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Introduction to web service usage in software engineering and enterprises

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Contents

- I Software engineering and software components
- II Web service fundamentals by W3C
- III XML, Web Services and the Changing Face of Distributed Computing by Frank P. Coyle
- IV Ebusiness, web services and IT vendors
- V Technical implementation of web services
- VI Conclusions

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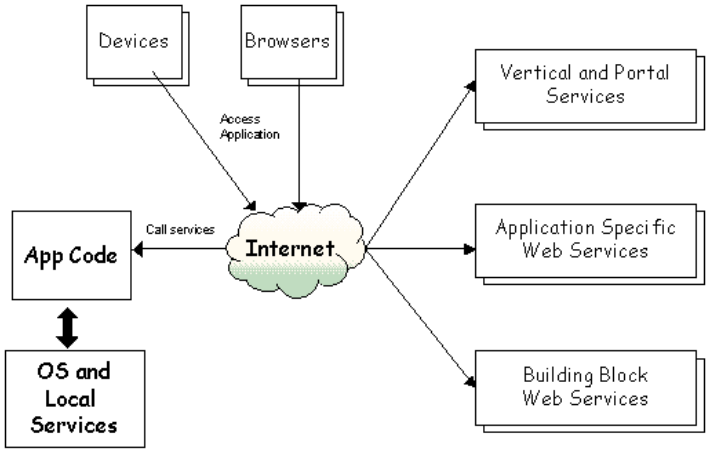
I Software engineering and software components

- changes in web
- new hardware
- new software (browsers) and
- new connectivity options
- transform software architectures from client/server to Peer-to-peer models



Internet when using web service architecture, reference X, A Platform for Web Services by Mary Kirtland, Microsoft Developer Network, January 2001 http://msdn.microsoft.com/library/default.asp?url=/library/en-us/dnwebsrv/html/websvcs_platform.asp

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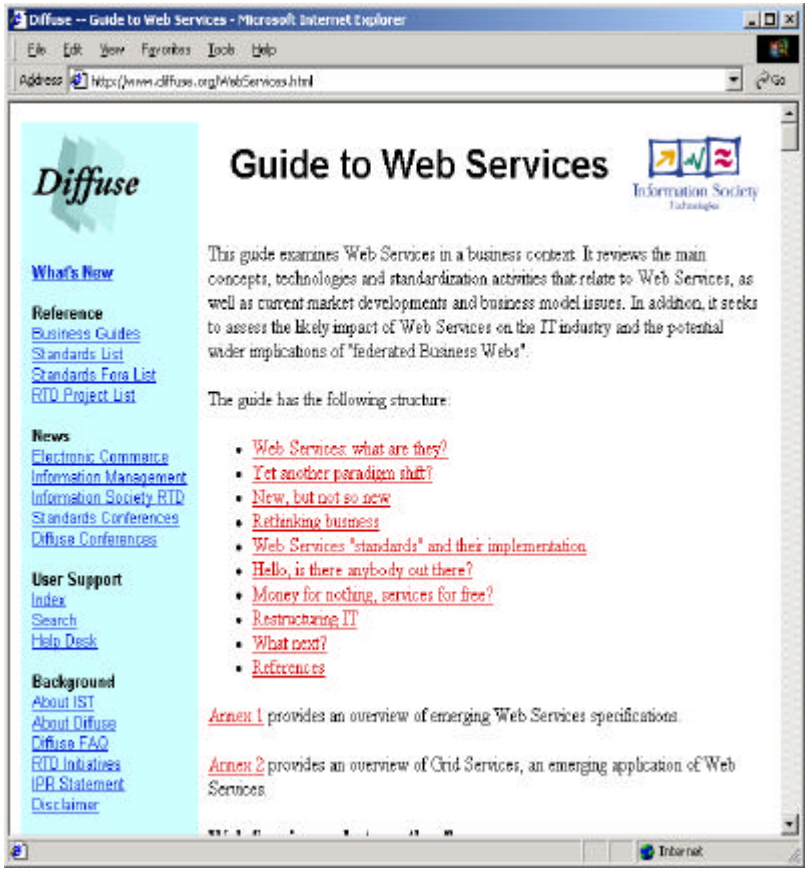
EU IST Diffuse project

- text from the EU IST project Diffuse, Dec 2002, report at
- http://www.diffuse.org/WebServices.html (available only via http://www.archive.org/)



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II Web service fundamentals

- WS Activity at W3C, http://www.w3.org/2002/ws/
- (Semantic Web at W3C, http://www.w3.org/2001/sw/)
- WS based software
- WS software component usage
- status of WS standardization

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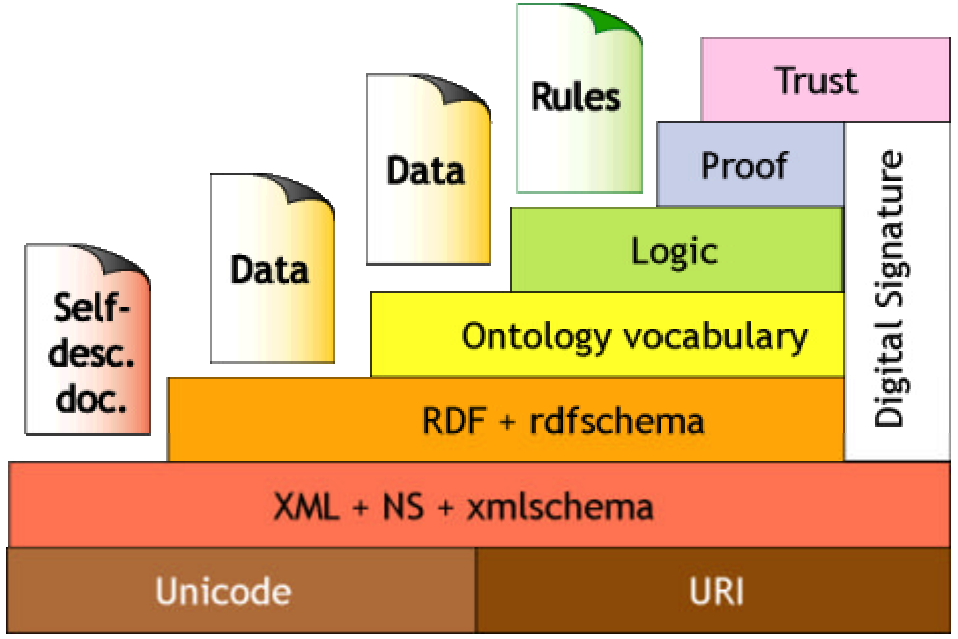
Web architecture by W3C

- service model as opposed to the traditional technically oriented model (e.g. "discovery" rather than "directory", "orchestration" rather than "messaging" and "transaction processing", "usage" rather than "distributed computing", "personalization" rather than "agent technologies", and so on).



http://www.w3.org/2000/Talks/1206-xml2k-tbl by Tim Berners-Lee, http://www.w3.org/People/Berners-Lee

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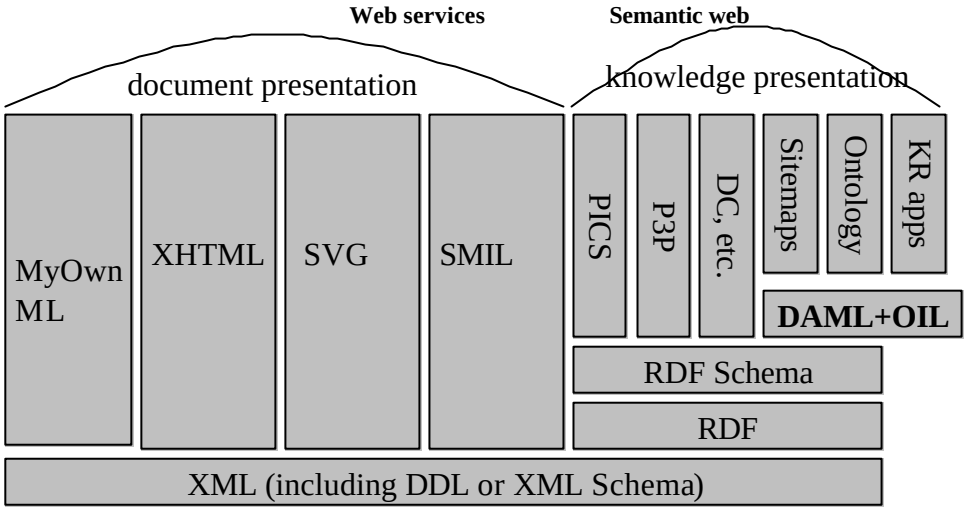
Role of web services in W3C

- Web Services connect computers and devices with each other using the Internet to exchange data and combine data in new ways



http://www.diffuse.org/event1.html, F. Nack, CWI

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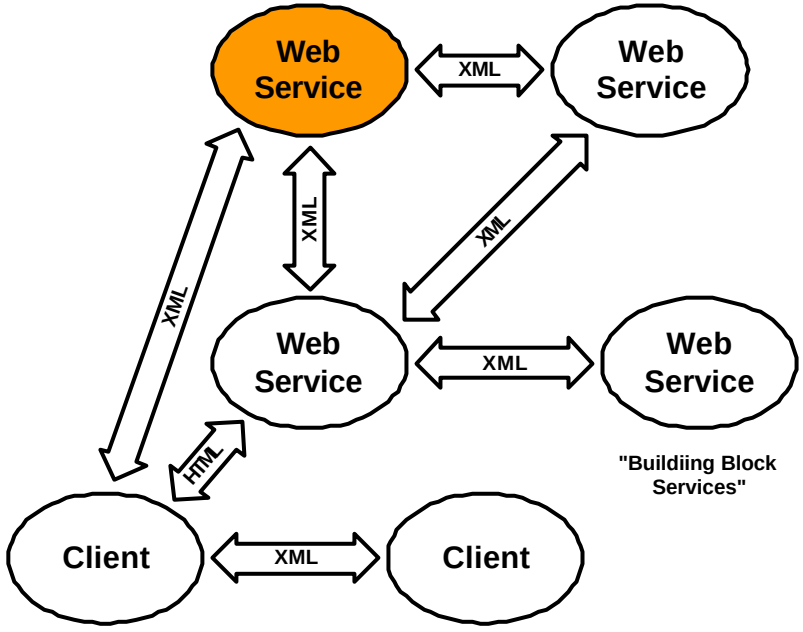
Introduction to web services (WS)

- Web Services can be defined as software objects that can be assembled over the Internet using standard protocols to perform functions or execute business processes



http://msdn.microsoft.com/webservices/

for ISPs

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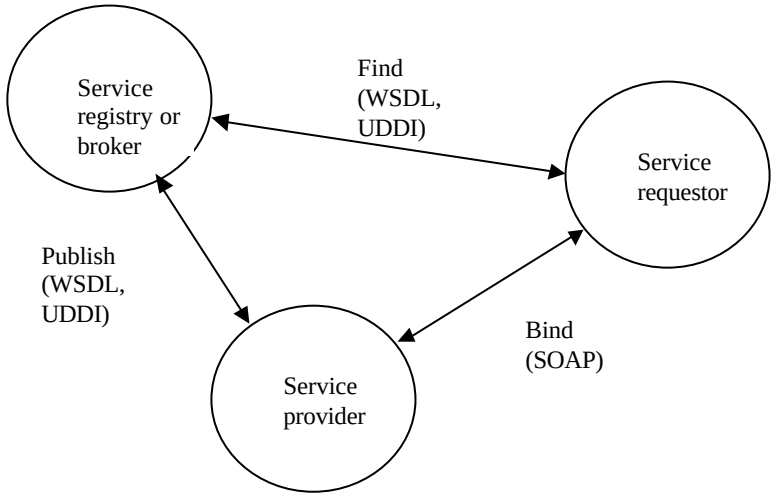
WS usage principle (idea)

- on-the-fly service creation through the use of loosely coupled, reusable software components
- software can be delivered and paid for as fluid streams of services as opposed to packaged products



It is possible to achieve automatic, ad hoc interoperability between systems to accomplish business tasks

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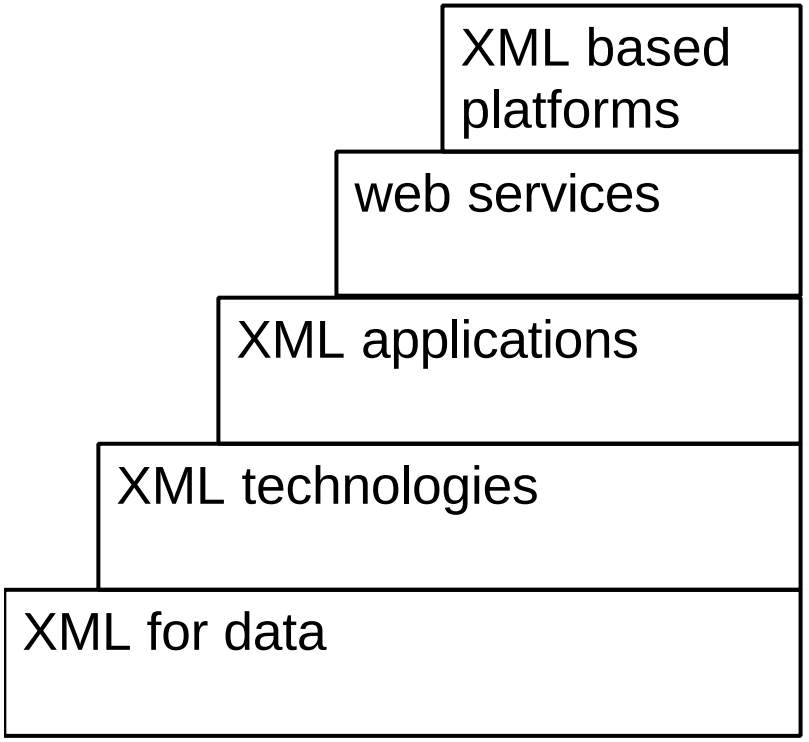
Advantages of web services

- Business services can be completely decentralized and distributed over the Internet and accessed by a wide variety of communications devices
- Businesses can be released from the burden of complex, slow and expensive software integration and focus instead on the value of their offerings and mission critical tasks



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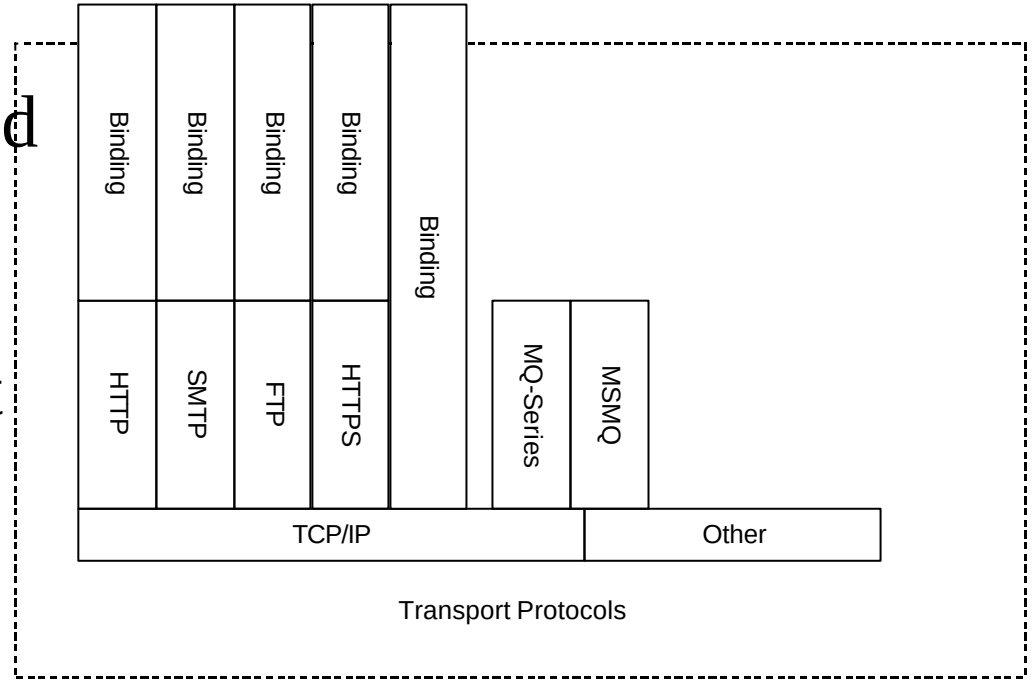
Security and WS

- Web Services paradigm is predicated on a trusted framework which requires the oversight of a neutral body



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Practical questions

Web Services Interop Stack	Universal Description, Discovery, and Integration (UDDI)
	Simple Object Access Protocol (SOAP)
	eXtensible Markup Language (XML)
	Common Internet Protocols (HTTP, TCP/IP)

- Although there is universal agreement among the biggest names in the IT industry that the future IT infrastructure will be based on the foundation of Web Services, there is no agreement on the business models for Web Services

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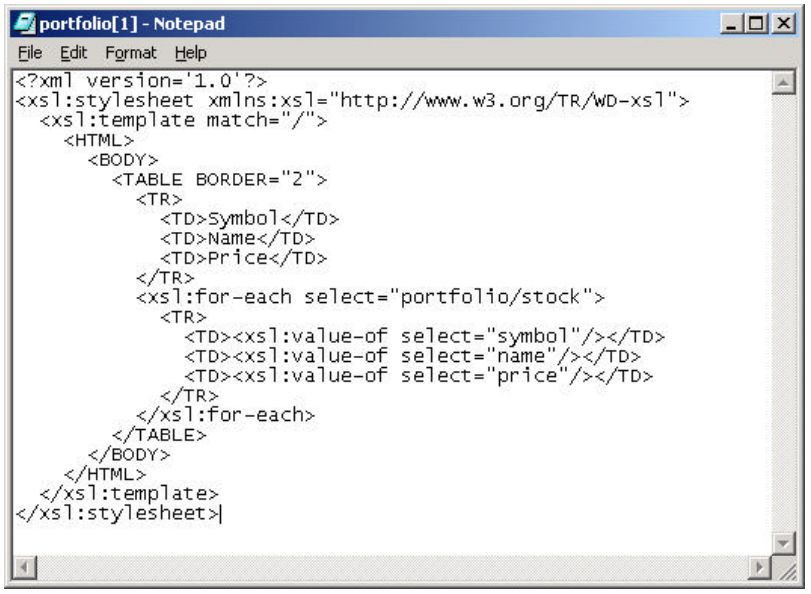
Obstacles to WS

- technologies//tools
- businesses are reluctant to embrace new technologies with promises for the future but require major present commitment



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Communication with WS/between applications

- Interoperability between two arbitrary systems is only possible if they understand the processes to be implemented when data is exchanged within a particular context
- The context can only be shared (and understood) if there is an agreed set of rules which define the context

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Next generation Internet

- In the third, Web Services, phase, the Internet itself would become a programming platform to support real time, fully customized and customizable service creation and development
- Instead of mostly static links between data or content, Web services would enable active links, or transactions, between functions

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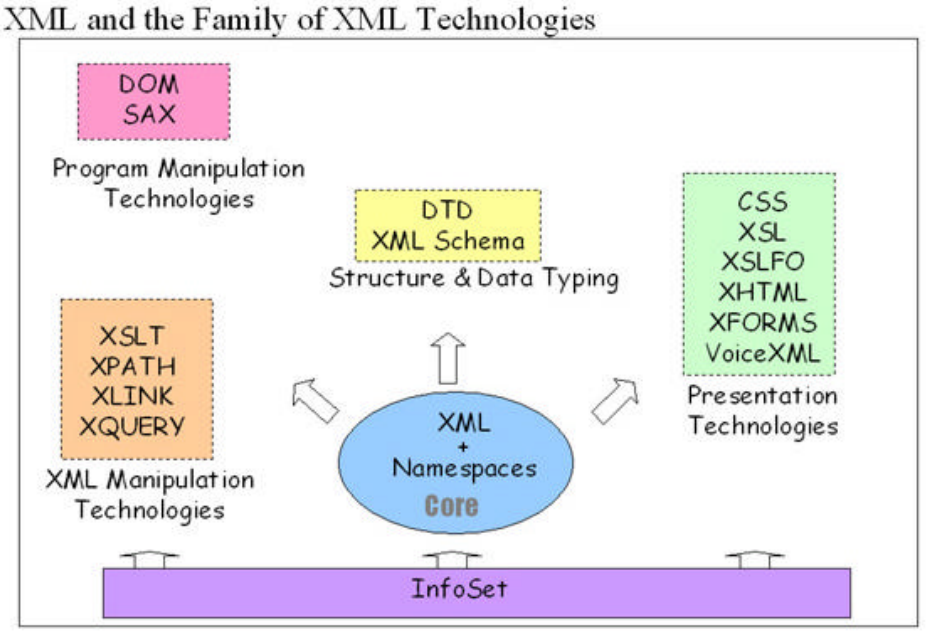
III XML, Web Services and the Changing Face of Distributed Computing by Frank P. Coyle

- XML
- XML based tools and technologies for data manipulation
- web services use XML based SOAP and WSDL to obtain web based software components



http://www.acm.org/ubiquity/views/f_coyle_1.html

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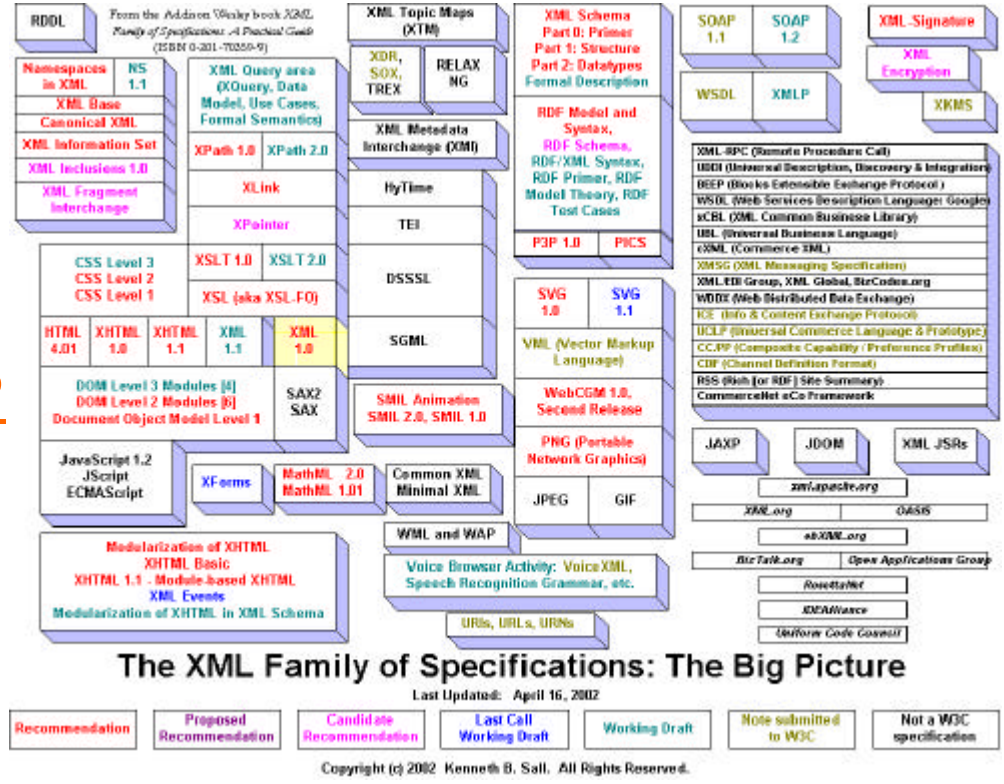
Standards behind WSs

- XML -- eXtensible Markup Language for structured data representation
- a near-universally agreed base specification (SOAP -- Simple Object Access Protocol) for structured message exchange
- a powerful vision for doing business online
- encompass the full spectrum of e-commerce



Ken Sall: Family of XML technologies: big picture

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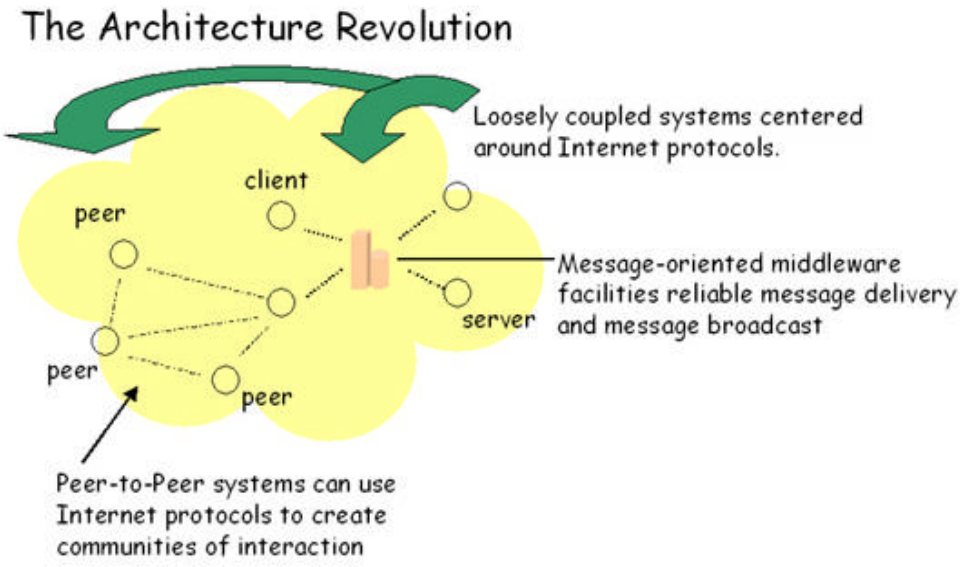
History of WS

- Electronic Data Interchange (EDI)
- Enterprise application integration (EAI)
- The application service provider (ASP) model
- evolution of portals, as well as in peer-to-peer (P2P) applications



XML, Web Services and the Changing Face of Distributed Computing by Frank P. Coyle, ACM Ubiquity magazine online: http://www.acm.org/ubiquity/views/f_coyle_1.html

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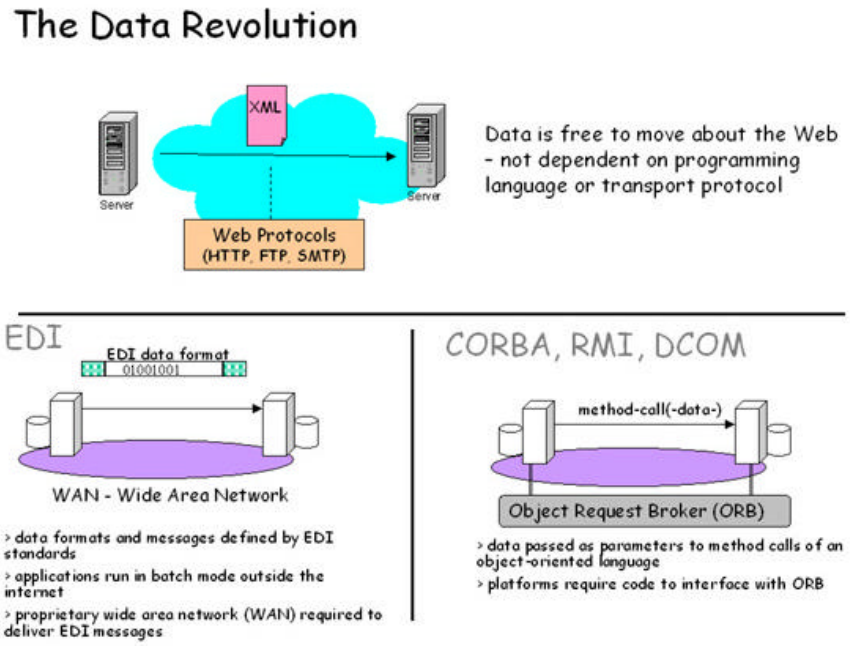
XML and data

- online transactions -- within a domain, across domains, intra-organization, inter-organization, as well as parties involved in the transactions in their different roles and in different contexts (to consider developments as culminating in specific killer apps is missing the point)



http://www.acm.org/ubiquity/views/f_coyle_1.html

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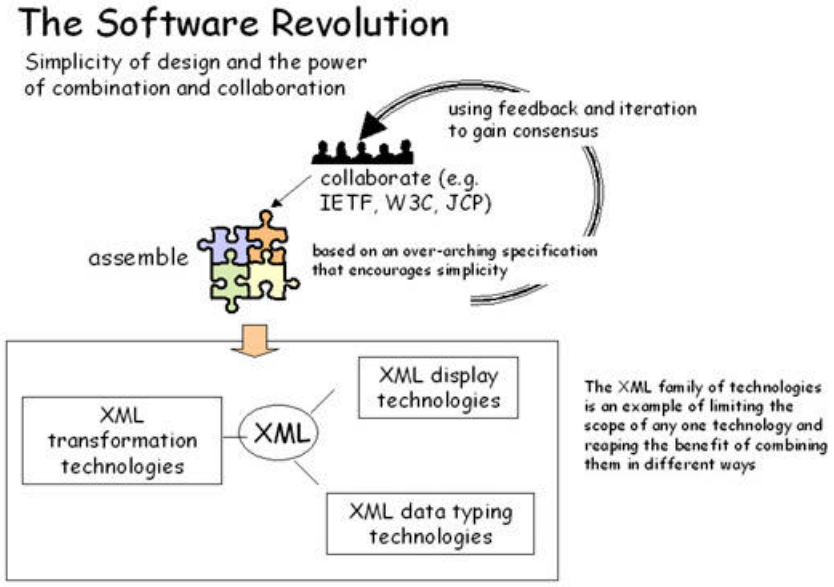
Full vision of web services

- Web Services can interact with each other ("be orchestrated") in an infinite variety of manners and through multiple iterations in order to deliver a particular task within any context
- Web Services are infinitely flexible, elastic to needs and, just like its foundation protocol XML, "extensible"



http://www.acm.org/ubiquity/views/f_coyle_1.html

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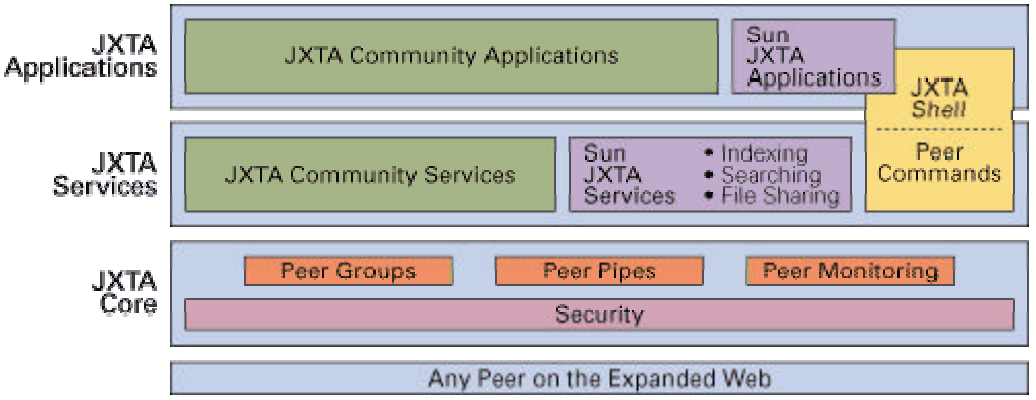
IV Ebusiness, web services and IT vendors

- all major IT vendors agree on the importance and primacy of Web Services and the overall vision if not the individual details



XMLMag.com S. Johnston: Special report on pervasive computing
http://www.xmlmag.com/upload/free/features/xml/2001/09sep01/sj0109/sj0109.asp

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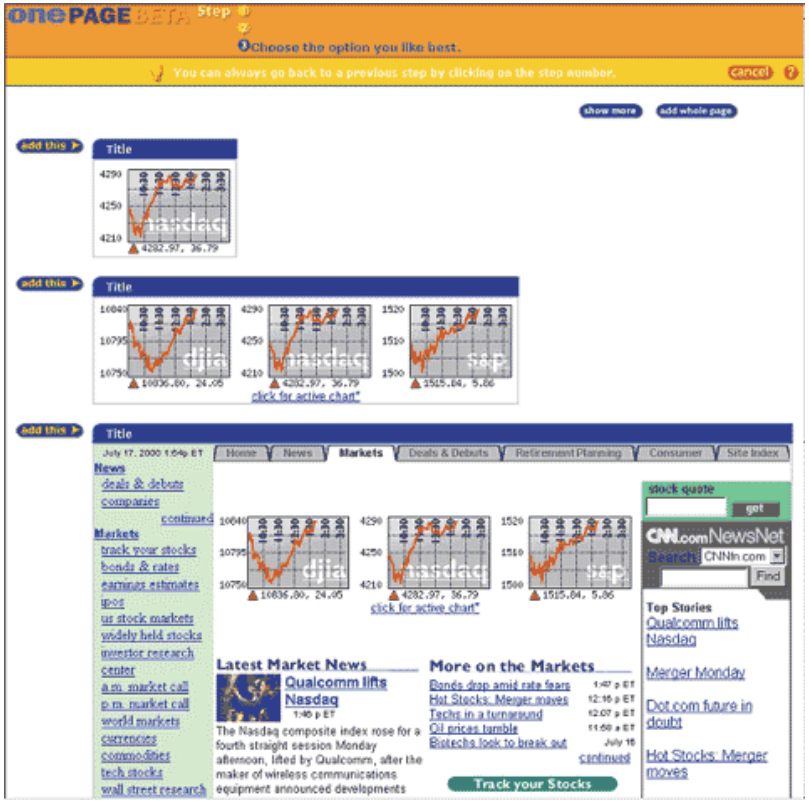
Example of automation

- productivity gains will come from fully automated machine-to-machine communications
- businesses will become more agile in operation and adaptive to changes in their environment



This screen shows levels of data extraction on a Web page using OnePage's toolset. (Source: OnePage)

XMLMag.com S. Johnston: Special report on pervasive computing

http://www.xmlmag.com/upload/free/features/xml/2001/09sep01/sj0109/sj0109.asp

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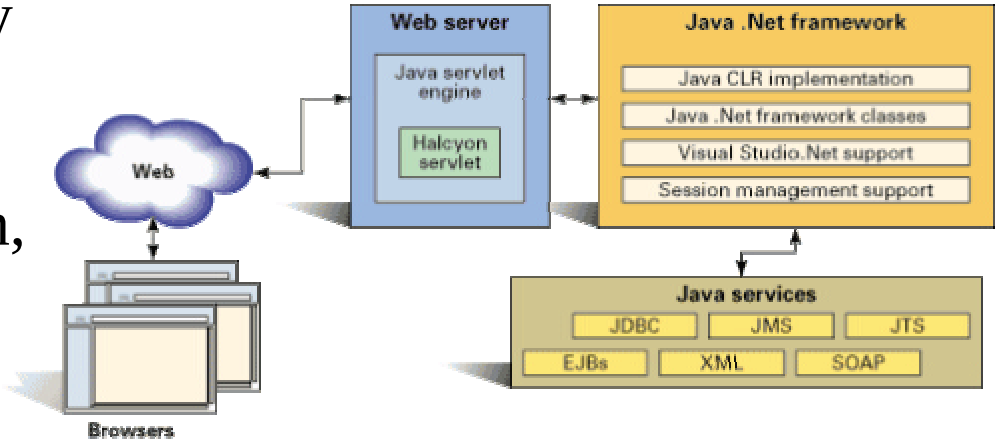
Exposing business process on the web

- to provide ("expose") any business function to any other entity, such as another business function, an organization, a particular community, as well as end users
- The Web Services can be provided by the organization directly, through trading networks or specific publishing hubs and other intermediaries on the Web



XMLMag.com S. Johnston: Special report on pervasive computing
http://www.xmlmag.com/upload/free/features/xml/2001/09sep01/sj0109/sj0109.asp

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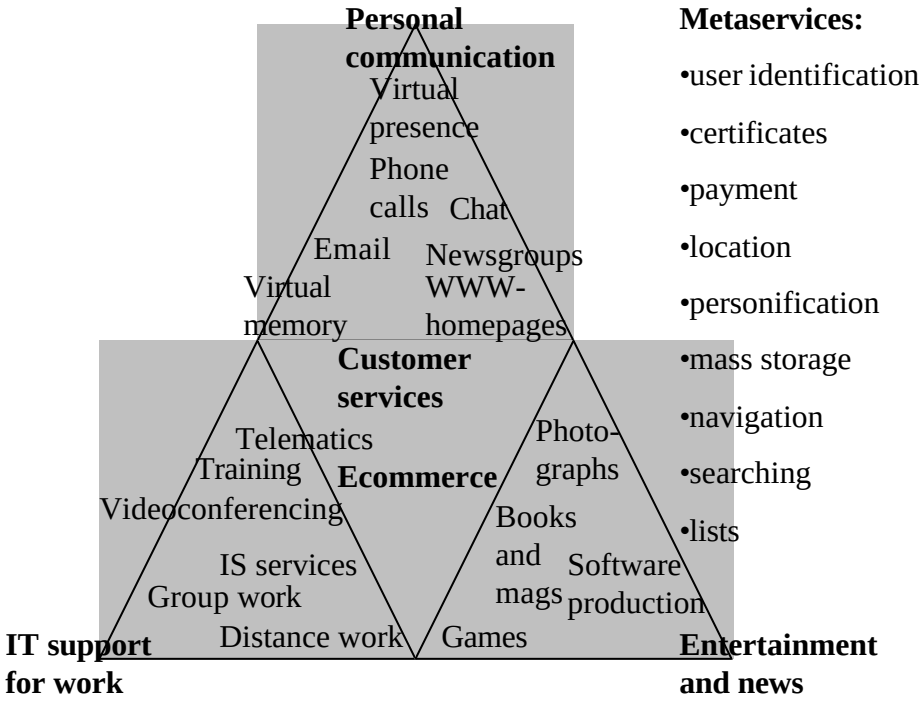
Services and business re-engineering

- All the processes as well as sub-processes related to marketing, ordering, payment, after sales maintenance, fulfillment of regulatory requirements and customer relationship management could be, for example, re-structured, outsourced/re-introduced in-house, and/or executed in collaboration with partners and customers on a global scale



http://www.uwasa.fi/~ksa/ICT%20research.ppt

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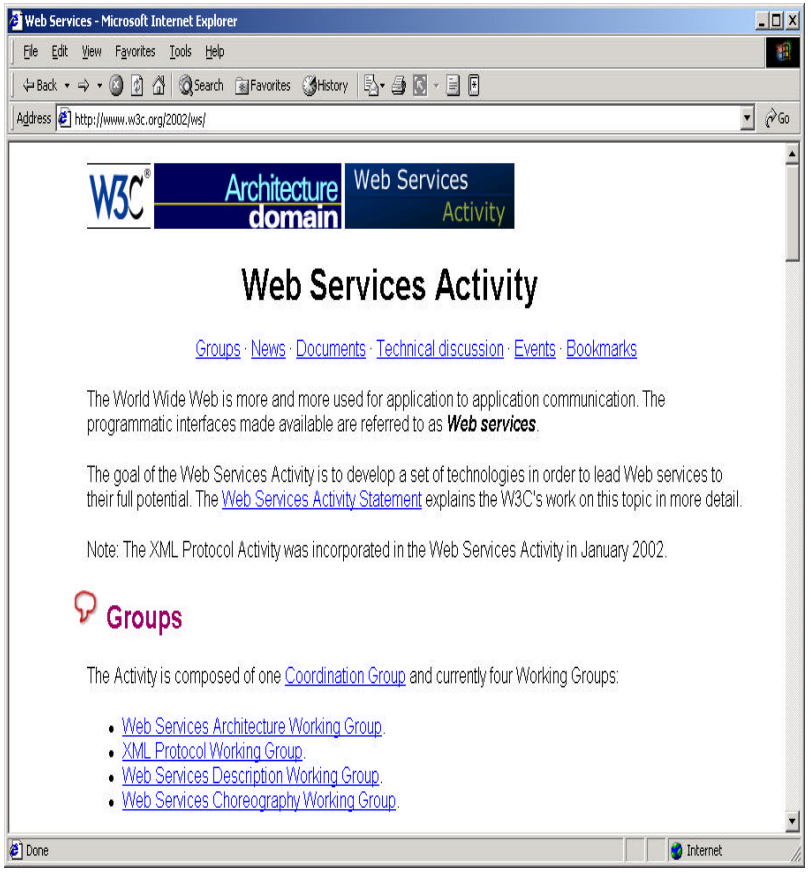
Further standard development activities

- Web Services Interoperability Organization (WS-I)
- W3C's Web Services Activity
- CEN/ISSS: its Electronic Commerce Workshop has established a Web Services Project to develop an architectural model for Web Services



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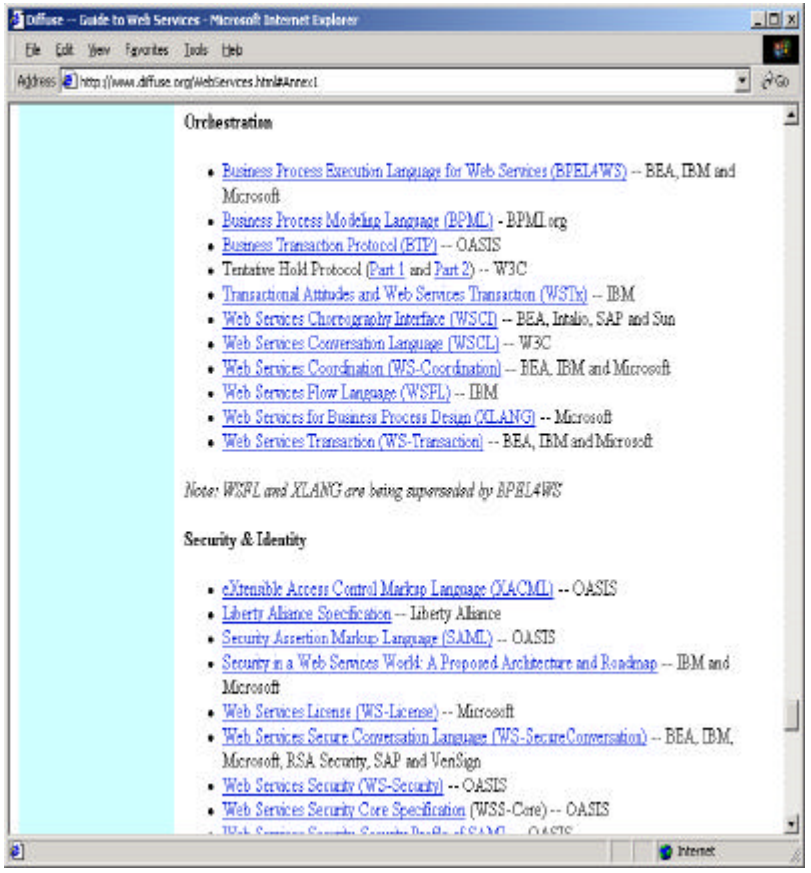
Other initia around WS

- ETSI: it has chartered a Specialist Task Force (STF) to develop Technical Reports and Technical Specifications on the definition, protocols, security requirements and roaming of an "m-signature Web Service", in support of the ETSI Mobile Commerce Project



http://www.diffuse.org/WebServices.html

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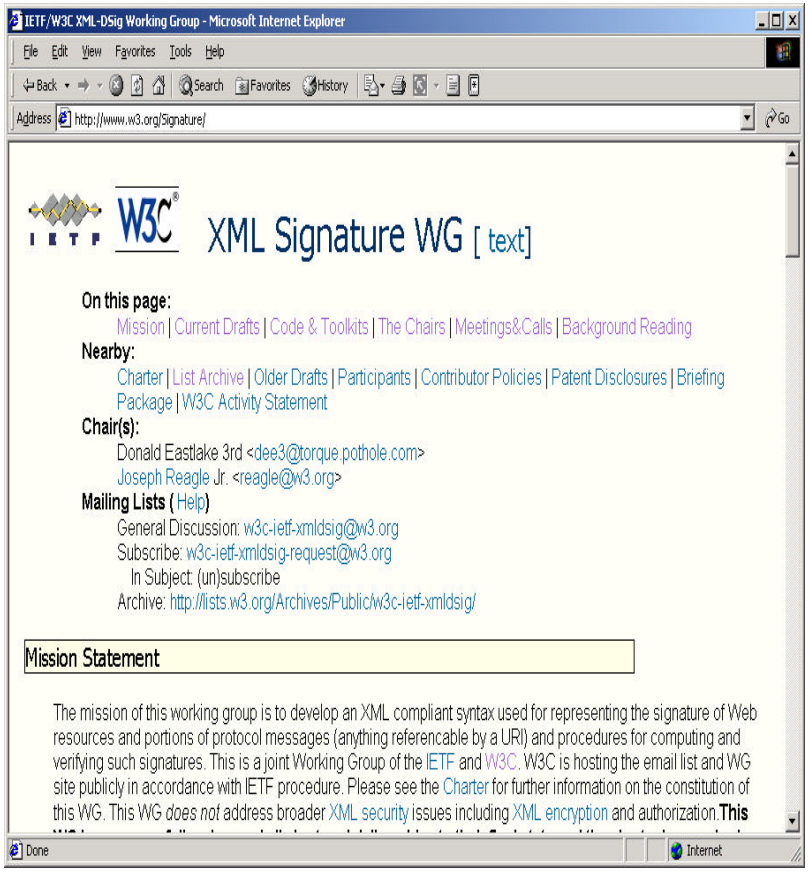
User identification

- IETF: it has a joint working group with W3C on XML Signatures
- Microsoft .NET Passport and Liberty Alliance: activity on defining federated network identity specifications could have a major influence on access to Web Services



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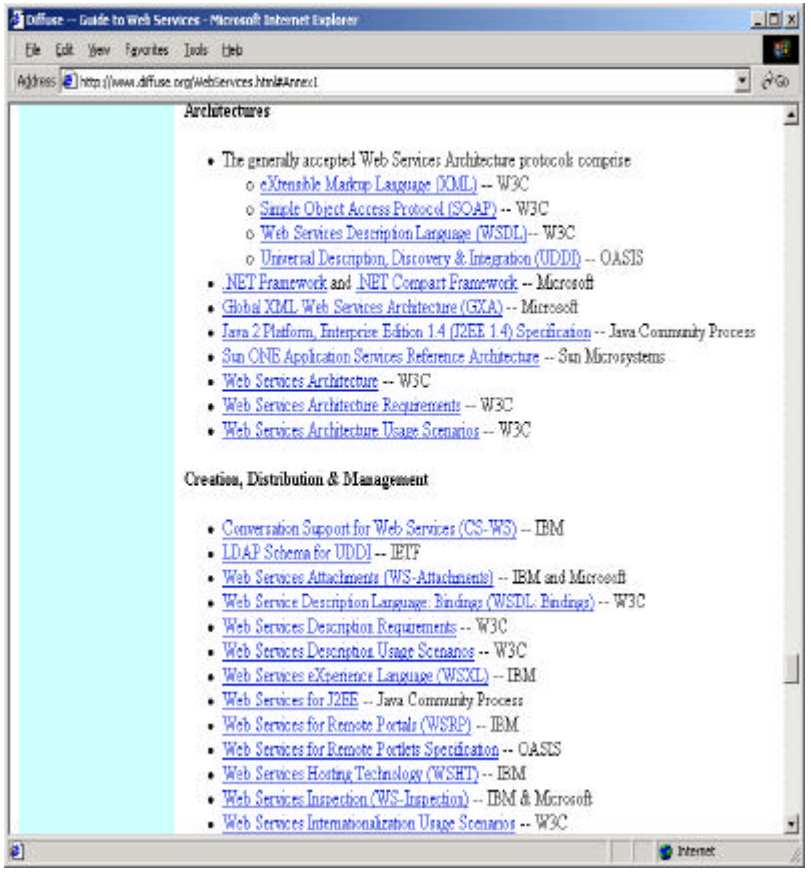
Standards groups / industry consortia

- OASIS Web Services for Interactive Applications (WSIA) Technical Committee, Web Services for Remote Portals (WSRP) Technical Committee, Web Services Security (WSS) Technical Committee and Management Protocol Technical Committee



http://www.diffuse.org/WebServices.html

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Software components and WS

- OMG also plans to progress specifications for interoperability between CORBA and Web Services
- combined usage of WS and semantic web (SW) later

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Business integration

- OMG: its Business Enterprise Integration (BEI) Domain Task Force (DTF) includes Web Services within its scope; its Analysis and Design Platform Task Force is investigating use of Web Services for metadata interchange that conforms to the consortium's Common Warehouse Metamodel (CWM);

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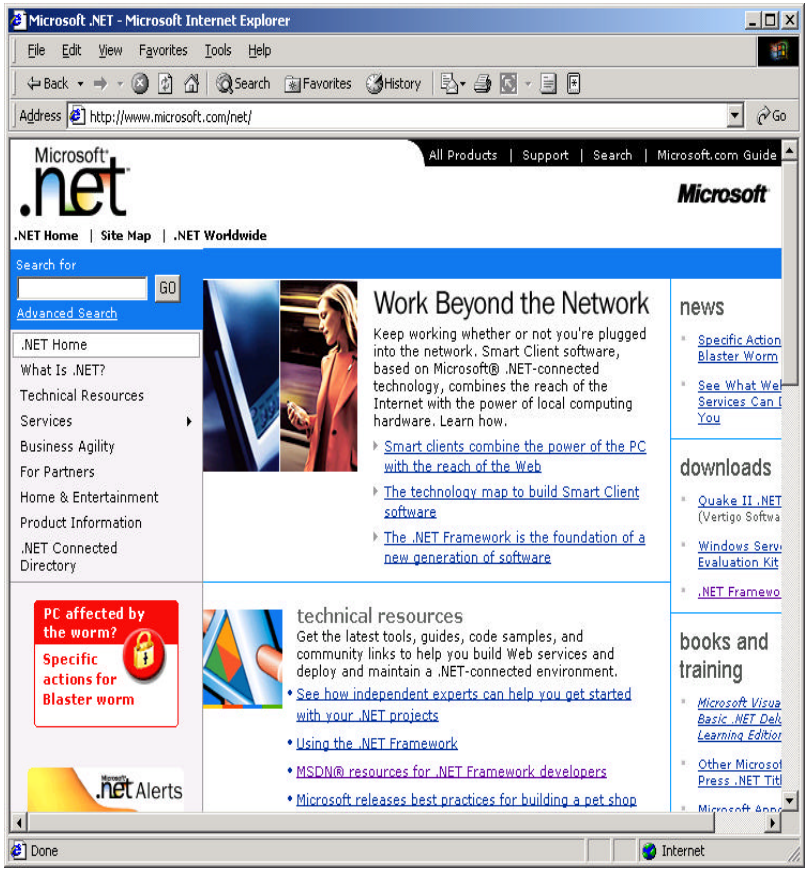
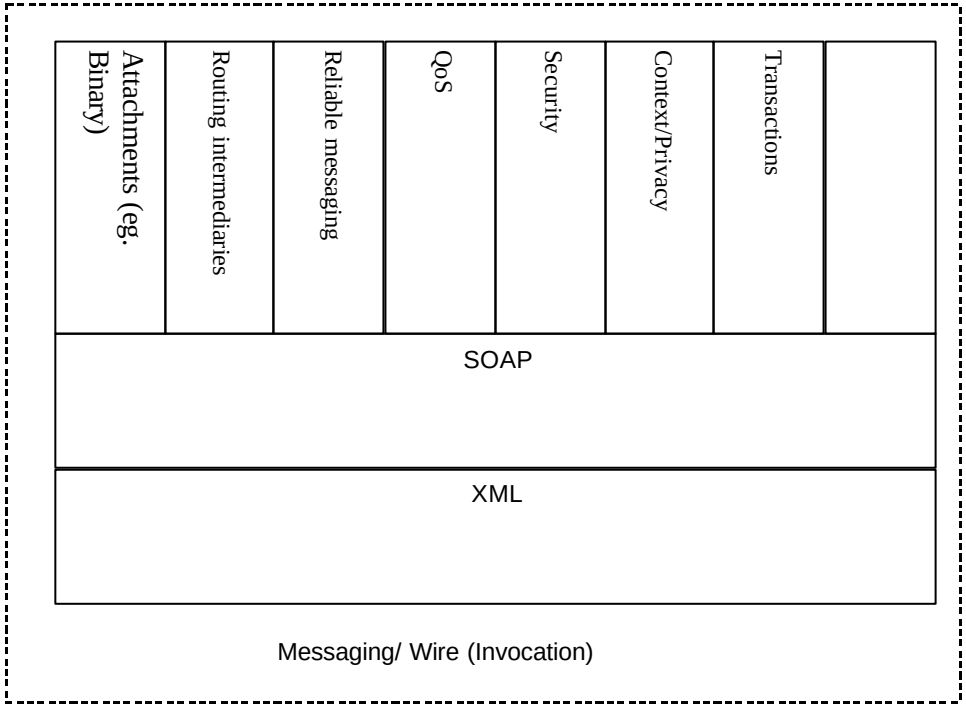
Main IT vendors of WS

- Microsoft's .NET (in August 2002 Microsoft announced that it plans to synchronize the next version of .NET product suite, code-named "Everett")
- Sun Microsystems' Sun Open Net Environment (Sun ONE)
- IBM's Web Services offering which is aligned with its e-business WebSphere products



Web Services "Strategies" of the IT vendors

- Microsoft .NET framework
- IBM: SOA and web services
- HP's web services solutions
- Oracle Technology Network (OTN) which is aligned with the Oracle9i products
- BEA's Web Services offering which is aligned with the company's WebLogic products



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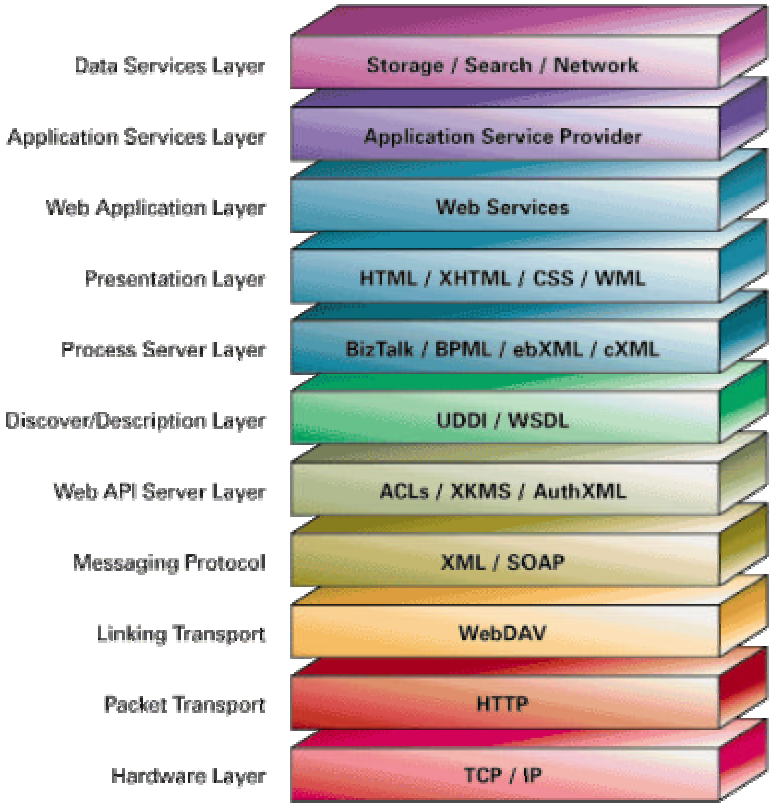
Extended web service stack

- combine business processes in applications and software components into one (web based) stack
- source http://xmlfund.com/roadmap/



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V Technical implementation of web services

- SOAP, WSDL and UDDI
- example of simple web service: service code, SOAP, execution and WSDL, lookup of services

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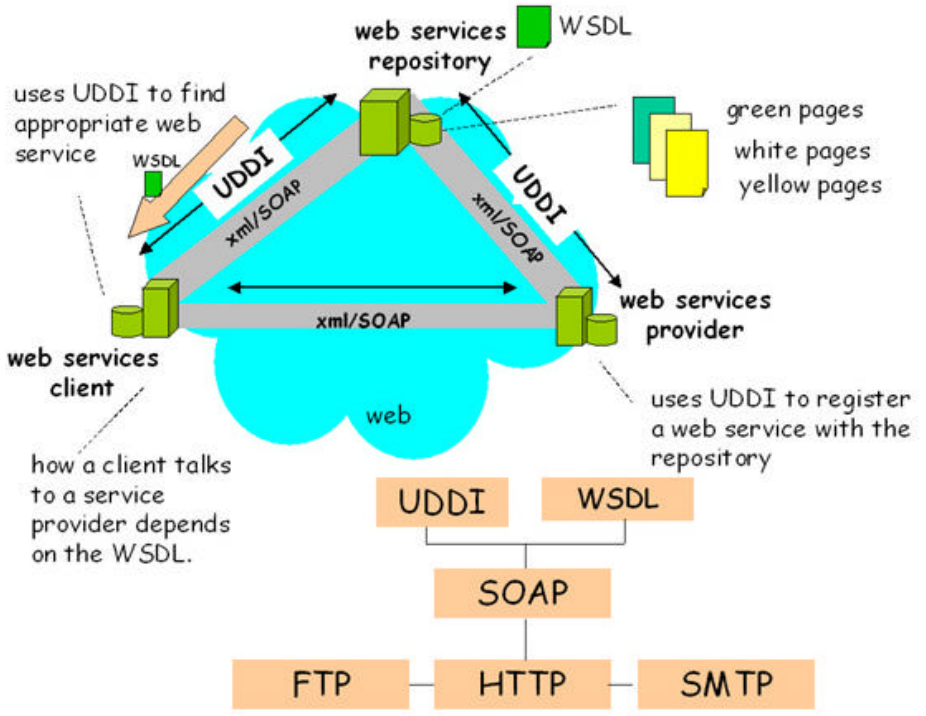
WS technical usage

- SOAP and
- Web Services Description Language (WSDL) is for enabling a common description of Web Services particularly their interfaces and functions
- Universal Description, Discovery & Integration (UDDI) is for the aggregation and identification of WSDL documents by providing registry capabilities



http://www.acm.org/ubiquity/views/f_coyle_1.html

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a. WS code and execution (with MS .NET)

MathService.asmx - Notepad

File Edit Format View Help

```
<%@ WebService Language="C#" Class="MathService" %>

using System;
using System.Web.Services;

public class MathService : WebService {

    [WebMethod]
    public float Add(float a, float b)
    {
        return a + b;
    }

    [WebMethod]
    public float Subtract(float a, float b)
    {
        return a - b;
    }

    [WebMethod]
    public float Multiply(float a, float b)
    {
        return a * b;
    }

    [WebMethod]
    public float Divide(float a, float b)
    {
        if (b==0) return -1;
        return a / b;
    }

}
```

MathService Web Service - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Search Favorites Media

Address http://193.166.111.5/webservices/aspx/omat/MathService.asmx Go Links

MathService

The following operations are supported. For a formal definition, please review the Service Description.

- Multiply
- Divide
- Add
- Subtract

This web service is using http://tempuri.org/ as its default namespace.

Recommendation: Change the default namespace before the XML Web service is made public.

Trusted sites

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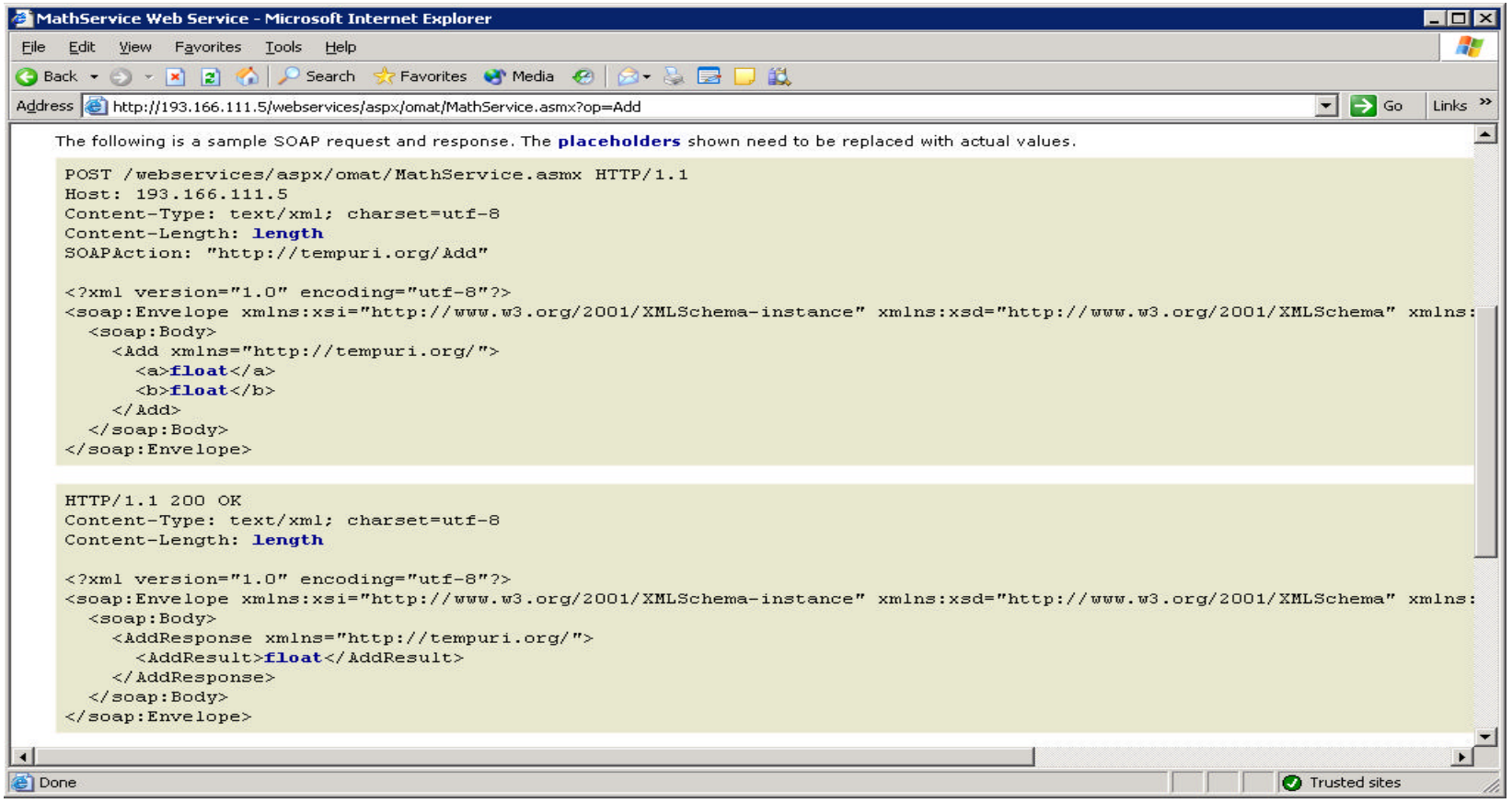
b. SOAP messages



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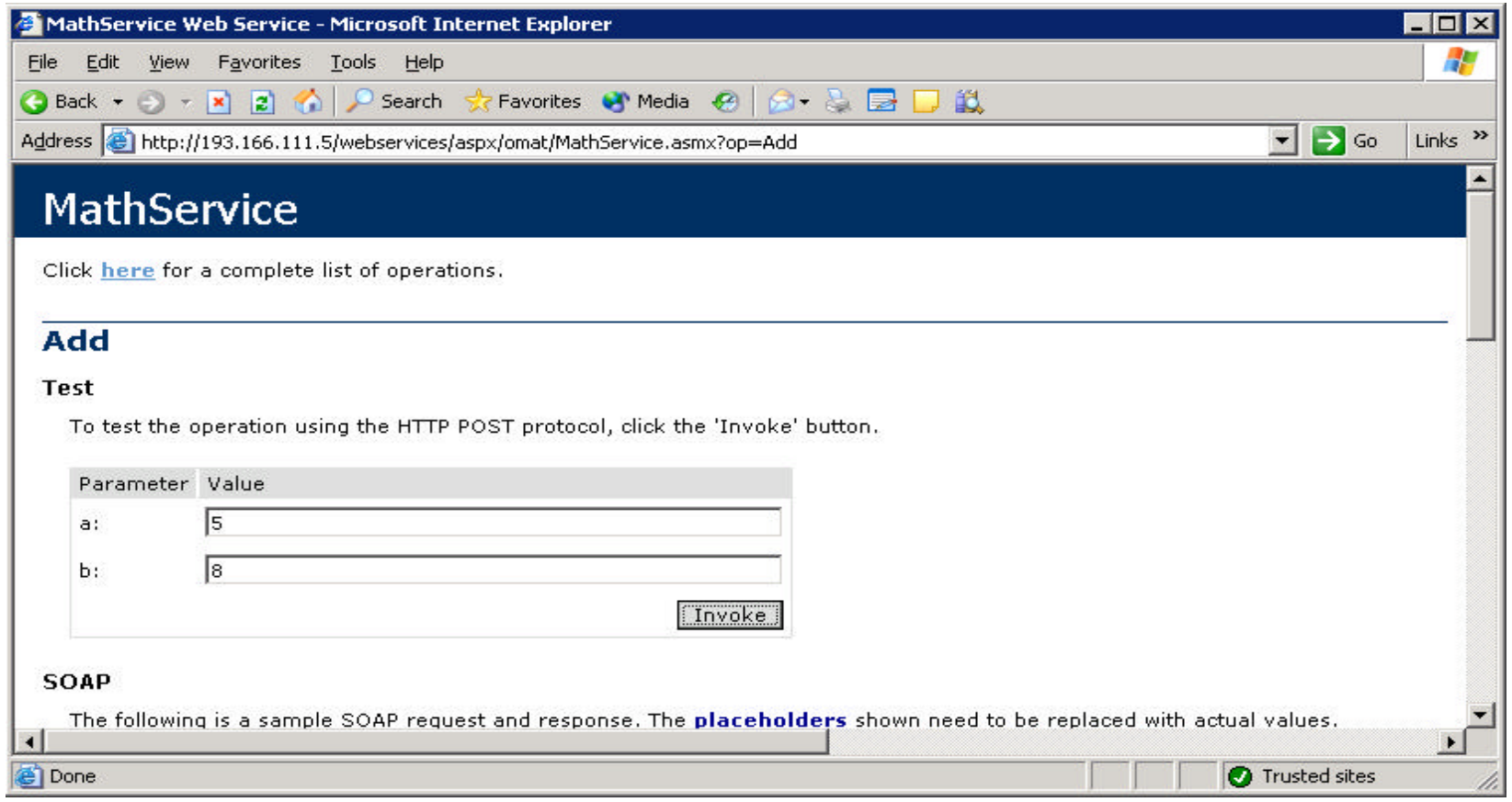
c. Input to WS…



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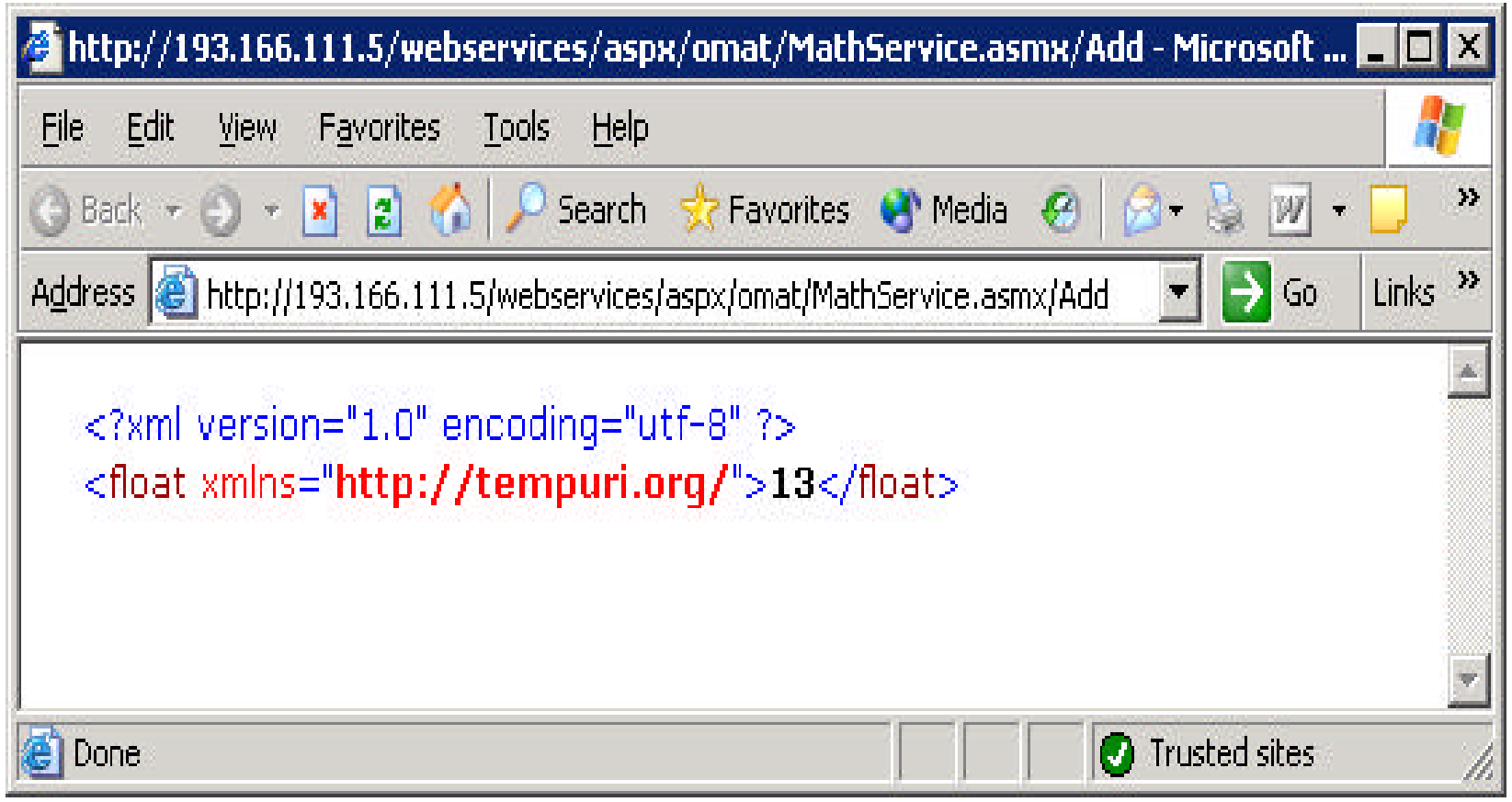
Output from the WS



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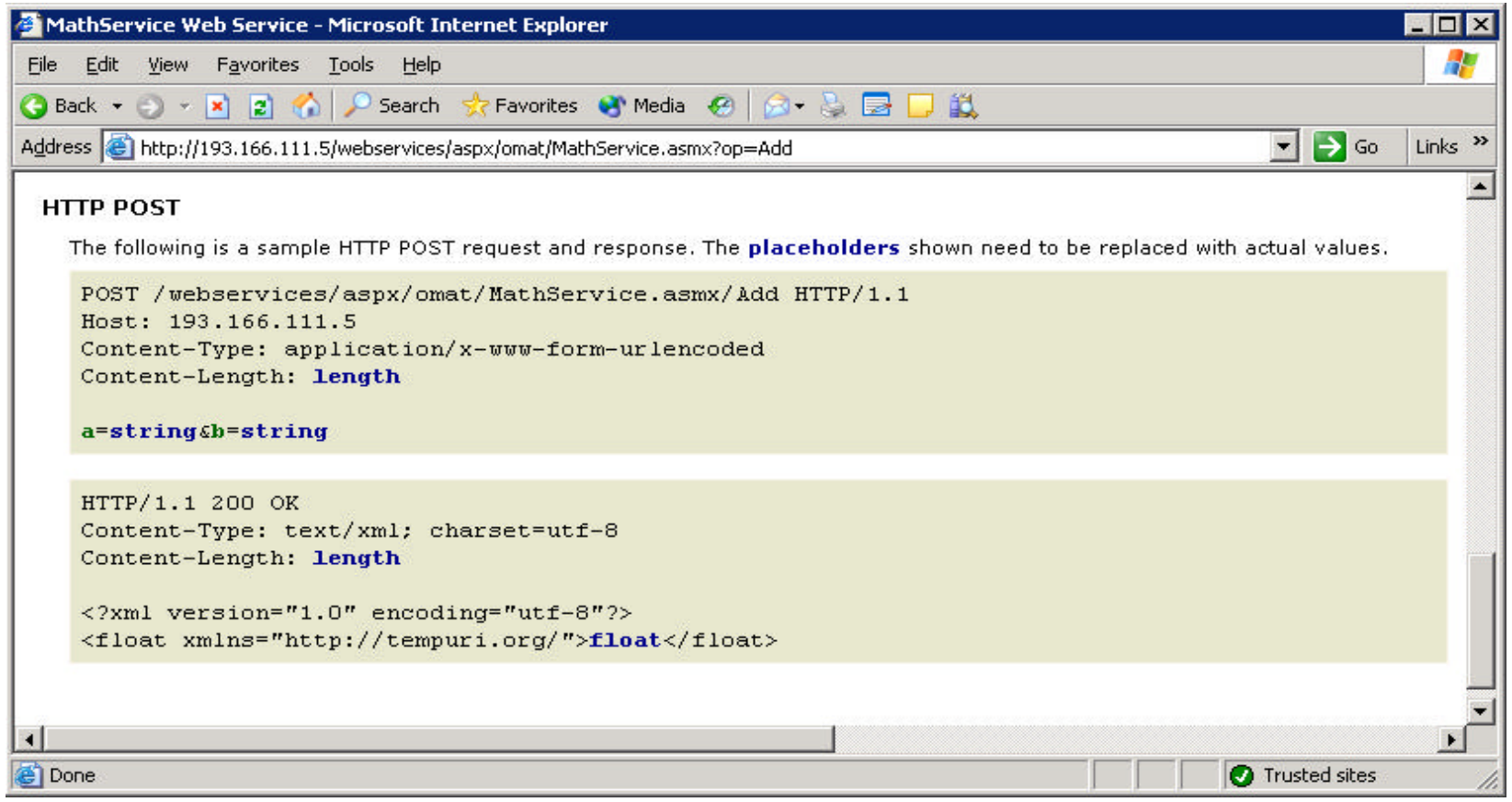
… in HTTP



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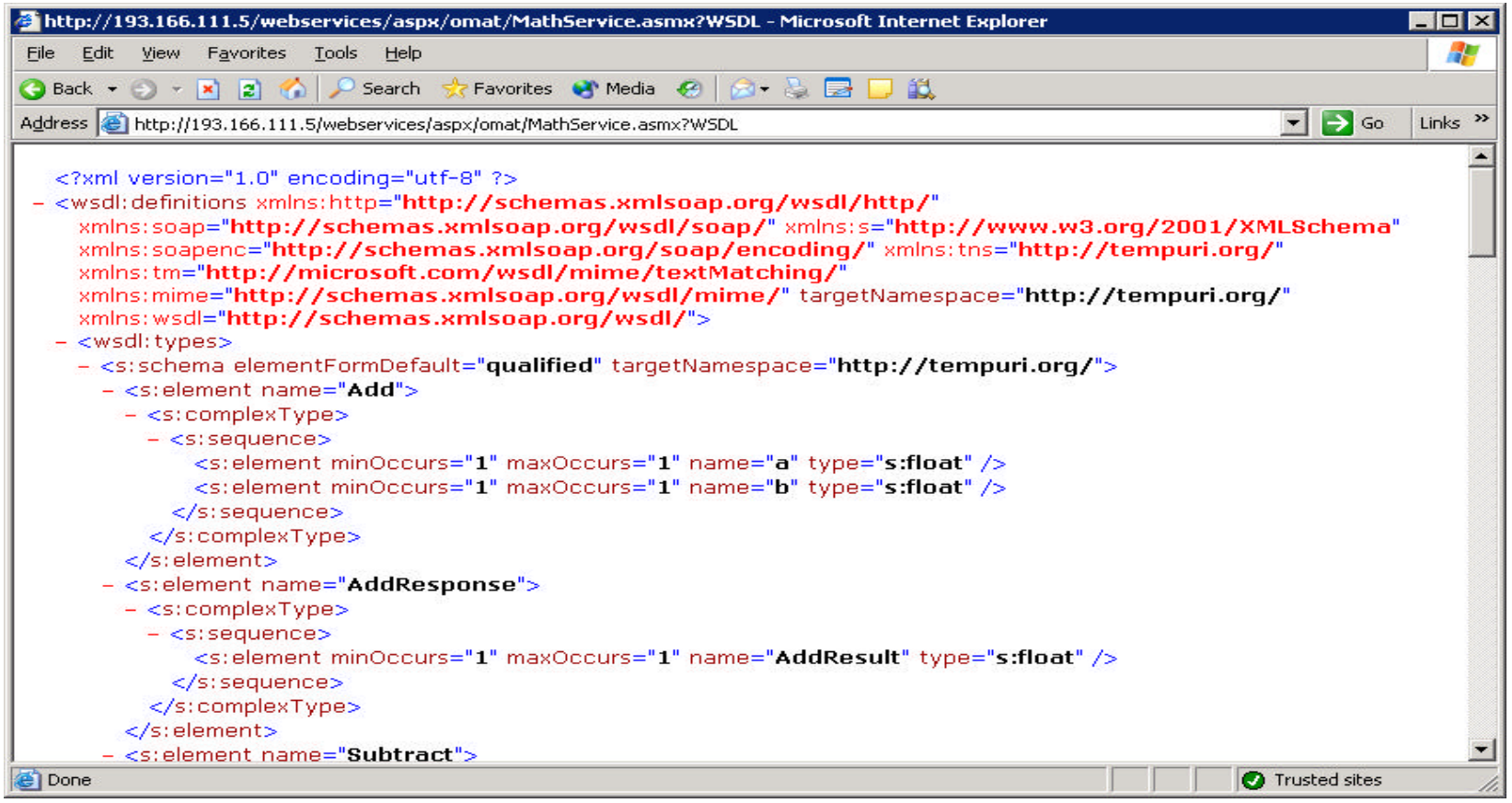
d. WSDL description



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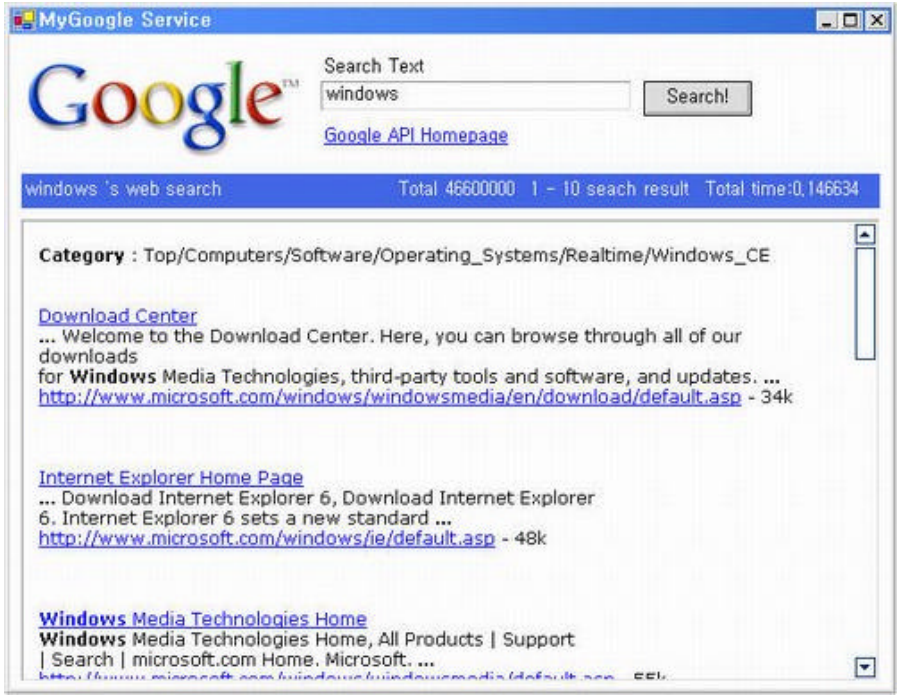
e. WS and end users

- DISCO, UDDI (ETC.) repositories like UBR http://uddi.microsoft.com/ by Microsoft
- Google API usage with SOAP and WSDL
- personal identity repositories and the possibility of a central repository of identities



http://www.codeproject.com/cs/webservices/mygoogle.asp

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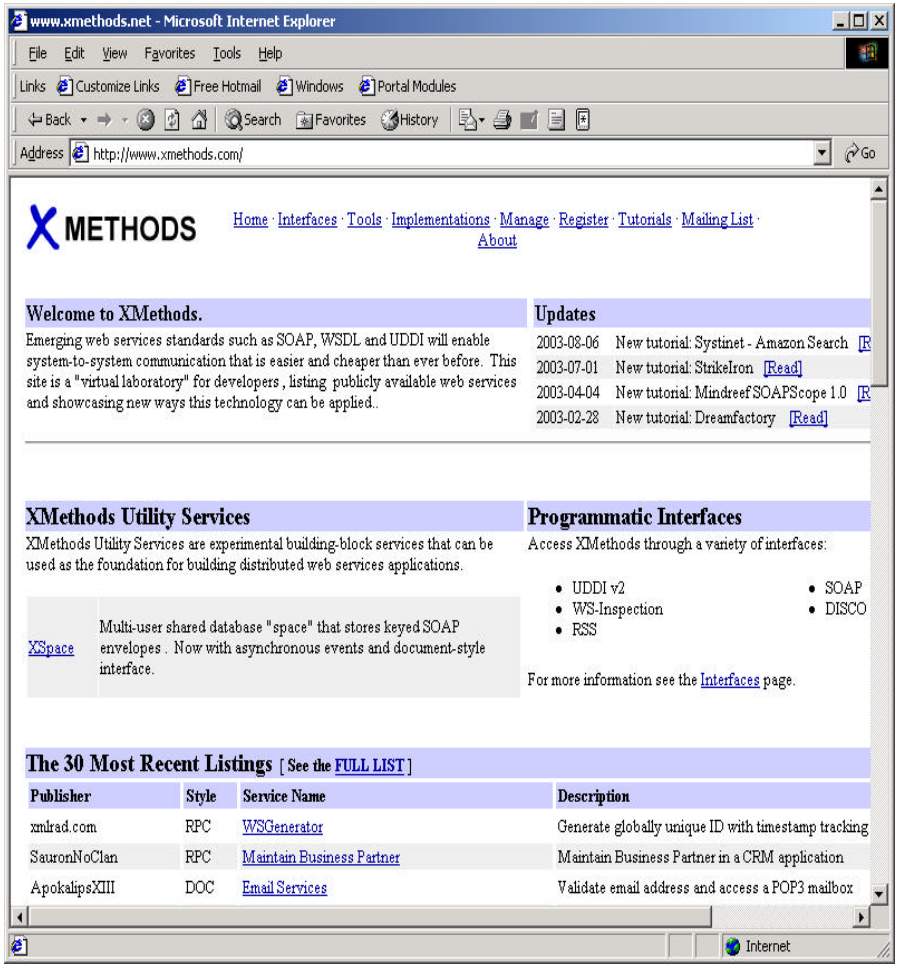
Test examples of WSs

http://www.xmethods.com

- A listing of publicly accessible Web Services is provided by XMethods
- The Web Services listed in these directories indicate the enormous variety and scope of service offering, from simple calculators to messaging to games to different mechanisms and parameters for information search (or "discovery" where the search is not domain specific



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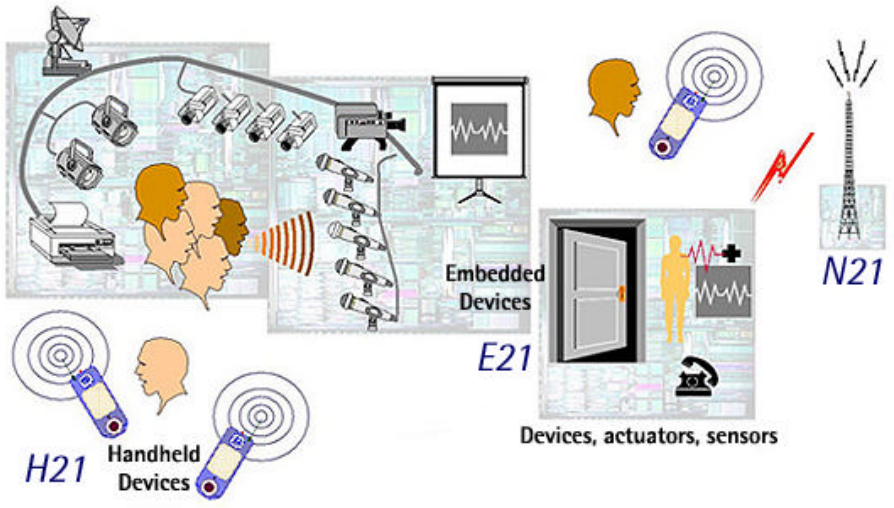
Pervasiveness of Web Services

- Machine-to-machine communications is insufficient for the full vision of the Web Services
- Machines need to "understand" the relevant processes in any particular interaction between Web Services (discussed further with semantic web later)



MIT Oxygen and HP Cooltown projects

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Pervasive information

- pervasiveness of Web Services will be directly proportional to the degree of semantic interoperability that is achievable
- Current work in specifying ontologies, or structured representations of knowledge and concepts, will determine the kind of Business Webs that are likely to emerge.

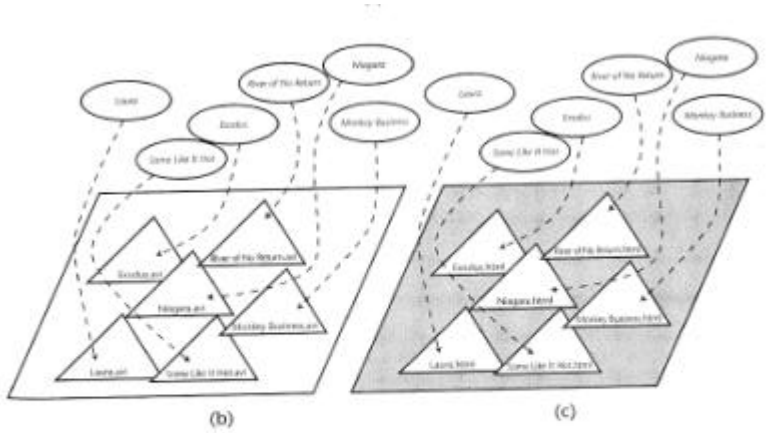

Figure 7.8 Using the merge facility of topic maps to abstract the semantic network from concrete resources. (a) This topic map defines only a semantic network. It can be applied to an information pool by merging it with one of the other topic maps. (b) This topic map maps only the topics from the semantic network to our video library. (c) This one does the same for the encyclopedia.

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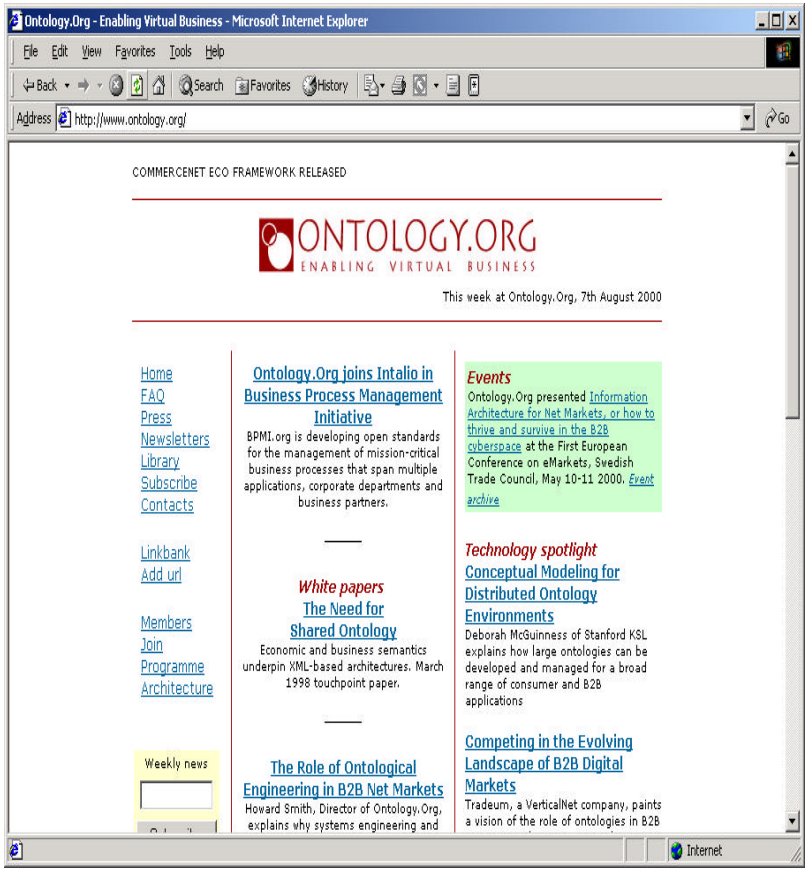
Ontologies

- Mapping of ontologies will become essential for the federation of the Business Webs
- Web Services are likely to work best in those domains with already commonly agreed as well as adhered to methods and vocabularies, such as stock quotes and commercial flight information



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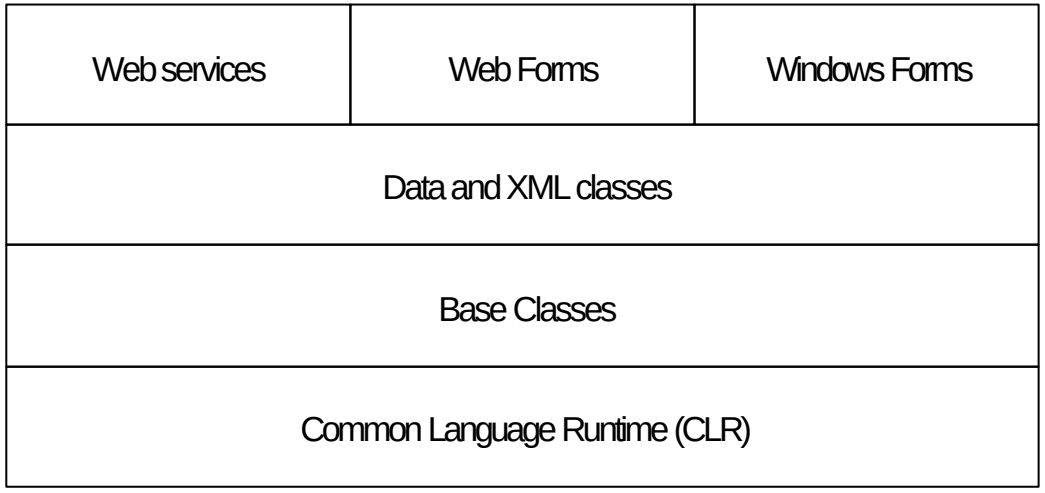
Microsoft .NET Framework

- Windows Server 2003 with in-built XML and WS support
- CLR and SMIL (with “any” programming language), ASP.NET
- three possible applications types (UI)
- mobile version with .NET Compact Framework



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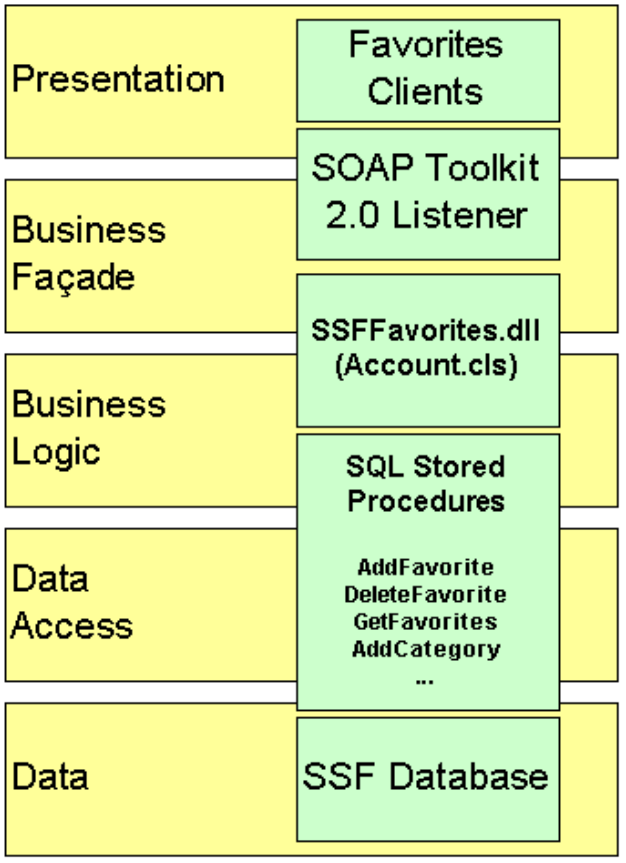
Example: old SOAP usage

- there is universal agreement that interoperability is one of the most urgent and critical issues for future development of Web Services



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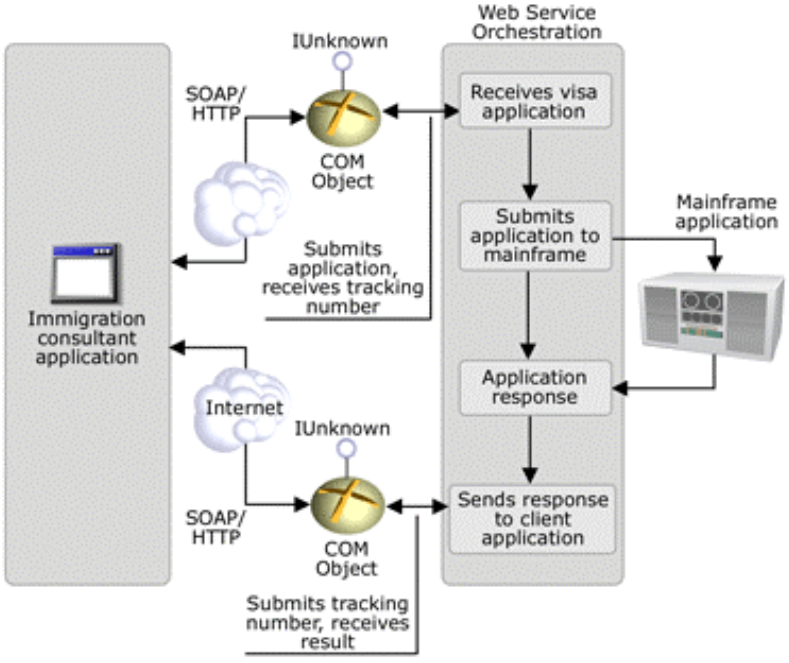
WS usage example

- For example, if I use a Web Service to book a car when purchasing an airline ticket, would that trigger another Web Service which looks up whether I have a valid driving licence? To what extent can I, the initiator of the original transaction, control the cascading of events?



http://msdn.microsoft.com/library/default.asp?url=/library/en-us/dnbiz2k2/html/bts_wp_net.asp

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.NET Favorites Service

http://www.coldrooster.com/default.aspx

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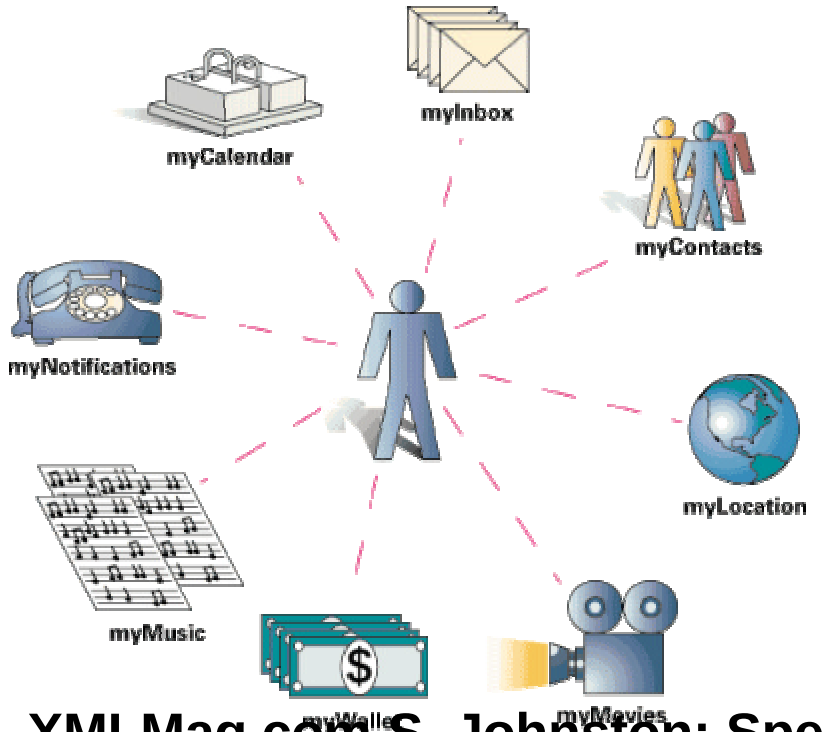
.NET: MyServices

- For example, Microsoft's My Services is ultimately intended to be a person's single point of access to all online services



XMLMag.com S. Johnston: Special report on pervasive computing
http://www.xmlmag.com/upload/free/features/xml/2001/09sep01/sj0109/sj0109.asp

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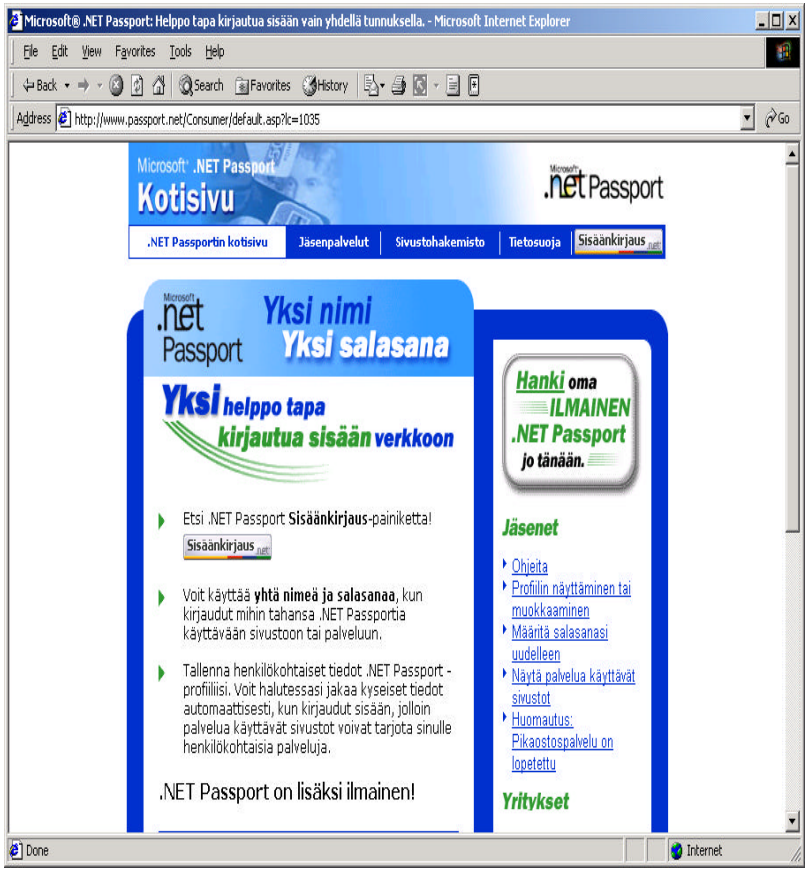
.NET: WS billing

- The handful of existing commercial Web Services network providers are experimenting with a combination of subscription and network usage charge. At least one is also charging users according to the number of parties that are connected to a user over the network (but with free point-to-point connection)



http://www.passport.net/

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.NET online example applications and web services

- Favorites Service before
- .Net Quickstart tutorials (for ASP.NET)
- MS ASP.NET Starter kits, http://www.asp.net/ (or http://www.uwasa.fi/~ksa/ubi/case2_portal.htm)
- Simple webService examples like http://www.uwasa.fi/~ksa/ubi/case1_url.htm
- Terrarium
- TaskVision
- Peer-to-peer samples at left

http://www.uwasa.fi/~ksa/tv/taulut2.htm http://www.gotdotnet.com

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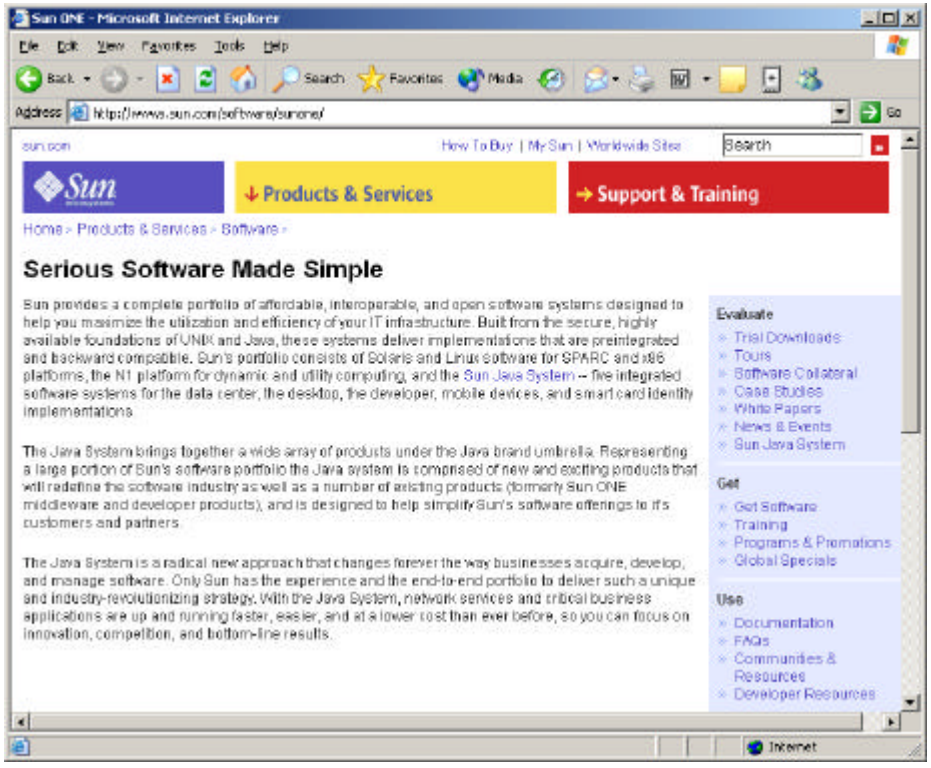
Present WS tools and back to business…

- Tools like .NET above and Sun ONE by Sun
- Toolkits like WSTK by IBM, http://www.alphaworks.ibm.com/tech/webservicestoolkit, Java WSDP, http://java.sun.com/webservices/jwsdp/index.jsp



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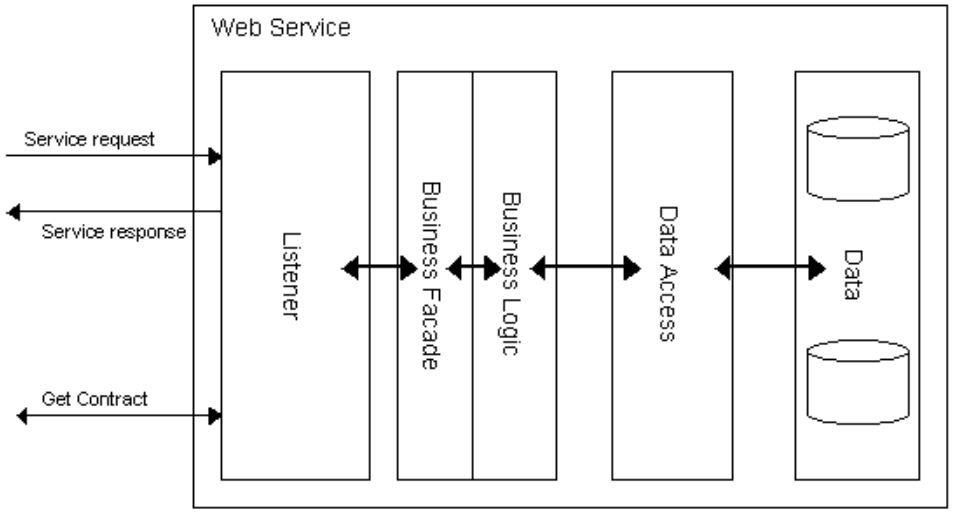
Orchestration

- Apart from the question of how the various Web Services are to be "orchestrated" to execute the transaction, who gets paid and for which part(s) of the transaction? Who would get paid if the transaction were not executed in its entirety



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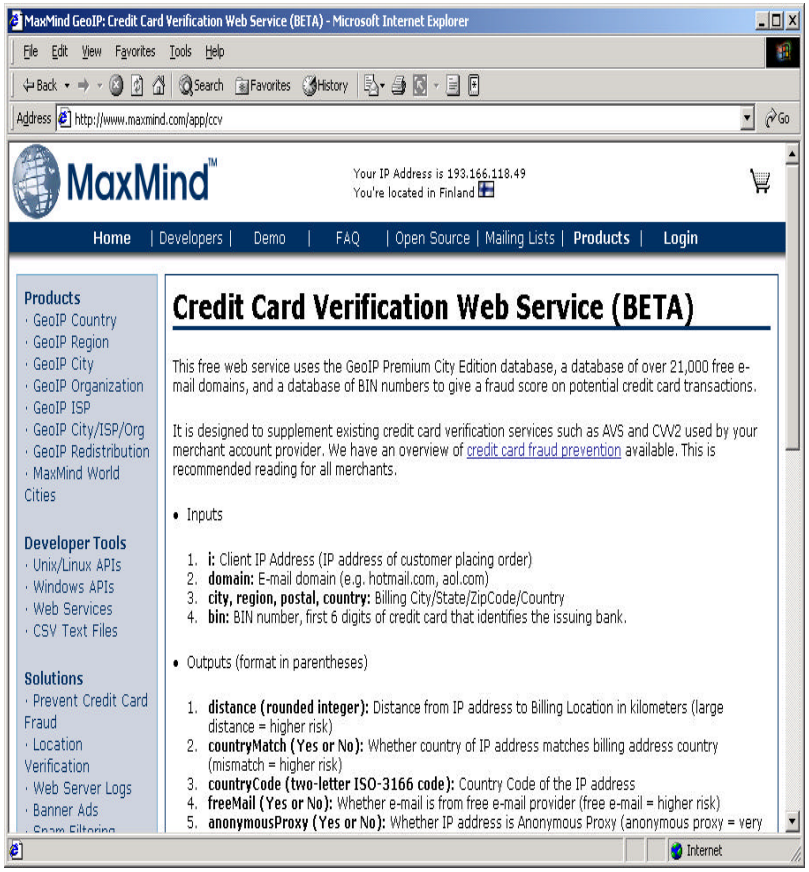
Transactions and WS

- (e.g. the line of my mobile phone drops, my manager has booked in another more important meeting for me for the relevant dates, no suitable flights are available, it turns out that no car hire is necessary as the client site is close to the airport, my client company's staff are not available to see me for the specified dates)?
- How would billing be handled?



http://www.maxmind.com/app/ccv

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Middleware and WS

- Up to now, conventional wisdom suggests that organizations need to implement an "open middleware" to enable scalability and future-proofing and the businesses of large segments of the software industry are based on this premise.

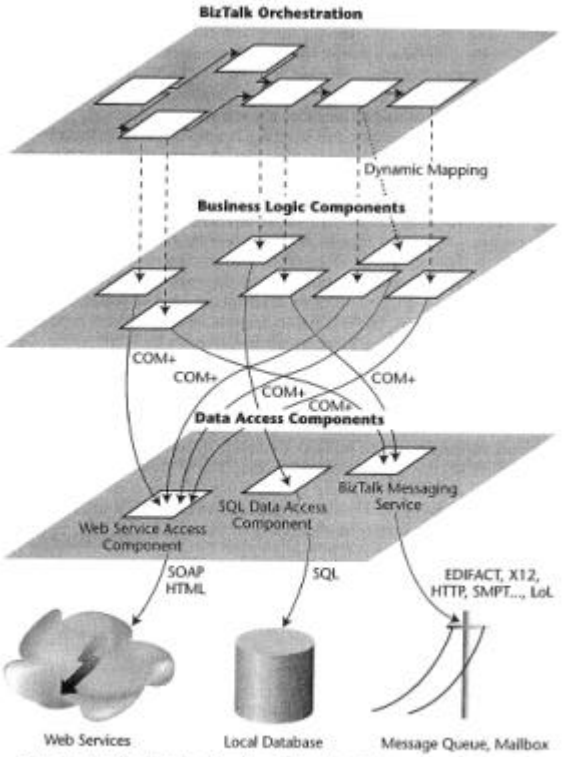

Figure 11.3 The layered architecture of BizTalk. Orchestration is defined on an abstract level. The abstract tasks are dynamically mapped onto concrete implementations—business logic components. These make use of data access components to access Web services, databases, and messaging services.

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Horizontal and vertical businesses

- The Internet and the Web have already transformed vertical sectors such as travel and personal financial services. Traditional intermediaries whose businesses were based on information are replaced by those who focus on advice and other more customer oriented services.

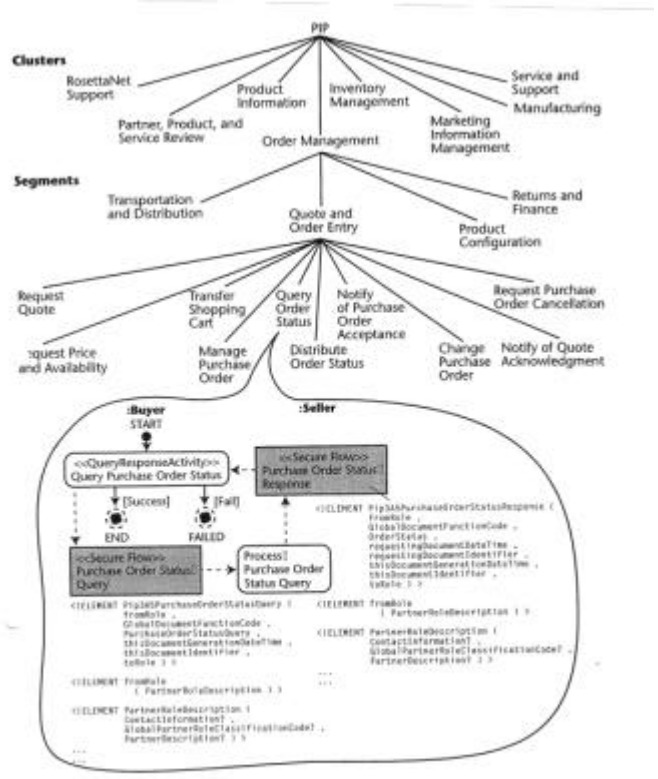

Figure 11.1 Hierarchy of predefined PIPs in RosettaNet (Version 2.0). Each PIP describes a specific collaborative process between partners. Here, we have drilled down into the busir object view of the PIP `QueryOrderStatus`. We have also listed the beginnings of the DTDs the two business documents exchanged in this process: `PurchaseOrderStatusQuery` and

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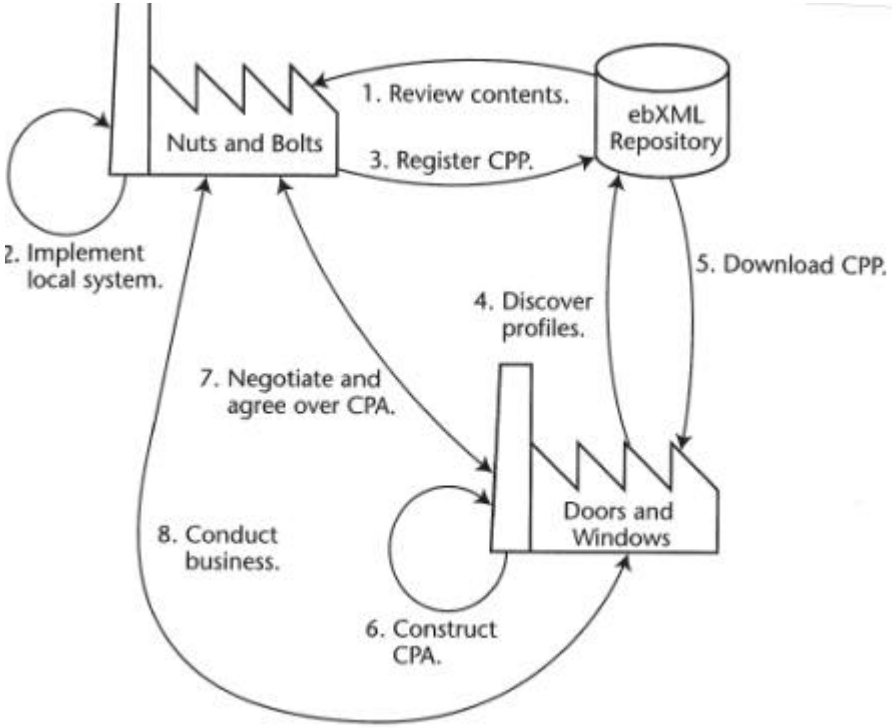
WS interaction

- These include the relationships between IT and businesses, the interdependencies or otherwise between technology drivers and business driver, as well as the management and governance aspects of essential services over the Internet as part of the fabrics of the business world



igure 10.1 Registration, discovery, and negotiation in ebXML.

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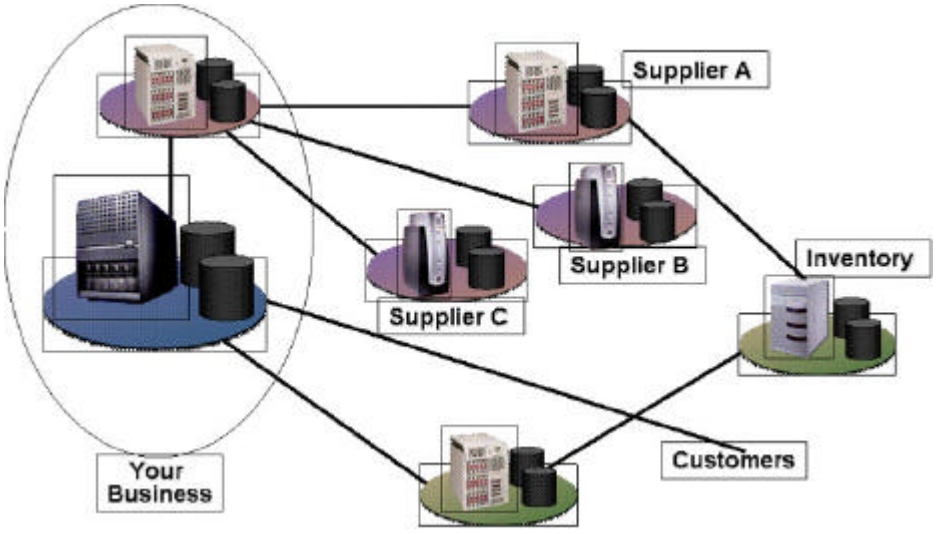
Global commerce

- The Internet has commoditized communications - every person and machine can potentially connect to a global network. In the full vision, Web Services increase communications exchange -- message exchange between any two persons and arbitrary systems is not only possible, but seamless



the world of Web Services also includes a myriad of "plumbing" such as queuing, policy management, access control, security, metering etc.

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Peer to peer networking

Grid computing

- Web Services networks have been described as "outsourced middleware", but with a new twist -- middleware is no longer a typically modularized software platform to support multiple applications

http://www.globus.org/

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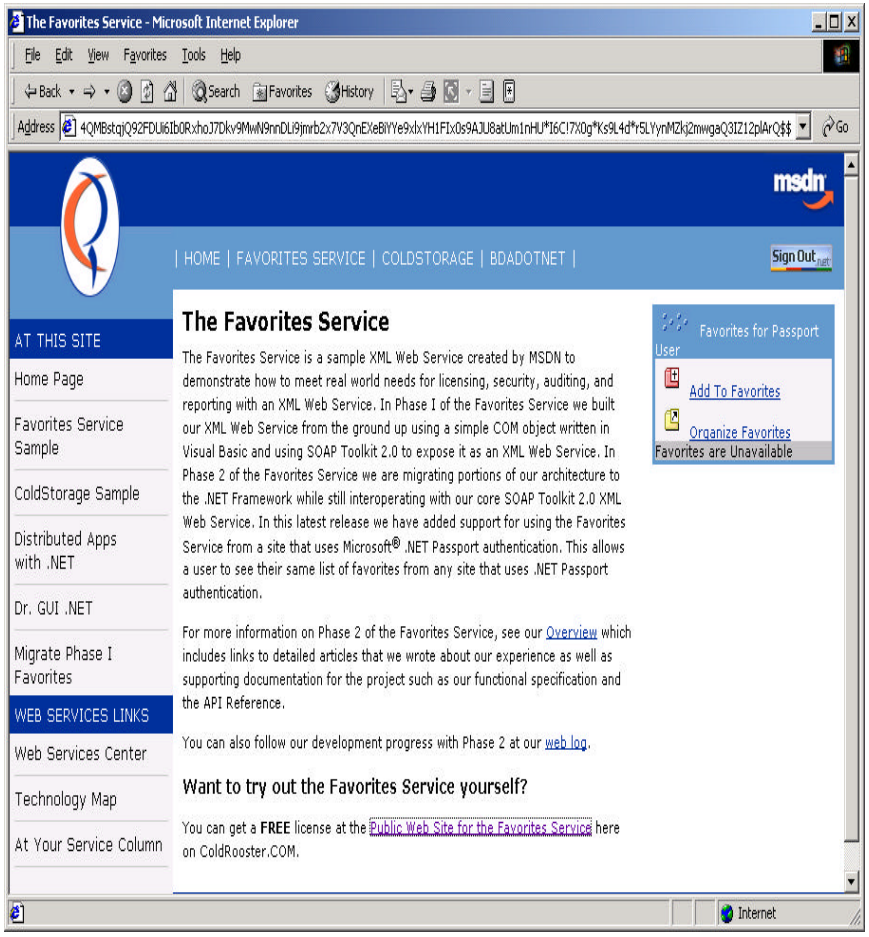
Personalization and WS

- customized and personalized services to new heights and into more vertical sectors. If, as has been claimed, all services that are accessible by human beings
- potentially accessible as well as processable by machines, then we can only begin to glimpse at the possibilities of the transformations that Web Services are to bring



http://www.coldrooster.com/favorites.aspx

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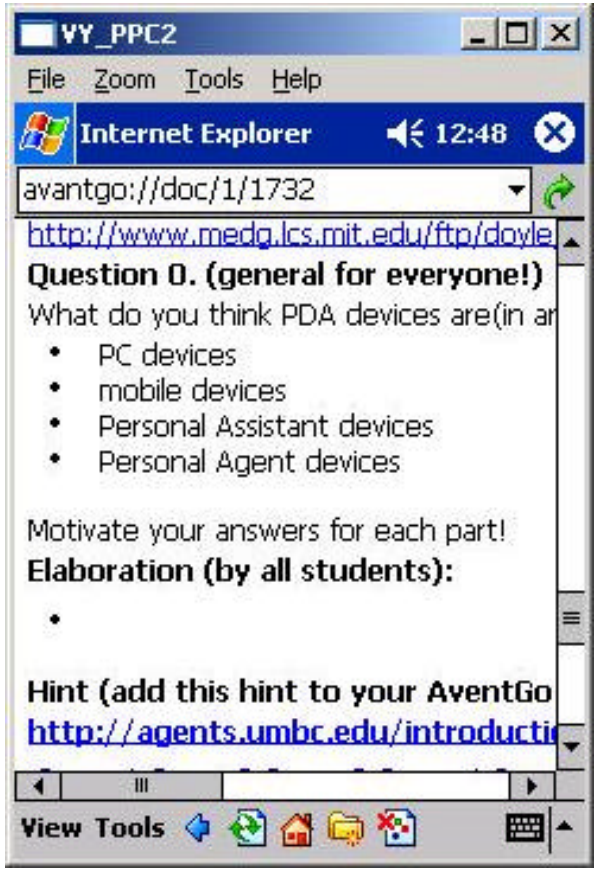
Ubiquity and WS

- The overall vision of access to any information, from any device, at any time is an extremely powerful one
- in doing so, Web Services have also opened up some of the most fundamental issues about IT



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Conclusions

- XML is a standard appreaciated by many
- XML standards provide ways for data storage, management, manipulation and communication
- with web services one gets methods (and software compoments) on the web

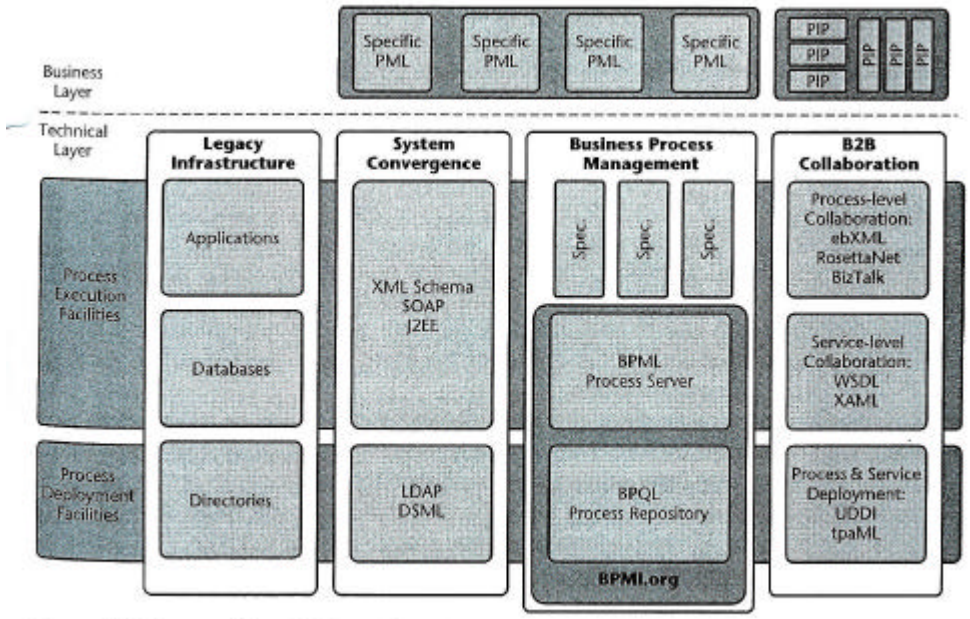

Figure 5.13 Scope of the BPMI specifications.

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  http://www.acm.org/ubiquity/views/f_coyle_1.html
- Daum, Merten: System Architecture with XML, 2003
- Diffuse project, http://www.diffuse.org/WebServices.html

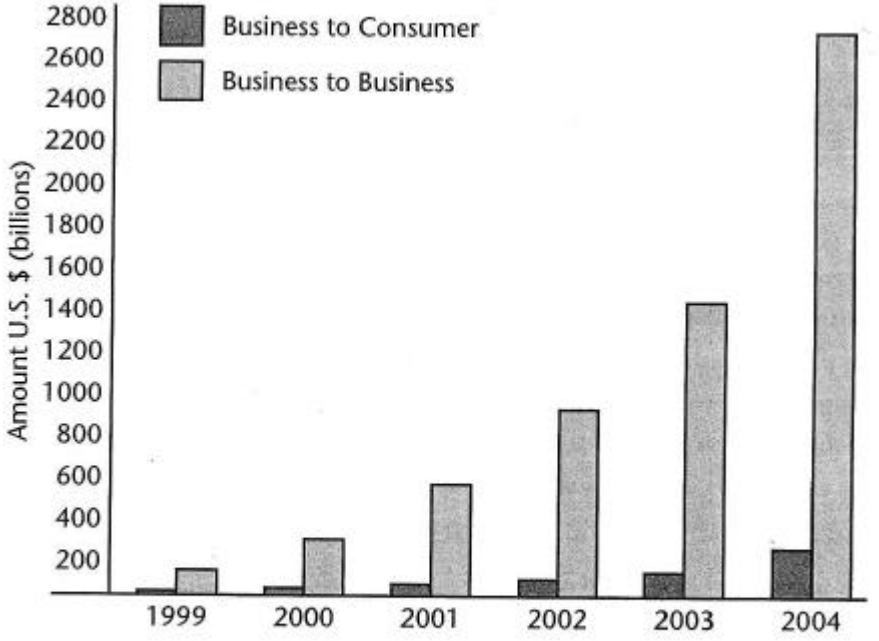

Figure P.2 A forecast showing the phenomenal growth of U.S. electronic business, especially in the area of business-to-business (B2B). (Source: Forrester Research.)

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