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

Today, we normally use Web browsers to interact with Web sites. Browser names document via URL request and reply messages encoded in HTML using HTTP as communication protocol. Use of Web Services in a distributed travel arrangement application.
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SOA differs from today's component-based architectures in the following respects:

<table>
<thead>
<tr>
<th>component-based</th>
<th>SOA</th>
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<tbody>
<tr>
<td>tight integration</td>
<td>loose horizontal integration</td>
</tr>
<tr>
<td>code-oriented development</td>
<td>process-oriented development</td>
</tr>
<tr>
<td>technical complexity of the IT infrastructure interoperable architecture for business and IT</td>
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</tr>
<tr>
<td>build to last</td>
<td>build to change</td>
</tr>
</tbody>
</table>

Focus is on business processes of enterprises:

**Mapping of business processes to services**

<table>
<thead>
<tr>
<th>Application layer</th>
<th>Process layer</th>
<th>Service layer</th>
<th>Component layer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application</td>
<td>Process</td>
<td>service</td>
<td>object layer</td>
</tr>
<tr>
<td></td>
<td></td>
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</table>
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 a class of software products used for the realization of SOA, a messaging middleware that provides interoperability between enterprise applications via XML, Web Services interfaces and standardized rule-based routing of documents.

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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
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**

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.