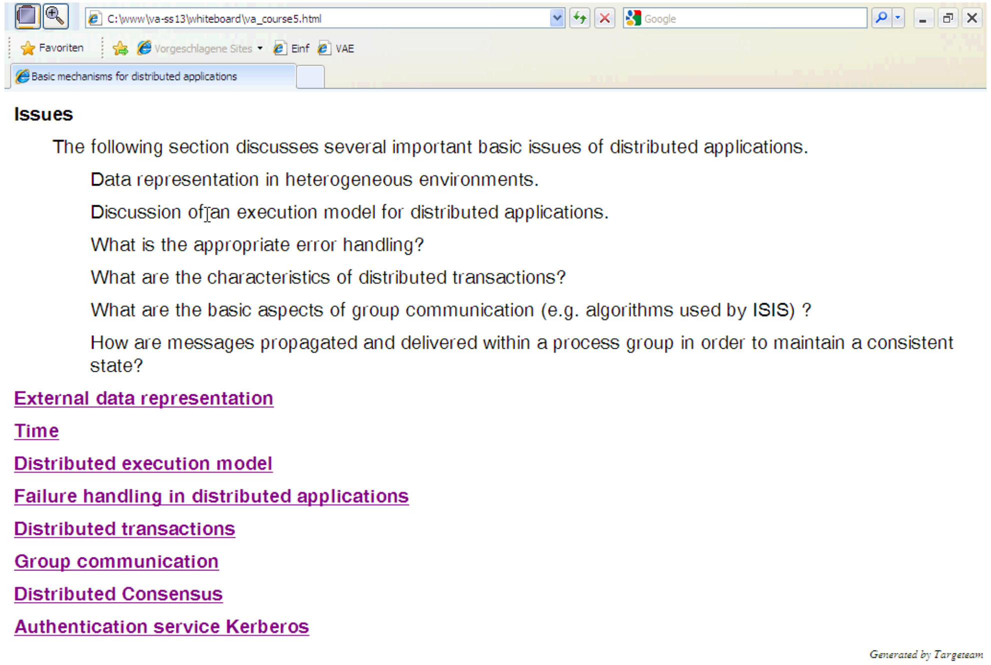
Script generated by TTT

Title: Distributed_Applications (18.06.2013)

Date: Tue Jun 18 14:30:46 CEST 2013

Duration: 88:30 min

Pages: 32


C:\www\va-ss13\whiteboard\va_course5.html
Google
Favoriten
Vorgeschlagene Sites
Einf
VAE
Basic mechanisms for distributed applications

Issues

The following section discusses several important basic issues of distributed applications.

Data representation in heterogeneous environments.

Discussion of an execution model for distributed applications.

What is the appropriate error handling?

What are the characteristics of distributed transactions?

What are the basic aspects of group communication (e.g. algorithms used by ISIS) ?

How are messages propagated and delivered within a process group in order to maintain a consistent state?

External data representation

Time

Distributed execution model

Failure handling in distributed applications

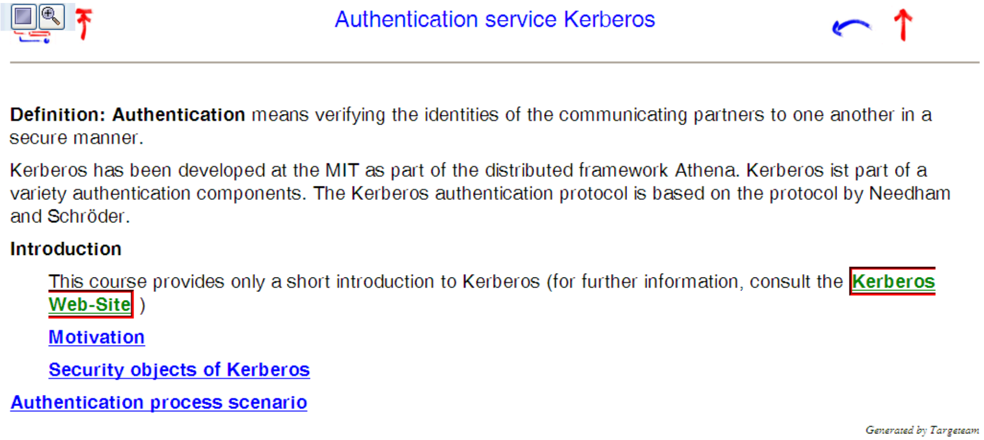
Distributed transactions

Group communication

Distributed Consensus

Authentication service Kerberos

Generated by Targeteam



Authentication service Kerberos

Definition: Authentication means verifying the identities of the communicating partners to one another in a secure manner.

Kerberos has been developed at the MIT as part of the distributed framework Athena. Kerberos ist part of a variety authentication components. The Kerberos authentication protocol is based on the protocol by Needham and Schröder.

Introduction

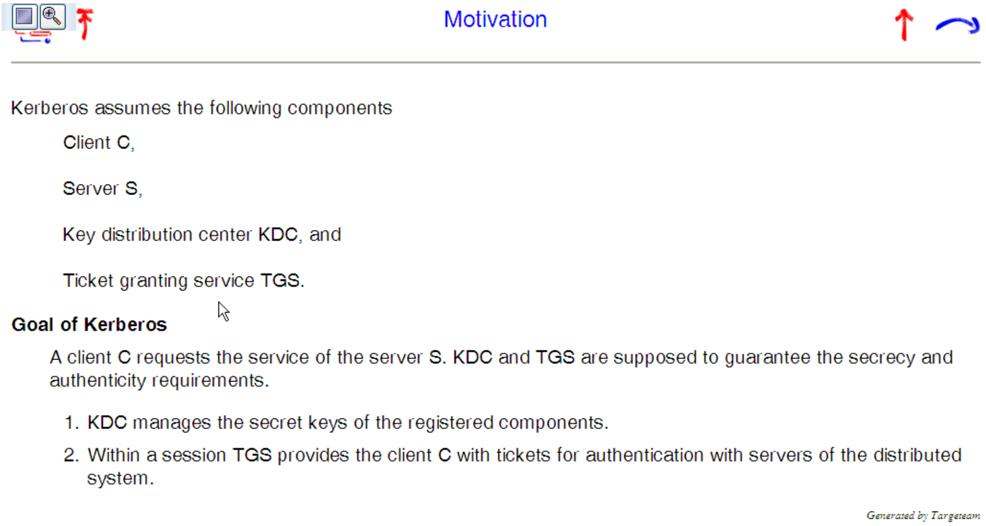
This course provides only a short introduction to Kerberos (for further information, consult the Kerberos Web-Site)

Motivation

Security objects of Kerberos

Authentication process scenario

Generated by Targeteam



Motivation

Kerberos assumes the following components

Client C,

Server S,

Key distribution center KDC, and

Ticket granting service TGS.

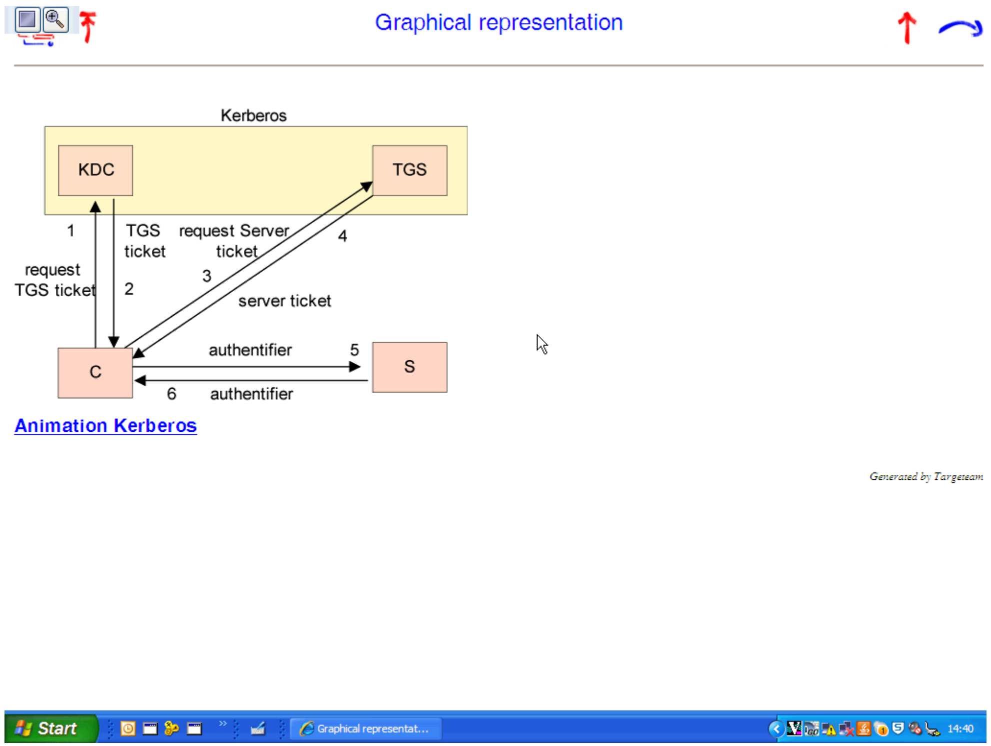
Goal of Kerberos

A client C requests the service of the server S. KDC and TGS are supposed to guarantee the secrecy and authenticity requirements.

1. KDC manages the secret keys of the registered components.
2. Within a session TGS provides the client C with tickets for authentication with servers of the distributed system.

Generated by Targeteam

Graphical representation



[Animation Kerberos]

Generated by Targeteam

Authentication process scenario

[Graphical representation]

[Description of exchanged messages]

Problems with Kerberos

Manipulation of local computer clocks to circumvent the validity time of tickets

i.e. synchronization of clocks in distributed systems must be authorized and authenticated.

[Example: user login with Kerberos]

Generated by Targeteam

Message 3: C to TGS

C → TGS with information	(C, T_C) $_{K[C,tgs]}$
	ticket(C, TGS) $_{K[tgs]}$
	S

TGS determines a random session key $K_{C,S}$, if

TGS ticket is still valid,

T_C is current, and

field C matches (of the first parameter and of the ticket).

Generated by Targeteam

Distributed Applications - Verteilte Anwendungen

- Prof. J. Schlichter
  - Lehrstuhl für Angewandte Informatik / Kooperative Systeme, Fakultät für Informatik, TU München
  - Boltzmannstr. 3, 85748 Garching

    Email: schlichter@in.tum.de

    Tel.: 089-289 18654

    URL: http://www11.in.tum.de/

[Overview]

[Introduction]

[Architecture of distributed systems]

[Remote Invocation (RPC/RMI)]

[Basic mechanisms for distributed applications]

[Web Services]

[Design of distributed applications]

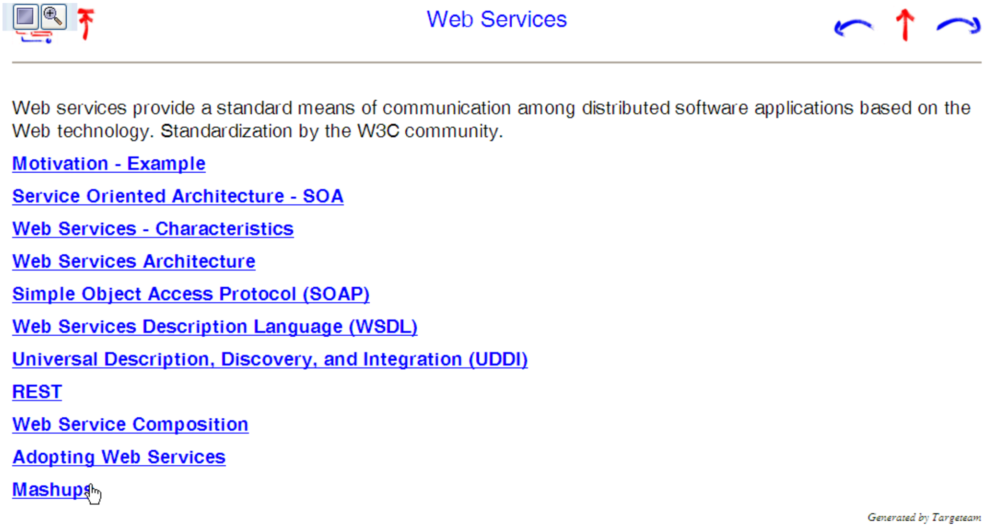
[Distributed file service]

[Distributed Shared Memory]

[Object-based Distributed Systems]

[Summary]

Generated by Targeteam



Web Services

Web services provide a standard means of communication among distributed software applications based on the Web technology. Standardization by the W3C community.

Motivation - Example

Service Oriented Architecture - SOA

Web Services - Characteristics

Web Services Architecture

Simple Object Access Protocol (SOAP)

Web Services Description Language (WSDL)

Universal Description, Discovery, and Integration (UDDI)

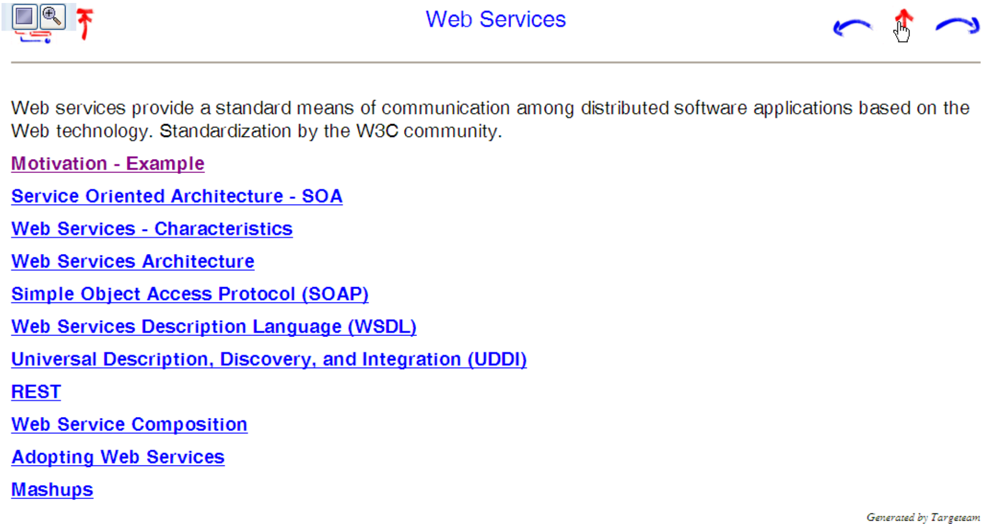
REST

Web Service Composition

Adopting Web Services

Mashups

Generated by Targeteam



Web Services

Web services provide a standard means of communication among distributed software applications based on the Web technology. Standardization by the W3C community.

Motivation - Example

Service Oriented Architecture - SOA

Web Services - Characteristics

Web Services Architecture

Simple Object Access Protocol (SOAP)

Web Services Description Language (WSDL)

Universal Description, Discovery, and Integration (UDDI)

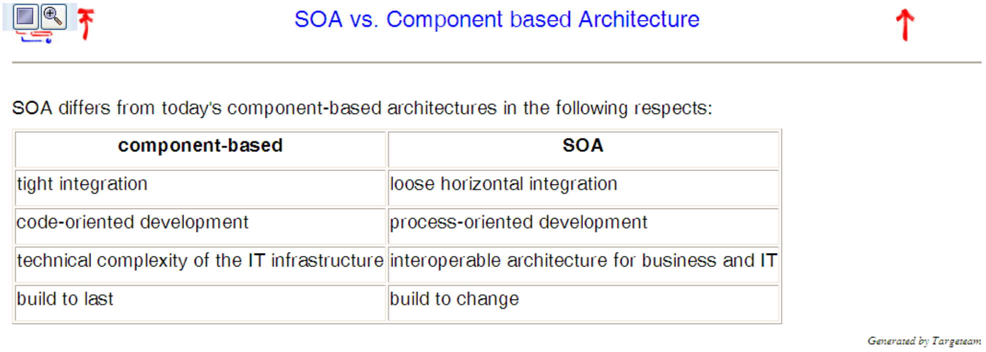
REST

Web Service Composition

Adopting Web Services

Mashups

Generated by Targeteam

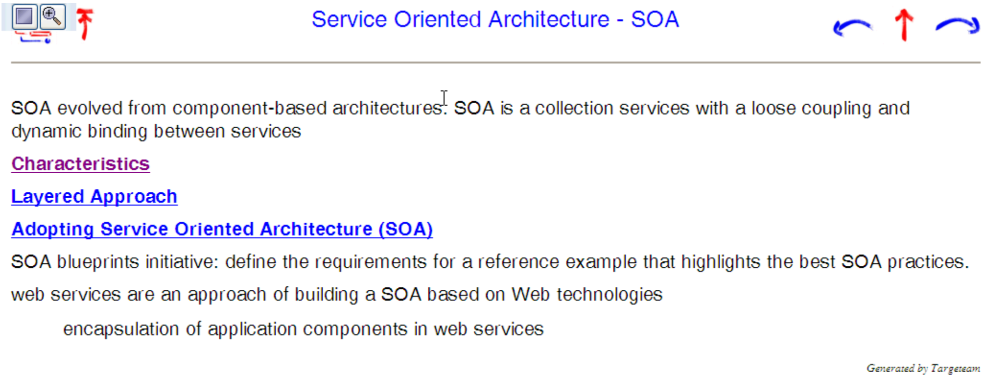


SOA vs. Component based Architecture

SOA differs from today's component-based architectures in the following respects:

component-based	SOA
tight integration	loose horizontal integration
code-oriented development	process-oriented development
technical complexity of the IT infrastructure	interoperable architecture for business and IT
build to last	build to change

Generated by Targeteam



Service Oriented Architecture - SOA

SOA evolved from component-based architectures. SOA is a collection services with a loose coupling and dynamic binding between services

Characteristics

Layered Approach

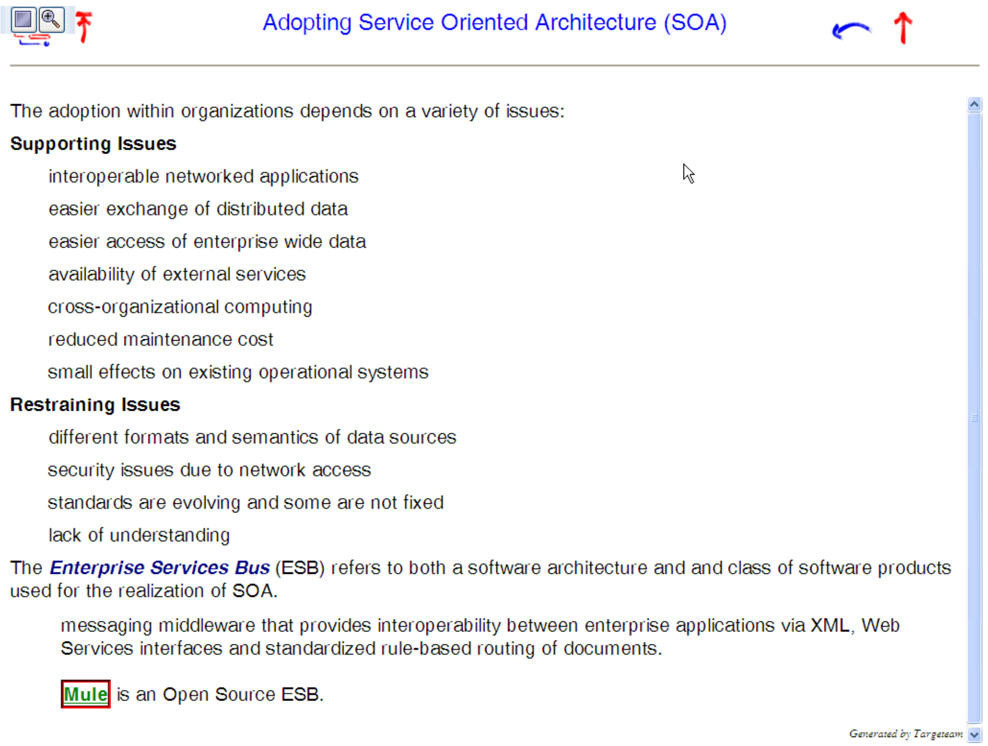
Adopting Service Oriented Architecture (SOA)

SOA blueprints initiative: define the requirements for a reference example that highlights the best SOA practices.

web services are an approach of building a SOA based on Web technologies

encapsulation of application components in web services

Generated by Targeteam



Adopting Service Oriented Architecture (SOA)

The adoption within organizations depends on a variety of issues:

Supporting Issues

- interoperable networked applications
- easier exchange of distributed data
- easier access of enterprise wide data
- availability of external services
- cross-organizational computing
- reduced maintenance cost
- small effects on existing operational systems

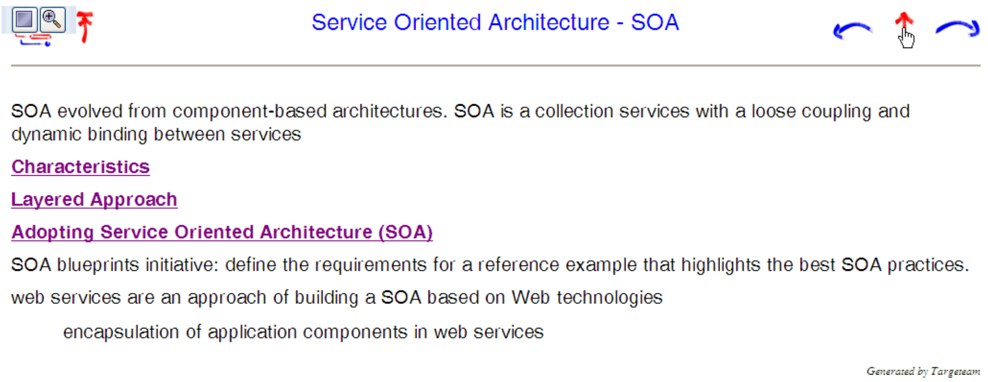
Restraining Issues

- different formats and semantics of data sources
- security issues due to network access
- standards are evolving and some are not fixed
- lack of understanding

The ***Enterprise Services Bus*** (ESB) refers to both a software architecture and and class of software products used for the realization of SOA.

- messaging middleware that provides interoperability between enterprise applications via XML, Web Services interfaces and standardized rule-based routing of documents.
- Mule is an Open Source ESB.

Generated by Targeteam



Service Oriented Architecture - SOA

SOA evolved from component-based architectures. SOA is a collection services with a loose coupling and dynamic binding between services

Characteristics

Layered Approach

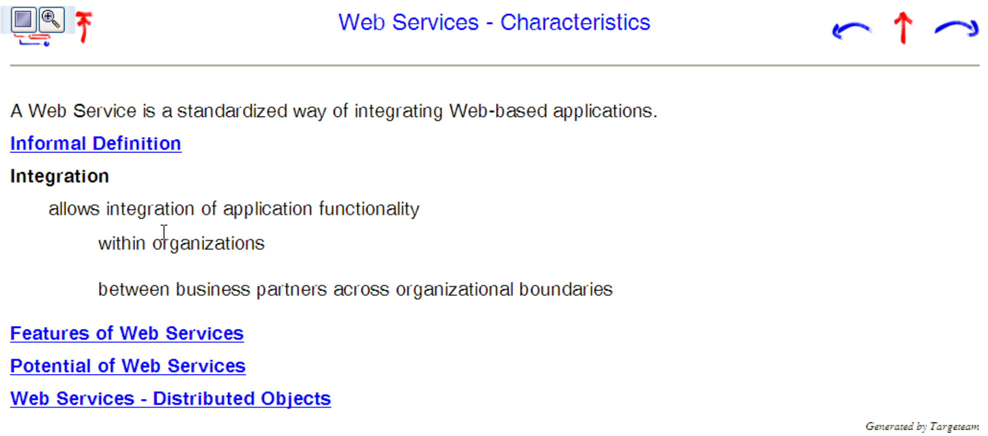
Adopting Service Oriented Architecture (SOA)

SOA blueprints initiative: define the requirements for a reference example that highlights the best SOA practices.

web services are an approach of building a SOA based on Web technologies

- encapsulation of application components in web services

Generated by Targeteam



Web Services - Characteristics

A Web Service is a standardized way of integrating Web-based applications.

Informal Definition

Integration

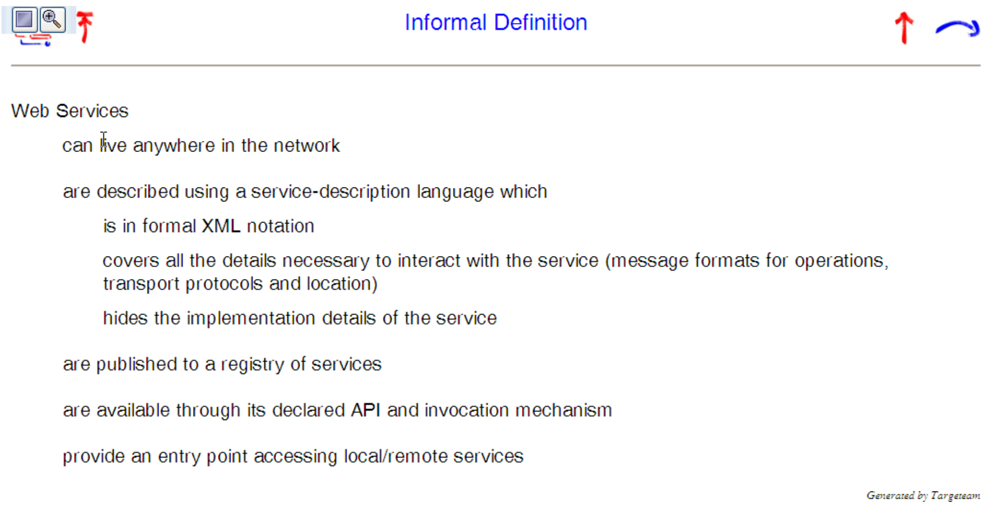
- allows integration of application functionality
  - within organizations
  - between business partners across organizational boundaries

Features of Web Services

Potential of Web Services

Web Services - Distributed Objects

Generated by Targeteam

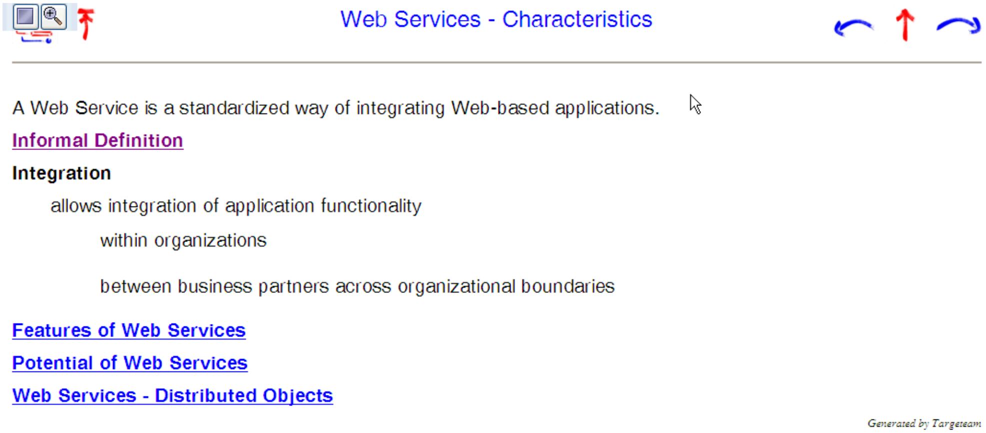


Informal Definition

Web Services

- can live anywhere in the network
- are described using a service-description language which
  - is in formal XML notation
  - covers all the details necessary to interact with the service (message formats for operations, transport protocols and location)
  - hides the implementation details of the service
- are published to a registry of services
- are available through its declared API and invocation mechanism
- provide an entry point accessing local/remote services

Generated by Targeteam



Web Services - Characteristics

A Web Service is a standardized way of integrating Web-based applications.

Informal Definition

Integration

allows integration of application functionality

within organizations

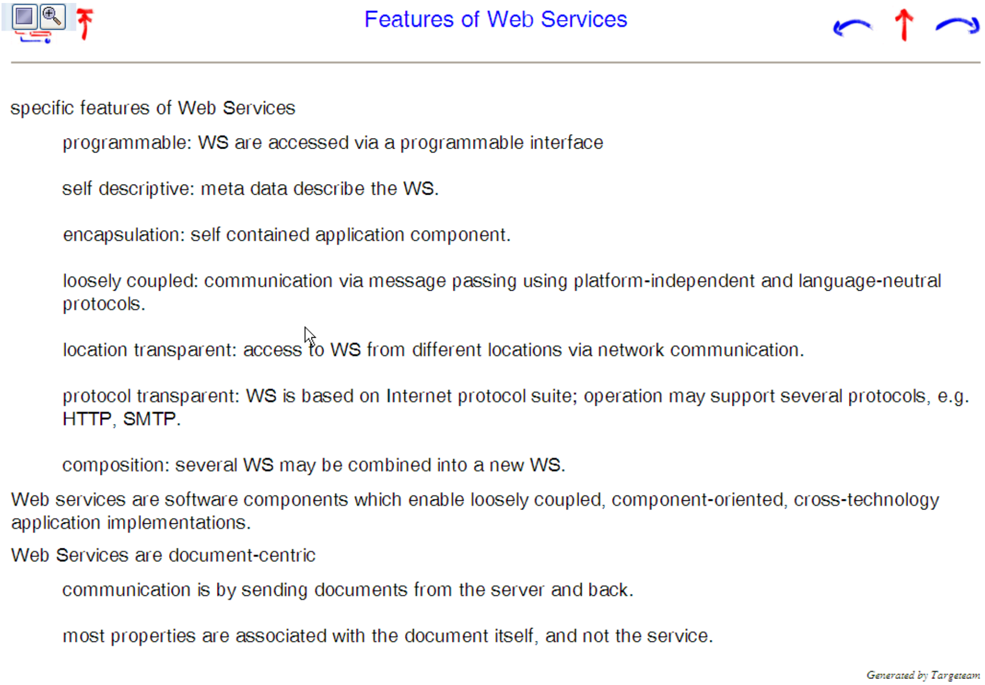
between business partners across organizational boundaries

Features of Web Services

Potential of Web Services

Web Services - Distributed Objects

Generated by Targeteam



Features of Web Services

specific features of Web Services

programmable: WS are accessed via a programmable interface

self descriptive: meta data describe the WS.

encapsulation: self contained application component.

loosely coupled: communication via message passing using platform-independent and language-neutral protocols.

location transparent: access to WS from different locations via network communication.

protocol transparent: WS is based on Internet protocol suite; operation may support several protocols, e.g. HTTP, SMTP.

composition: several WS may be combined into a new WS.

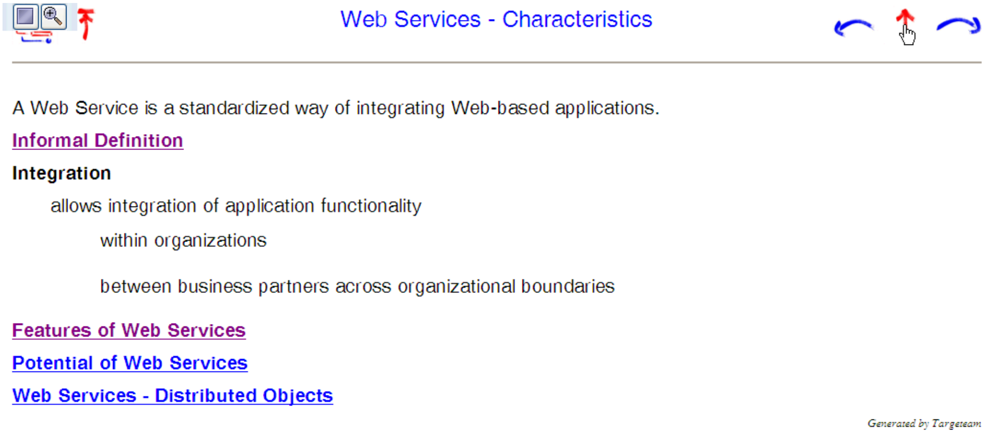
Web services are software components which enable loosely coupled, component-oriented, cross-technology application implementations.

Web Services are document-centric

communication is by sending documents from the server and back.

most properties are associated with the document itself, and not the service.

Generated by Targeteam



Web Services - Characteristics

A Web Service is a standardized way of integrating Web-based applications.

Informal Definition

Integration

allows integration of application functionality

within organizations

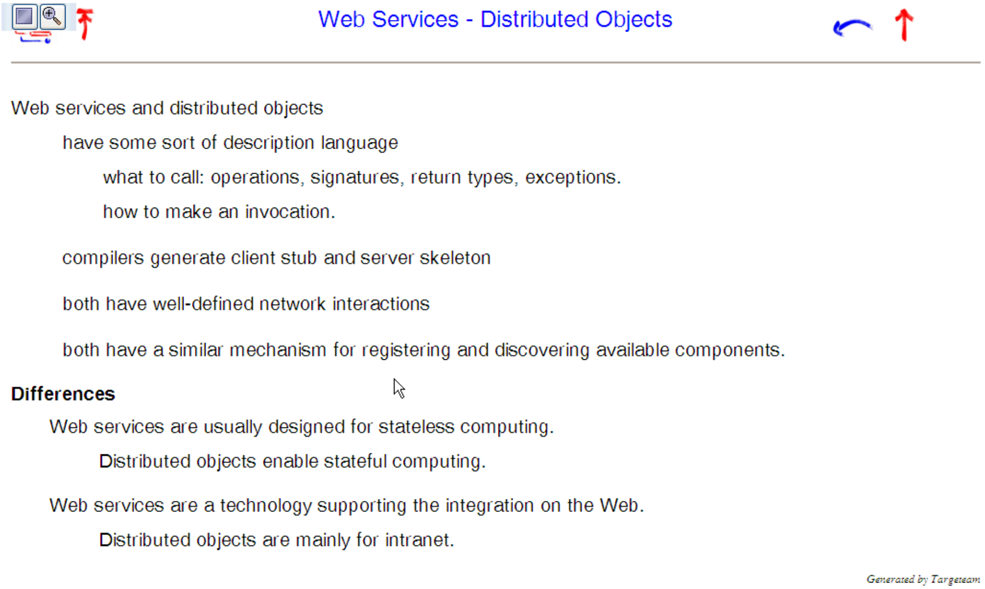
between business partners across organizational boundaries

Features of Web Services

Potential of Web Services

Web Services - Distributed Objects

Generated by Targeteam



Web Services - Distributed Objects

Web services and distributed objects

have some sort of description language

what to call: operations, signatures, return types, exceptions.

how to make an invocation.

compilers generate client stub and server skeleton

both have well-defined network interactions

both have a similar mechanism for registering and discovering available components.

Differences

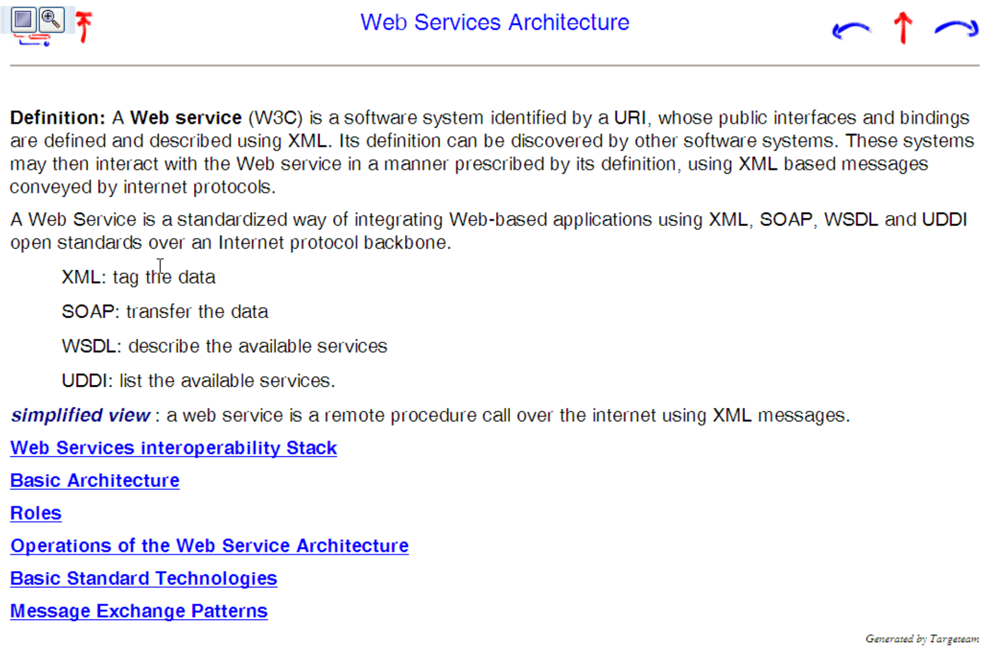
Web services are usually designed for stateless computing.

Distributed objects enable stateful computing.

Web services are a technology supporting the integration on the Web.

Distributed objects are mainly for intranet.

Generated by Targeteam



Web Services Architecture

Definition: A **Web service** (W3C) is a software system identified by a URI, whose public interfaces and bindings are defined and described using XML. Its definition can be discovered by other software systems. These systems may then interact with the Web service in a manner prescribed by its definition, using XML based messages conveyed by internet protocols.

A Web Service is a standardized way of integrating Web-based applications using XML, SOAP, WSDL and UDDI open standards over an Internet protocol backbone.

XML: tag the data

SOAP: transfer the data

WSDL: describe the available services

UDDI: list the available services.

simplified view : a web service is a remote procedure call over the internet using XML messages.

Web Services interoperability Stack

Basic Architecture

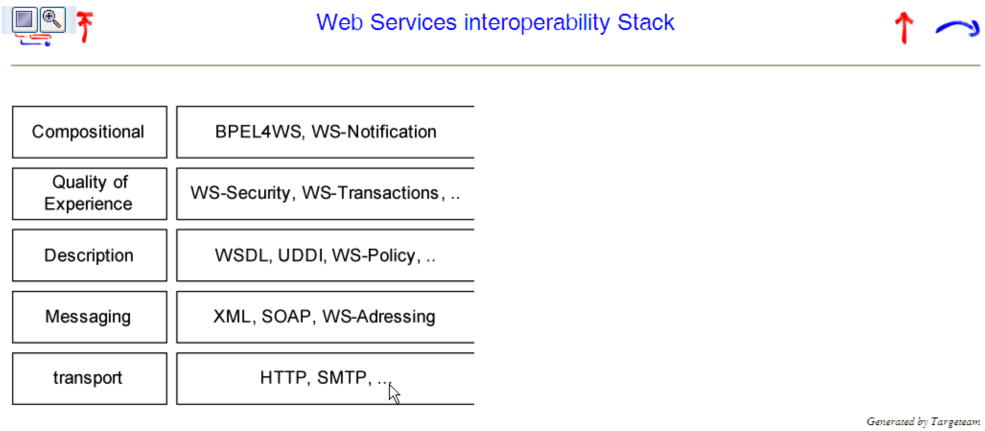
Roles

Operations of the Web Service Architecture

Basic Standard Technologies

Message Exchange Patterns

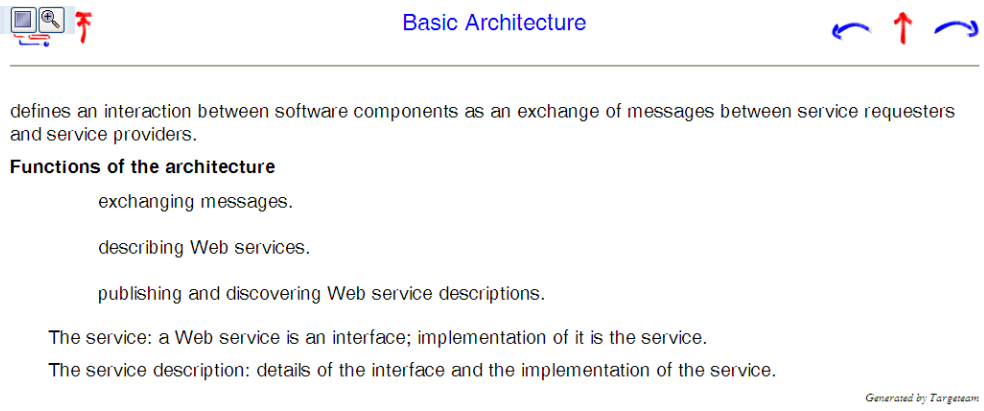
Generated by Targeteam



Web Services interoperability Stack

Compositional	BPEL4WS, WS-Notification
Quality of Experience	WS-Security, WS-Transactions, ..
Description	WSDL, UDDI, WS-Policy, ..
Messaging	XML, SOAP, WS-Adressing
transport	HTTP, SMTP, ..

Generated by Targeteam



Basic Architecture

defines an interaction between software components as an exchange of messages between service requesters and service providers.

Functions of the architecture

exchanging messages.

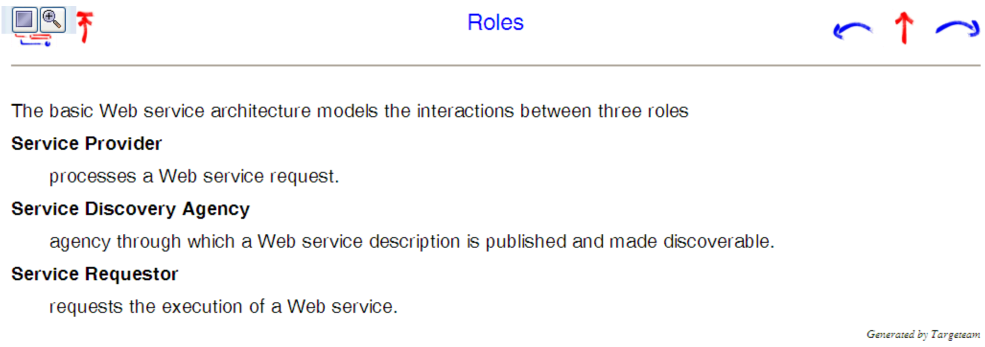
describing Web services.

publishing and discovering Web service descriptions.

The service: a Web service is an interface; implementation of it is the service.

The service description: details of the interface and the implementation of the service.

Generated by Targeteam



Roles

The basic Web service architecture models the interactions between three roles

Service Provider

processes a Web service request.

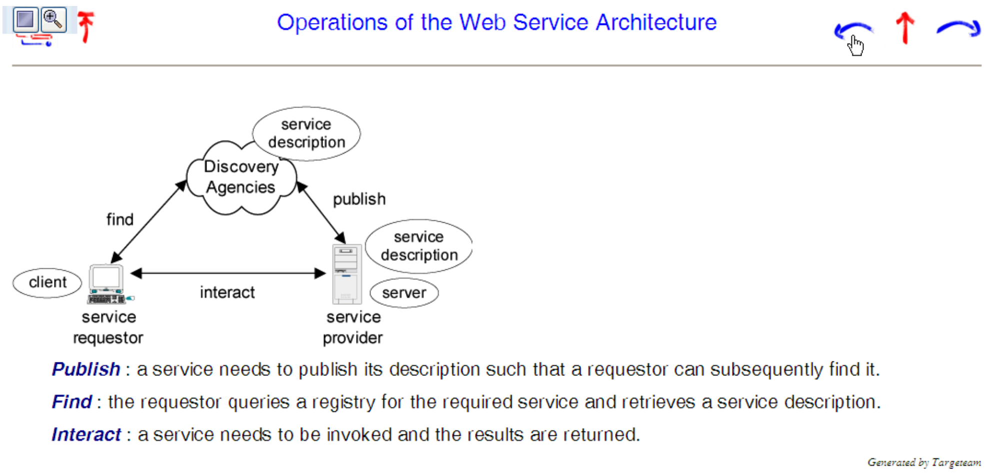
Service Discovery Agency

agency through which a Web service description is published and made discoverable.

Service Requestor

requests the execution of a Web service.

Generated by Targeteam



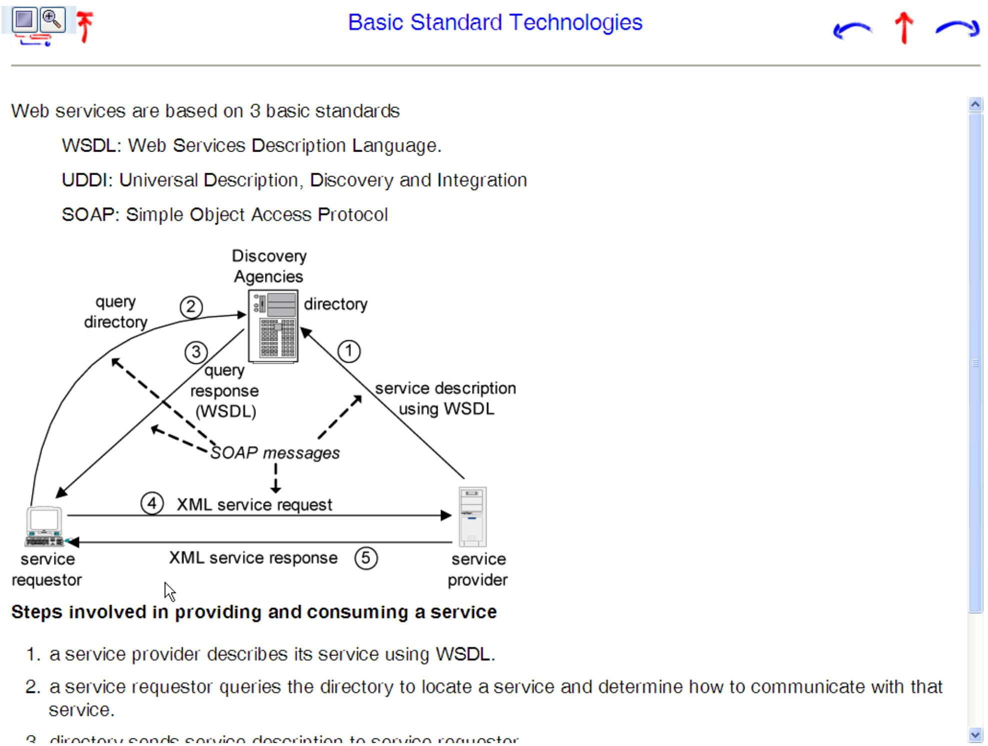
Operations of the Web Service Architecture

Publish : a service needs to publish its description such that a requestor can subsequently find it.

Find : the requestor queries a registry for the required service and retrieves a service description.

Interact : a service needs to be invoked and the results are returned.

Generated by Targeteam



Basic Standard Technologies

Web services are based on 3 basic standards

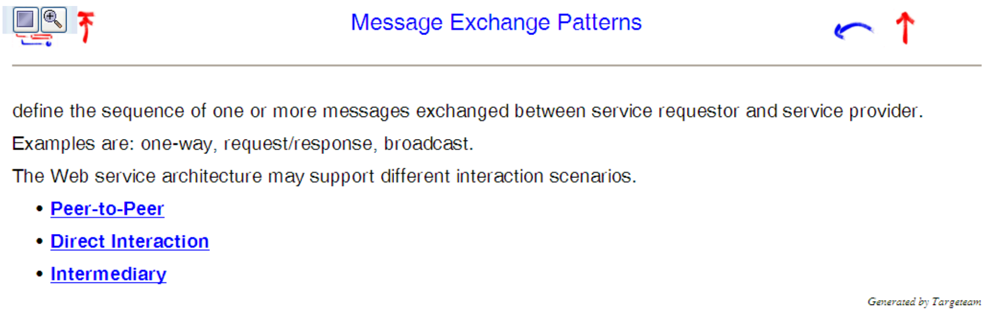
WSDL: Web Services Description Language.

UDDI: Universal Description, Discovery and Integration

SOAP: Simple Object Access Protocol

Steps involved in providing and consuming a service

1. a service provider describes its service using WSDL.
2. a service requestor queries the directory to locate a service and determine how to communicate with that service.
3. directory sends service description to service requestor



Message Exchange Patterns

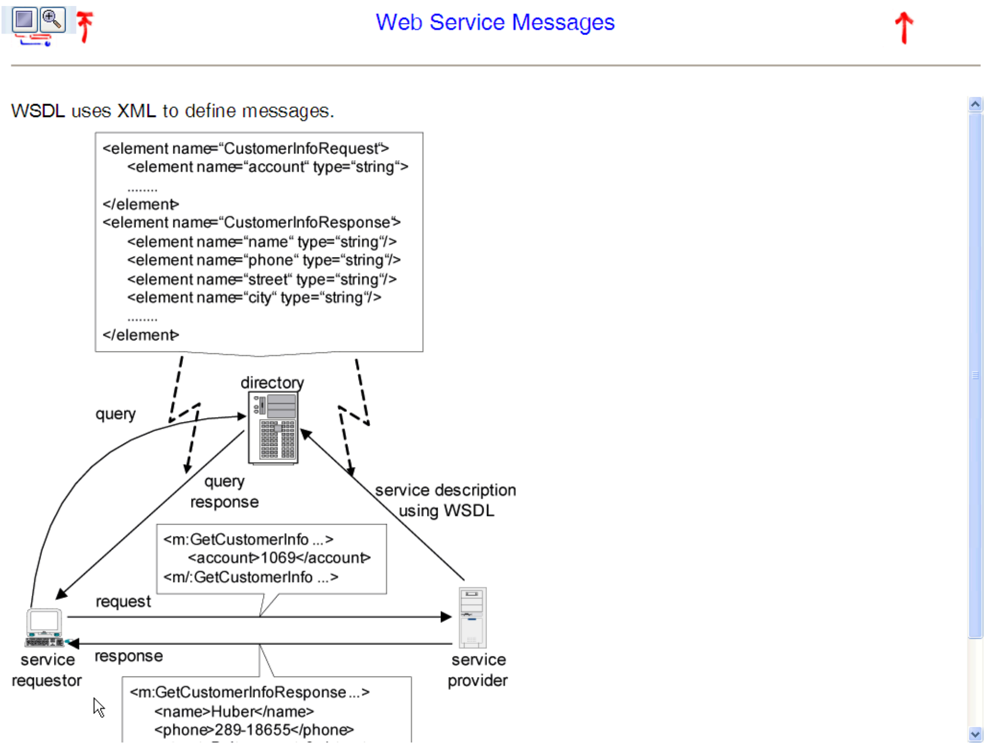
define the sequence of one or more messages exchanged between service requestor and service provider.

Examples are: one-way, request/response, broadcast.

The Web service architecture may support different interaction scenarios.

- **Peer-to-Peer**
- **Direct Interaction**
- **Intermediary**

Generated by Targeteam



Web Service Messages

WSDL uses XML to define messages.

```
<element name="CustomerInfoRequest">
    <element name="account" type="string">
    ........
</element>
<element name="CustomerInfoResponse">
    <element name="name" type="string"/>
    <element name="phone" type="string"/>
    <element name="street" type="string"/>
    <element name="city" type="string"/>
    ........
</element>
```

```
<m:GetCustomerInfo ...>
    <account>1069</account>
<m/:GetCustomerInfo ...>
```

```
<m:GetCustomerInfoResponse ...>
    <name>Huber</name>
    <phone>289-18655</phone>
```

Message Exchange Patterns

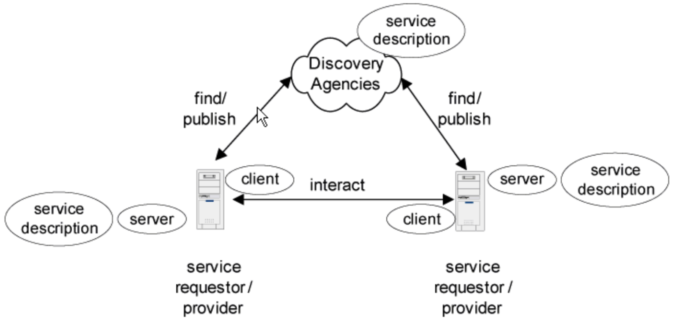
define the sequence of one or more messages exchanged between service requestor and service provider.

Examples are: one-way, request/response, broadcast.

The Web service architecture may support different interaction scenarios.

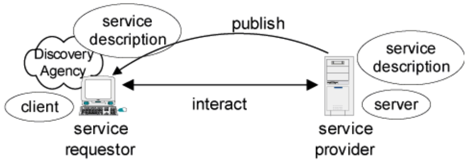
- **Peer-to-Peer**
- **Direct Interaction**
- **Intermediary**

Peer-to-Peer



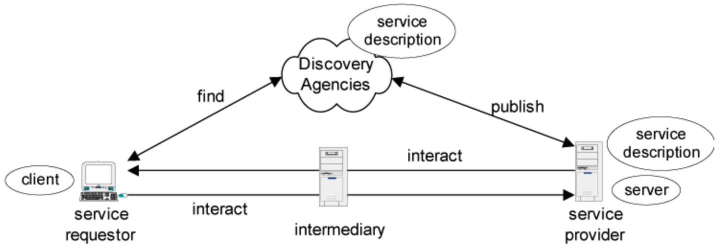
In the peer-to-peer scenario, each Web service instance serves in both the service requestor and service provider roles.

Direct Interaction

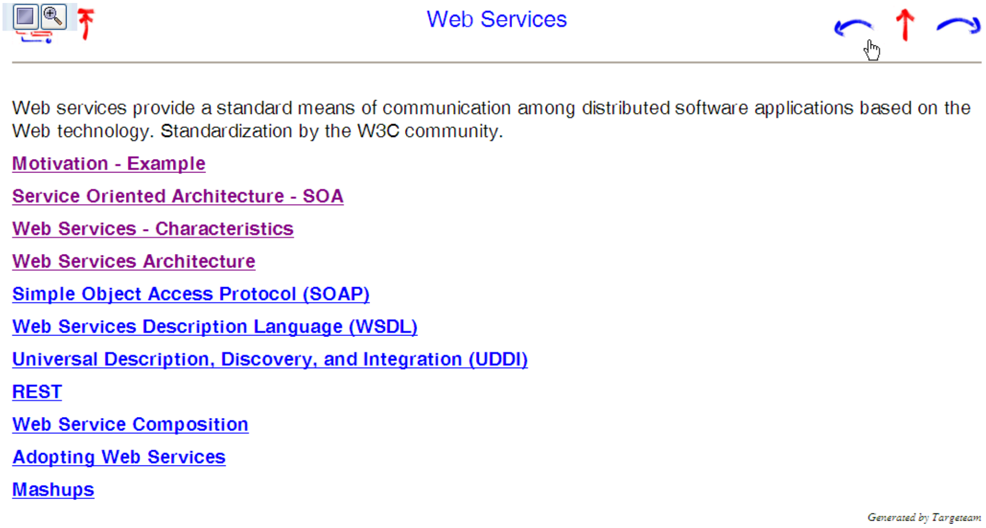


The role service requestor and discovery agency are fulfilled by the client.

Intermediary



Intermediaries may perform additional functions (besides the operations defined by the message exchange patterns) with a message such as routing, security, management.



Web Services

Web services provide a standard means of communication among distributed software applications based on the Web technology. Standardization by the W3C community.

Generated by Targeteam