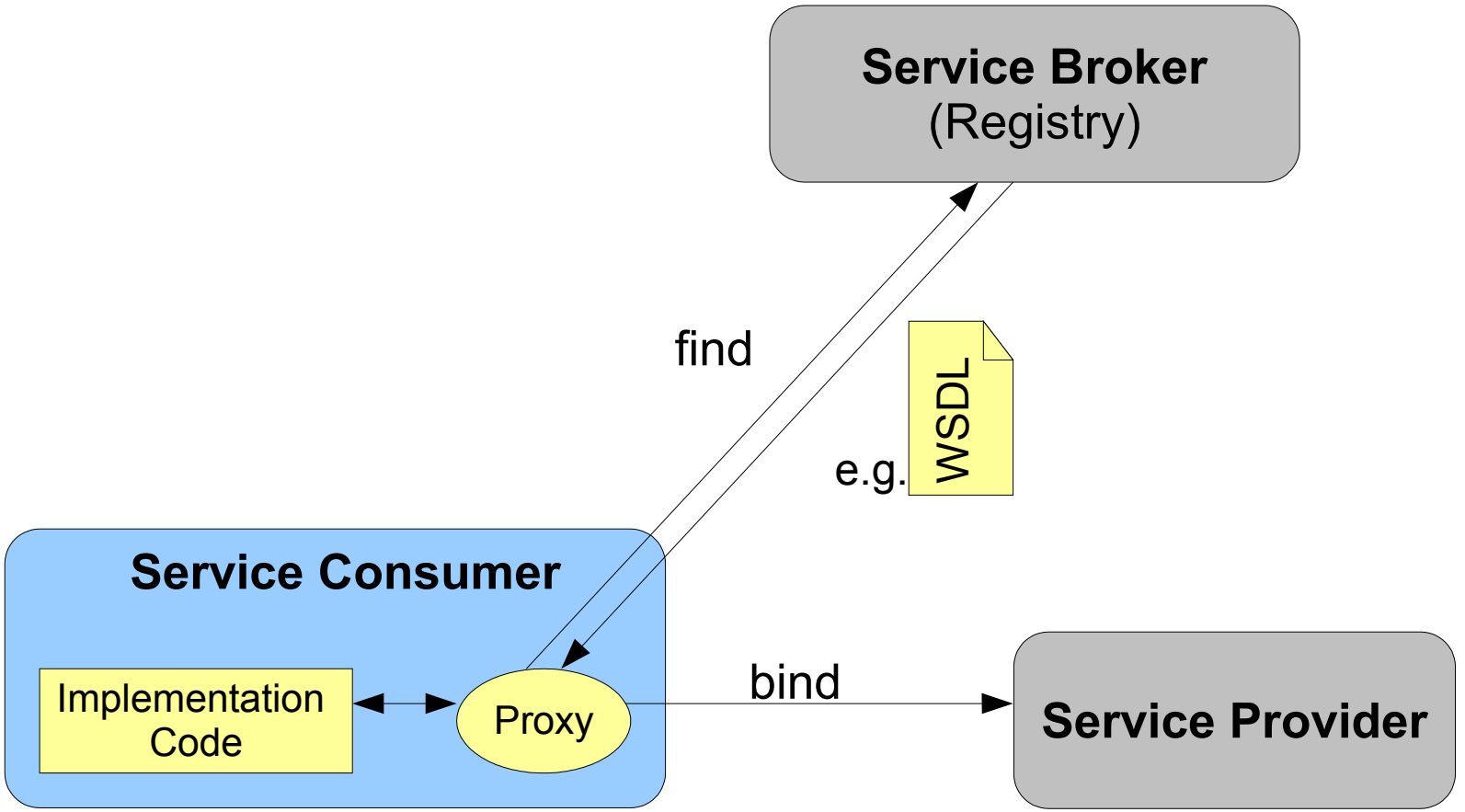
Services: (Dynamic) Proxy



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Objects

- **Reference**
  identifier to reference an object during its lifetime
- **State**
  state of the object represented by its attributes
- **Interface**
  “collection” of methods which are necessary to interact with the object

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Is a Service an Object in general?

A service ...

- *... can be referenced during its lifetime* ☑☒
- *... does not necessarily have a state* ☒
- *... does have an interface* ☑

⇨ A service is not an Object in general.

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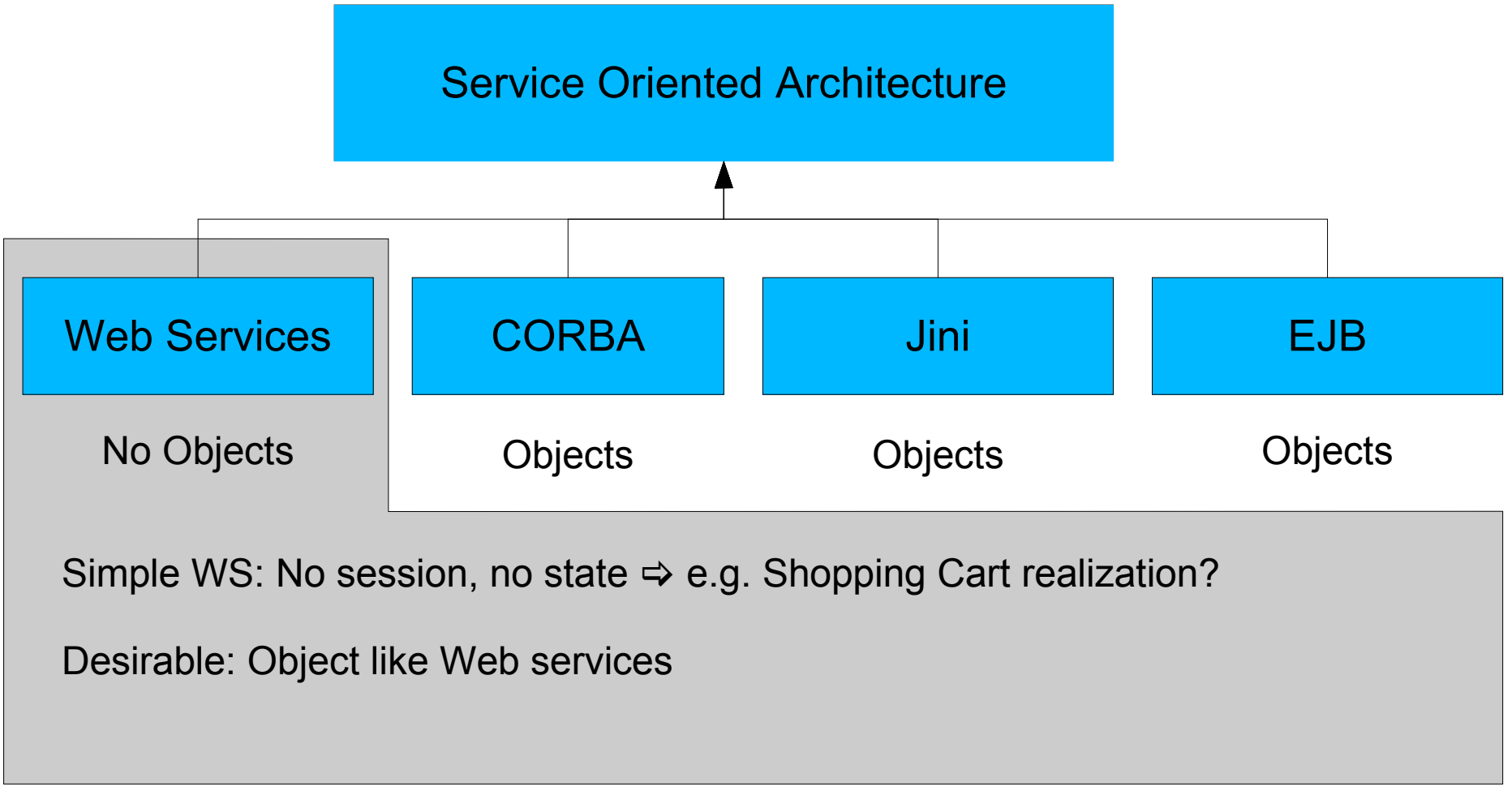
Service Oriented Architectures (SOA)

An architecture of software which is composed of services.



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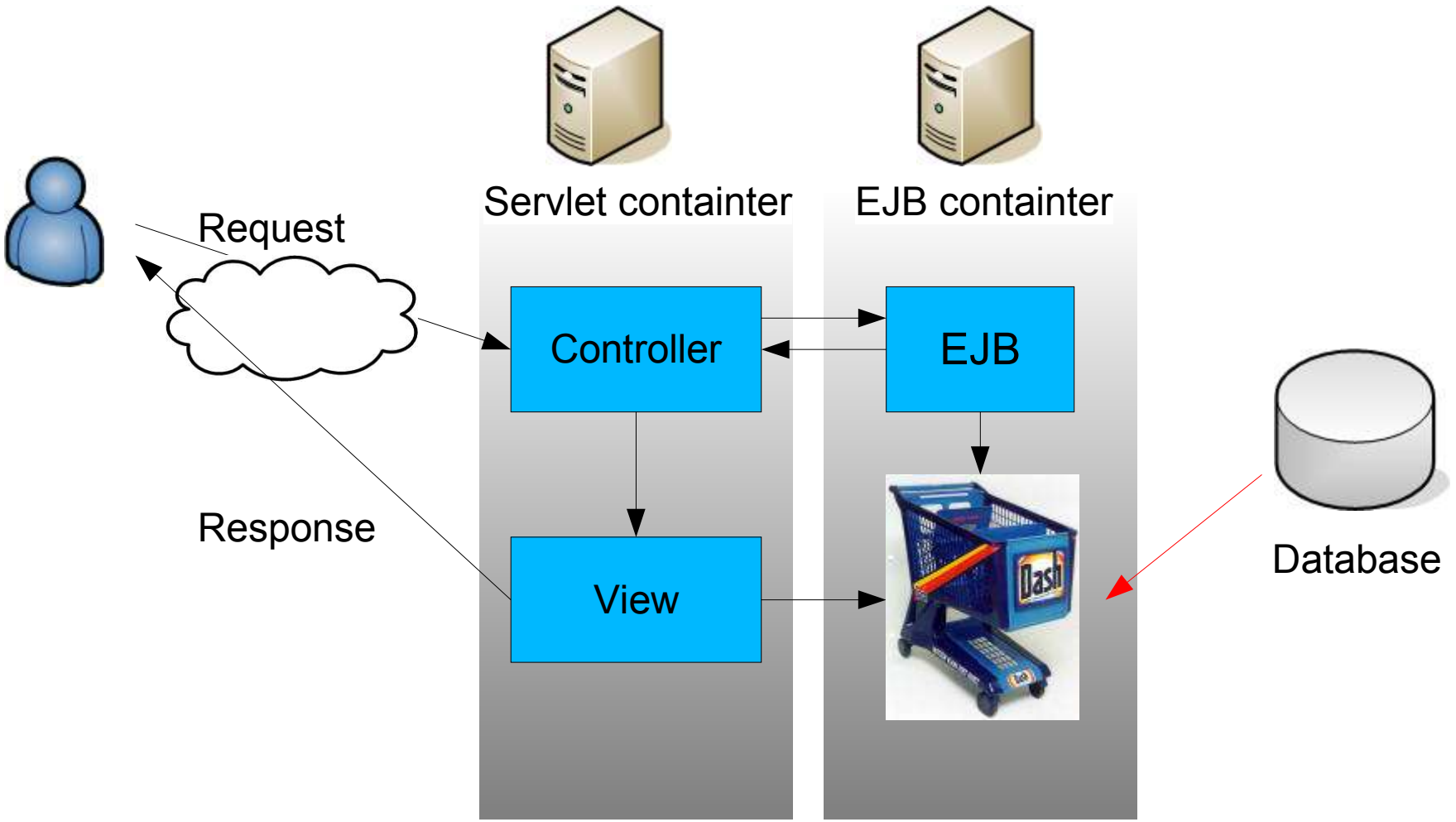
Example: Shopping Cart in J2EE



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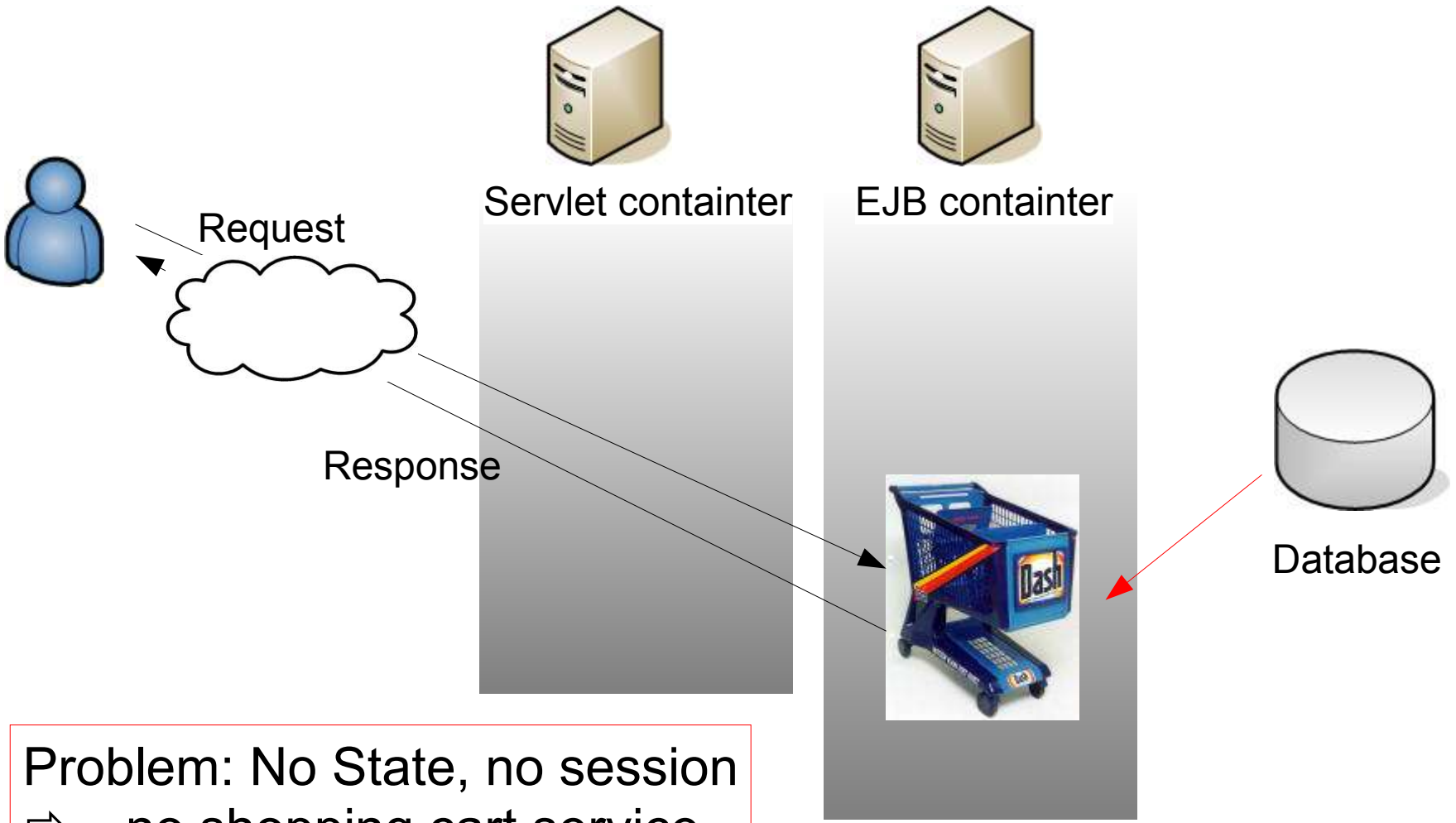
Problem: Shopping Cart in a Web Service world



Problem: No State, no session
⇨ no shopping cart service

Note: HTTP(S) session is not enough

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Services Architectures

Web service

- Is not an object in general
- Rather XML documents are exchanged
- Are the interface to a part of the Business Logic

Enterprise Java Beans

- Are Objects by definition
- Encapsulate the Business Logic of J2EE applications

CORBA – Common Object Resource Broker Architecture

- CORBA Objects are Objects by definition
- Encapsulate the Business Logic of Enterprise Applications

Further: Jini, ...

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From a simple Web Services to an (quasi) Object

The Web Services Resource Framework WS-RF

A Web Service Resource (WS-Resource)

- ... *can be destroyed (explicit destroy or expiration) and its lifetime may be monitored*
  WS-ResourceLifetime
- ... *contains a state through attributes/properties*
  WS-ResourceProperties
- ... *references can be renewed*
  WS-Addressing
  WS-RenewableReferences
- ... *employs a (more) standardized fault reporting mechanism*
  WS-BaseFault

Further: By-reference collections of Web Services can be defined.
WS-ServiceGroup

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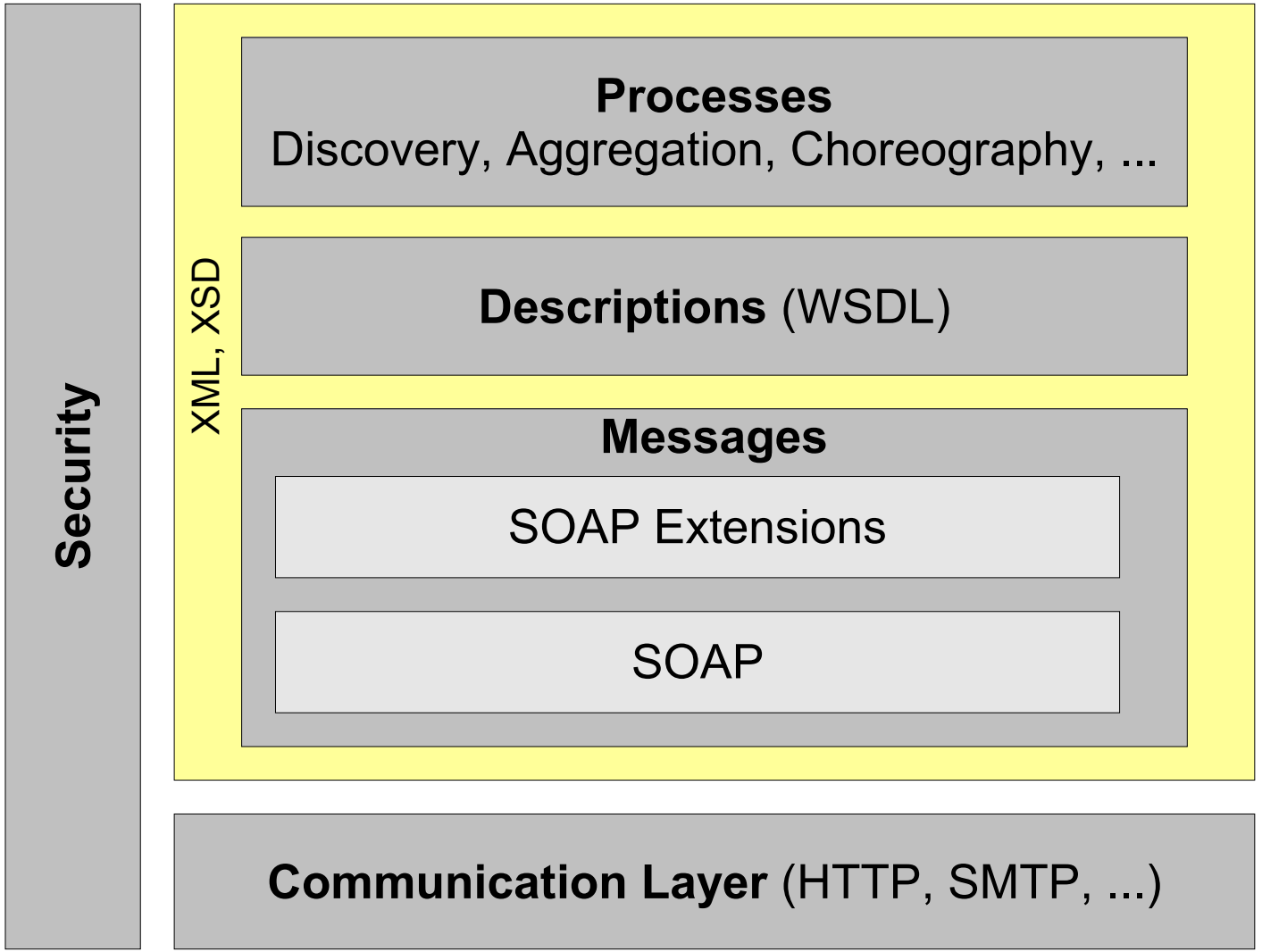
Web Services Architecture Stack



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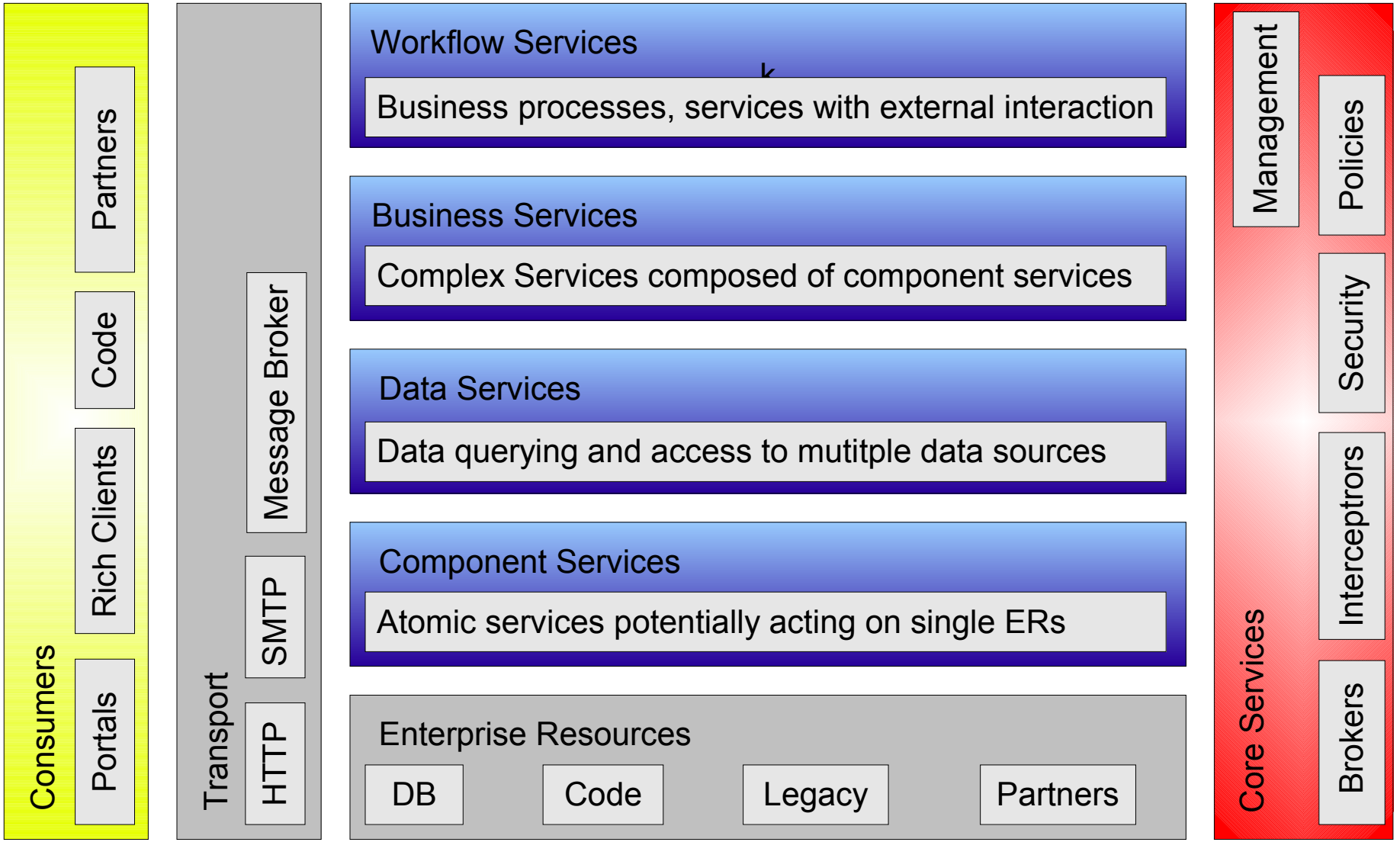
Software Architecture for the Access Infrastructure



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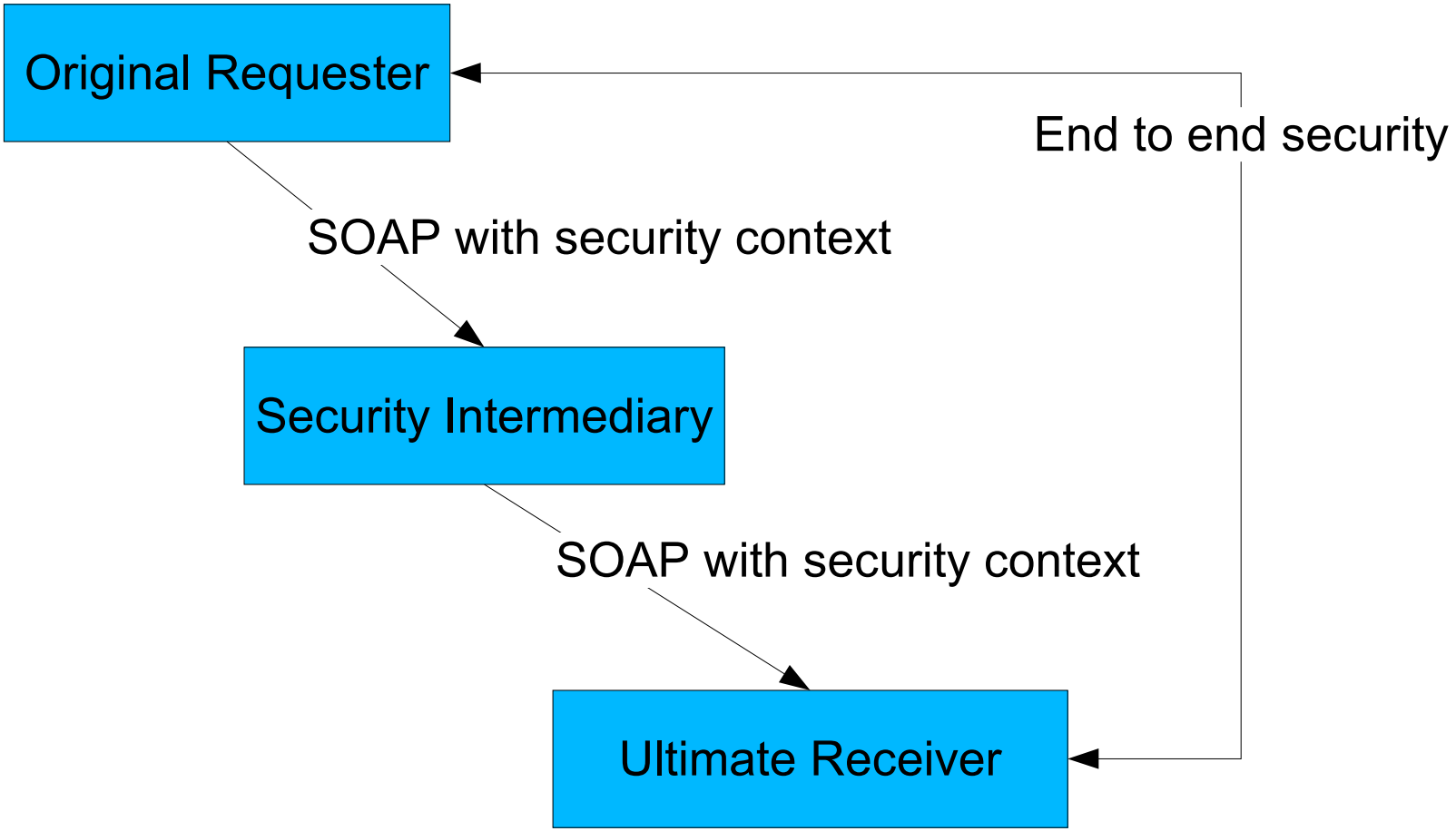
WS-Security



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WS-Security

Threats:

- Message Alteration – *modifiifying the message content*
- Confidentiality – *accessing message parts such as credit card info*
- Man-in-the-middle – *establishing complete access to messages*
- Spoofing – *exploting trusted relationships*
- Denial of Service – *preventing a legitimate user from accessing a service*
- Replay Attacks – *interception of messages and playing to back to the service*

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WS-Security

WS-Security has to insure/provide

- Authentication mechanisms (PKI)
- Authorization
- Data integrity and confidentiality
- Integrity of transactions and communications
- Non-repudiation (detection of transaction initiated/altered by a 3rd party)
- End-to-end integrity and confidentiality of messages
- Audit trails (trace user's behavior)

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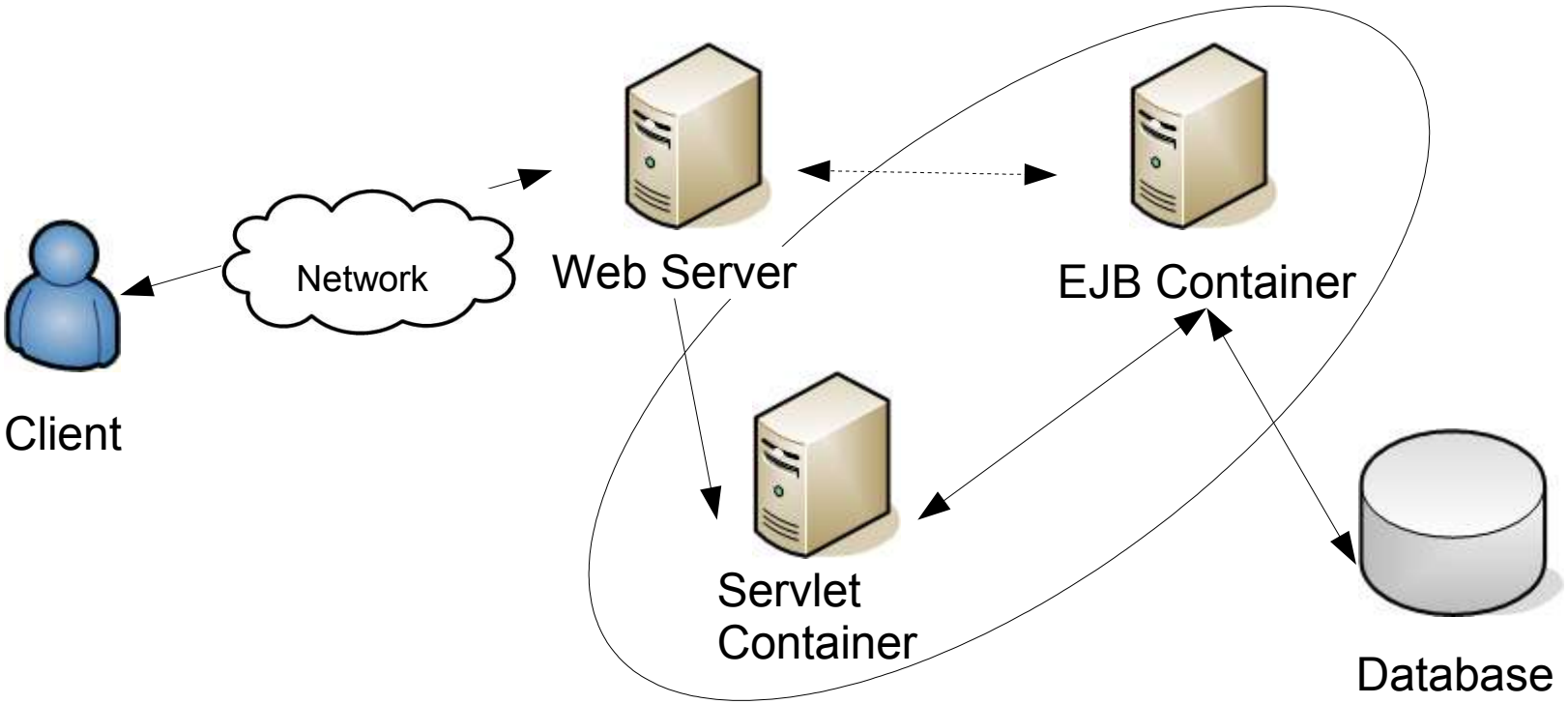
Implementation and deployment: J2EE



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Distributed Service Centers