

Web Services Architectures

An introduction to the course at the University of Helsinki

January 26th – March 18th 2004

Suresh Chande

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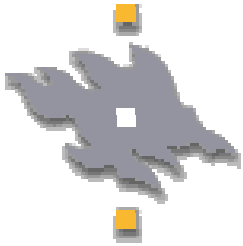
My room: A323a,

only on urgent matters use : 05048373281, start with SMS ☺

Department of Computer Science

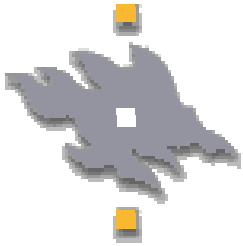
Course Web Page:

<http://www.cs.helsinki.fi/u/chande/courses/cs/WSA/>

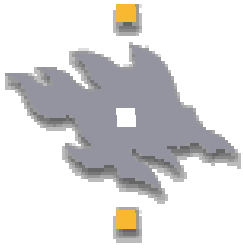


In brief

- This Seminar/Course aims to give an in-depth understanding of the Web Architectures and specifically the developments of Web in the Web Services arena.
- The goal of this course is to develop competence in the upcoming new web technologies and understanding the potential strengths and pitfalls of each of these technologies.
- The course will be scheduled twice a week and will be aided by report and seminar as a requirement to complete the course by the students
 - **Course location:** Room B450
 - **Lectures:** 2-4 /week
 - **Course Schedule:** 26.1.2004 - 18.3.2004 / Mon 16-18, Thu 16-18
 - **Report deadline:** February 12th / Review deadline : February 23rd
 - **Seminar article:** Deadline March 25th
 - **Presentation:** 1 – 1½ hour per seminar topic
 - Room Number : C474
 - Time: 8:30-17:00 hrs
 - Date : 31st March & 1st April 2004



A brief introduction to ourselves

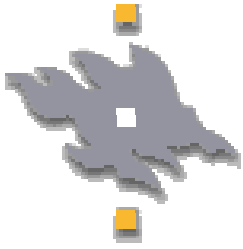


Introduction

- Web Services are the next evolution in the Web (WWW):

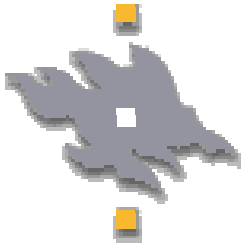
The resources over the web are made accessible through a XML based programmatic access. The solution provided by Web Services are agnostic to the platform, vendor tools, and development environment and at the same time build on top of the widely utilized Web technologies (HTTP, SMTP, FTP, XML, XML Schema).

- In this course we will understand the core technologies utilized in the Web Services
- Utilize the core technologies to develop a basic understanding of how the different web technologies and architectural components fit together.
- The course should give the participant a good understanding of Web Services and their potential strengths and pitfalls in several application areas.



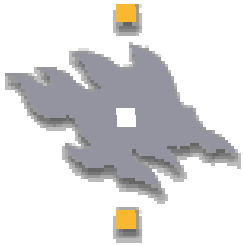
Participation in the Course

1. Lectures
2. Study Report: Discussions defending and offending the potential strengths and pitfalls of specific Web Services technology elements and concepts behind them.
3. A Seminar presentations on Web Services technologies



Course Overview

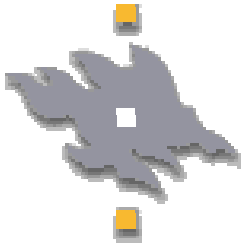
- **Introduction** 26 Jan 2004
 - Course Overview, Reports ,Seminar Topics
- **Web Evolution** 29 Jan 2004
- **Web Services Architectures**
 - Web Services overview 2nd Feb 2004
 - REST (5 Feb No class) 9th Feb 2004
 - Semantic Web Services 12th feb 2004
- **Web Services Core Technologies**
 - XML Schema 16th Feb 2004
 - SOAP 19th Feb 2004
 - WSDL
 - UDDI 23rd Feb 2004



Course Overview

26th Feb 2004

- **Seminar Review**
 - Students seminar discussion
 - (5 min brief presentation)
- **Web Services Standardization Efforts**
 - W3C & OASIS
 - OMA & LIBERTY
 - WS-I
- **Advanced Web Services Technologies and Architectures**
 - Web Services Workflows
 - Service oriented Architecture
 - Enterprise Service Bus
- **Web Services Critical issues**
- **Student Work:**
 - Reports (<http://www.cs.helsinki.fi/u/chande/courses/cs/WSA/Report.html>)
 - Seminars (<http://www.cs.helsinki.fi/u/chande/courses/cs/WSA/Seminar.html>)

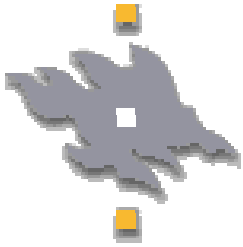


Study Report

Discussions defending and offending the potential strengths and pitfalls of specific Web Services technology stack elements and concepts behind them.

The topics are related to the Web Services Stack Elements (See Next Slide).

- Each topic is allocated to a student, (topics will be listed on the course page)
- What is Expected:
 - A 10 page report which will be an effort of 20-25hours **deadline 12th February / Hard deadline:16th February**
 - 2 Review reports each of 1-2 pages long, which should be an effort of 8-10 hours **-deadline 23rd February / Hard deadline: 27th February**



Report Topics

- Reliability
- Addressing
- Transaction
- Eventing
- Notification
- Resource Framework
- Security
- Federation
- Policy
- Trust

Send me an email by **27th January 18:00hrs** if you are particular about a specific topic, Your name will be listed against a topic by 28th on the course web page.

You could propose topics here too

- **Web Services Workflows**

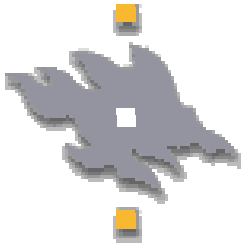
- BPEL4WS
- WSCI
- BPML
- CAF

- **Web Services User Interactions**

- WSRP[OASIS]

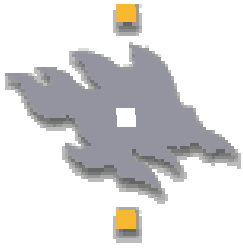
- **Web Services Discovery**

- Global -> UDDI [OASIS]
- Site local -> WSIL [IBM/Microsoft]



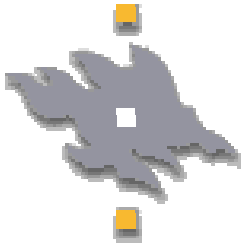
Reference Links

- **Web Services Addressing:**
 - WS Addressing : <http://www-106.ibm.com/developerworks/webservices/library/ws-add/>
- **Web Services Reliability**
 - WS Reliability: <http://www.oasis-open.org/committees/download.php/4889/WS-Reliability-2004-01-06.pdf> - 6th January 2004
 - WS ReliableMessaging: <ftp://www6.software.ibm.com/software/developer/library/ws-reliablemessaging.pdf>
- **Web Services Transaction**
 - WS-Automatic Transaction: <ftp://www6.software.ibm.com/software/developer/library/ws-atomictransaction.pdf>
 - WS-Transaction: <http://dev2dev.bea.com/techtracks/ws-transaction.jsp>



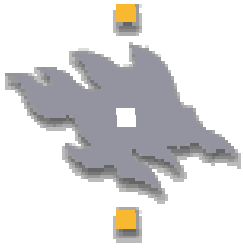
Reference Links

- **WS Eventing**
 - <http://ftpna2.bea.com/pub/downloads/WS-Eventing.pdf>
- **WS Federation**
 - <ftp://www6.software.ibm.com/software/developer/library/ws-fed.pdf>
- **WS Notification**
 - <http://www-106.ibm.com/developerworks/library/ws-resource/ws-notification.pdf>
- **WS Resource framework**
 - <http://www-106.ibm.com/developerworks/webservices/library/ws-resource/>



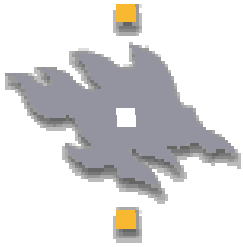
Reference Links

- **WS Security**
 - <http://www.oasis-open.org/committees/download.php/5072/oasis-200401-wss-soap-message-security-1.0.pdf>
- **WS Trust**
 - <http://www-106.ibm.com/developerworks/library/ws-trust/>
- **WS Policy**
 - <ftp://ftpna2.bea.com/pub/downloads/WS-Policy.pdf>



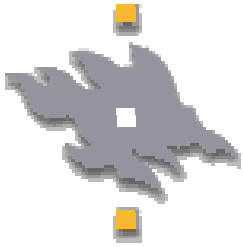
Reference Links

- **Workflows:**
 - Article comparing WSCI & BPEL4WS
 - <http://www.webservices.org/index.php/article/articleview/1178/1/24/?PHPS ESSID=1e93ba7f6299712243c124d8130f6179>
 - **WSCI**
 - <http://www.sun.com/software/xml/developers/wsci/>
 - <http://www.w3.org/TR/wsci/>
 - <http://www.w3.org/2002/ws/chor/>
 - **BPEL4WS**
 - <http://www-106.ibm.com/developerworks/library/ws-bpel/>
 - http://www.oasis-open.org/committees/tc_home.php?wg_abbrev=wsbpel
 - **BPML**
 - <http://www.bpml.org/bpml-downloads/BPML-PR-2003.zip>



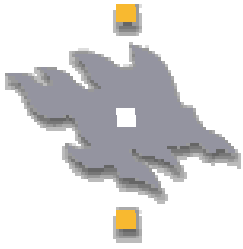
Reference Links

- **CAF (Group of 2)**
 - http://www.oasis-open.org/committees/documents.php?wg_abbrev=ws-caf
 - WS Co-ordination
 - WS Context
 - WS Transaction Management
- **WSRP**
 - WSXL : <http://www-106.ibm.com/developerworks/library/ws-wsxl/>
 - WSRP: <http://www.oasis-open.org/committees/download.php/3343/oasis-200304-wsrp-specification-1.0.pdf>
- **UDDI 2.0 (Group of 2)**
 - <http://www.oasis-open.org/committees/uddi-spec/doc/tcspecs.htm#udiv2>
- **WS Inspection Language:**
 - <http://www-106.ibm.com/developerworks/webservices/library/ws-wslover/> & the specification at: <http://www-106.ibm.com/developerworks/webservices/library/ws-wsilspec.html>



Seminar

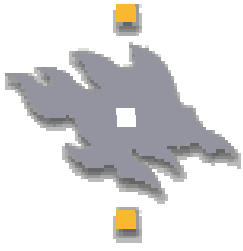
- Each topic is allocated to a student or a group(2-3) of students , Final list of topics will be updated on the course page by **the 1st of February 2004.**
- What is required to be done ?
 - A. **Make a brief informal topic presentation – 26th February**
 - B. **Write an article (20-25 page) – hard deadline March 25th**
 1. Background theory study, what is the reason for its existence
 2. What is the current status
 3. Standardization in this topic
 4. Potential Limitations & Strengths
 5. Advantages / disadvantages over existing solutions
 6. Applications and use cases for this topic
 7. Future research developments
 8. Utilise as much of the results of the reports generated with cross references as possible
 - B. **1 hour seminar presentation on: March 31st / April 1st**
- What will be provided as a starting point ?
 1. List of topics **(You can also propose any new topics of your interest by the 31st of Jan)**
 2. Reference links



Seminar Topics

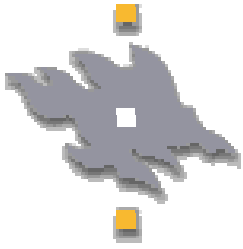
Updated List of Topics will be available by the 1st of February

- **Web Services as a technology for Enterprise Application Integration**
- **Web Services technologies applied to Business Processes automation**
 - Refer to Web Services Workflows (BPEL4WS, WSCI, BPML, etc) in W3C and OASIS
- **Web Services as a technology for Hand Held mobile devices**
 - A Web Services Strategy for Mobile Phones :
<http://webservices.xml.com/pub/a/ws/2003/08/19/mobile.html>
 - http://www.microsoft.com/serviceproviders/mobilewebservices/mws_tech_roadmap.asp
 - http://www.microsoft.com/serviceproviders/mobilewebservices/mws_whitepaper.asp
 - <http://www.microsoft.com/serviceproviders/mobilewebservices/>
 - <http://www.alphaworks.ibm.com/tech/wstkmd/>



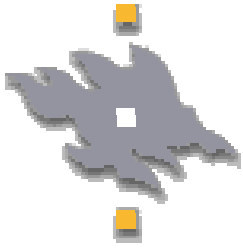
Seminar Topics

- **Web Services in Gridcomputing**
 - Convergence of Web Services and grid Computing: http://www.infoworld.com/article/04/01/20/HNgridspecs_1.html
 - The Physiology of the Grid: http://www.gridforum.org/ogsi-wg/drafts/ogsa_draft2.9_2002-06-22.pdf
 - Towards open Grid Services : <http://www.globus.org/ogsa/>
 - Grid Web Services and Application Factories : <http://www.extreme.indiana.edu/xgws/afw/appFactory.pdf>
 - IBM's White Paper : <http://www-106.ibm.com/developerworks/library/ws-resource/ws-modelingresources.html>
 - Web Services resource Framework : <http://www-106.ibm.com/developerworks/library/ws-resource/index.html>
- **RESTful Web Services**
 - <http://www.ics.uci.edu/~fielding/pubs/dissertation/top.htm>
 - <http://conveyor.com/RESTwiki/moin.cgi>
 - <http://www.xfront.com/REST-Web-Services.html>
 - <http://www.nwfusion.com/ee/2003/eerest.html>
 - <http://www.prescod.net/rest/>
 - <http://www.sys-con.com/xml/article.cfm?id=454&count=5105&tot=2&page=2>



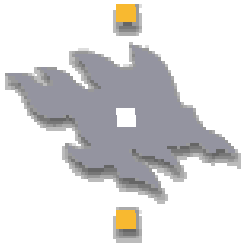
Seminar Topics

- **Web Services in Office Environment (for e.g: Web Service accessible from Office applications, office 2003(Microsoft))**
 - Starting point reference Link :
http://www.msdn.microsoft.com/library/default.asp?url=/library/en-us/dnxpwst2/html/odc_offxpwstoolkit2.asp
- **Semantic Web Services**
 - <http://www.w3.org/2002/ws/swsig/>
- **Service Oriented Architecture**
 - <http://www.service-architecture.com/>
- **Enterprise Service Bus**
 - http://searchwebservices.techtarget.com/tip/1,289483,sid26_gci913058,00.html
 - <http://www.techmetrix.com/trendmarkers/publi.php?C=2EOKO>
 - IBM's redbook

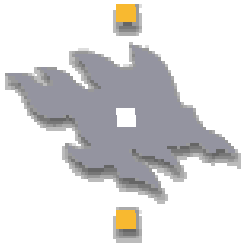


Seminar Topics

- Web Service Discovery
 - Local(WSIL, DISCO) vs Global Discover (UDDI)
- Service Management & Deployment
- Web Services Security
- Web Services Reliability
- Routing and the role of Web Services Intermediaries
- RPC Vs Document Style
- Peer 2 Peer Web Services
 - <http://www.webservicesarchitect.com/content/articles/samtani05.asp>
 - <http://www.onjava.com/pub/a/onjava/2001/10/24/jxta.html>
 - <http://www.intel.com/update/departments/initech/it09016.pdf>
- Message oriented Middleware and Web Services Reliability
IBM's redbook.



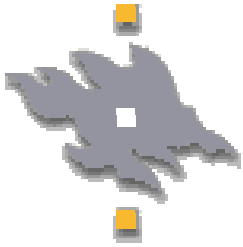
A Brief Discussion of Web Services



Web Services - Definition

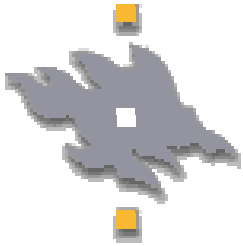
Web Services are the means of exposing services of an organization, enterprise or any sort of service provider to its consumers or partners over the Web utilizing open Web-based standards, which are agnostic to development platform used, vendor tools and the underlying implementation specifics.

"A Web service is a software system identified by a URI, whose public interfaces and bindings are 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." [W3C]

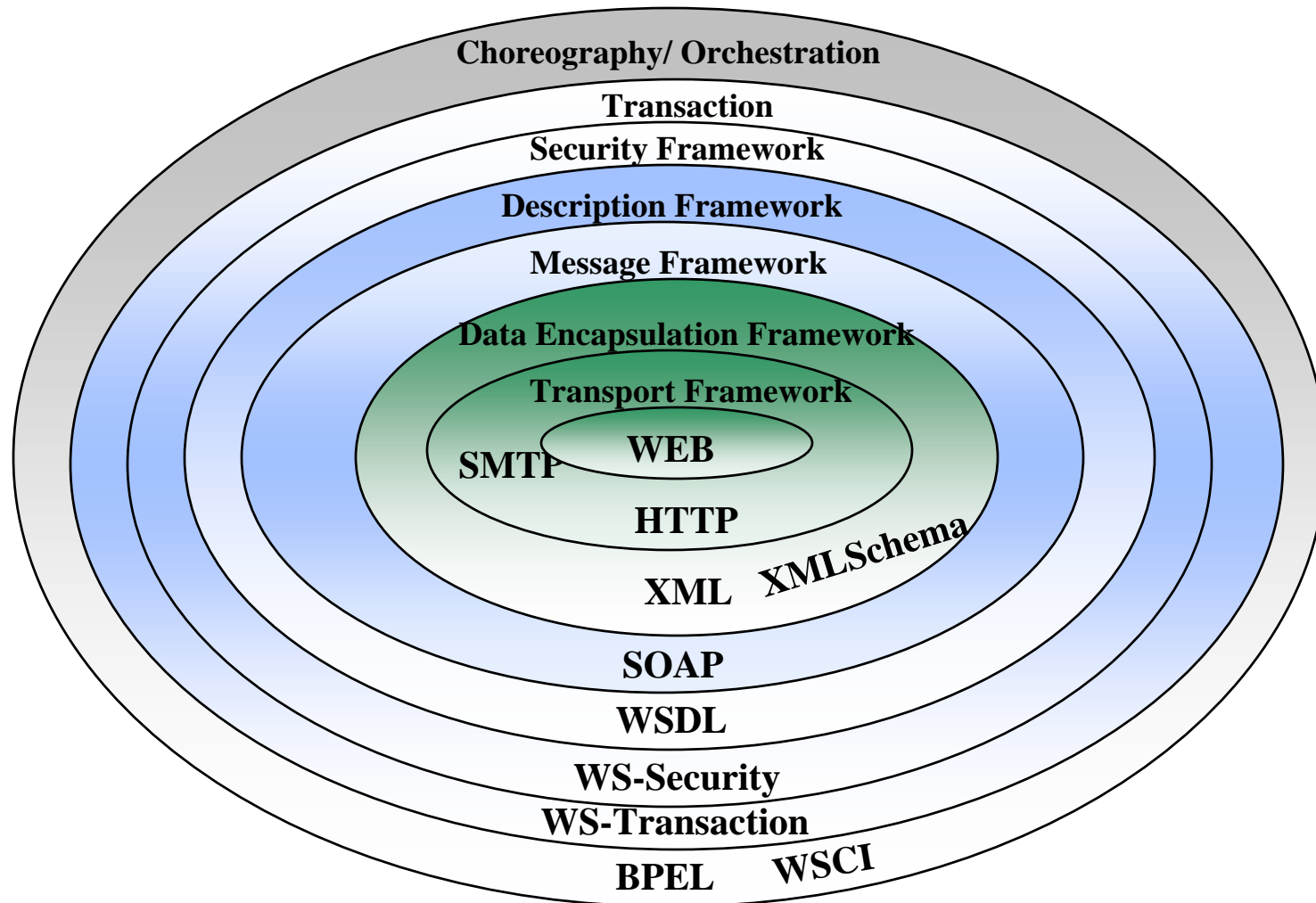


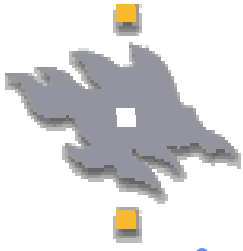
Web Services in a Nutshell

- The next wave of web development – XML based **Programmatic access to the services over the Web.**
- Programmatic access enabled via a set of XML related horizontal Frameworks :
 - Data Encapsulation (XML, XML Schemas).
 - Message Framework (SOAP).
 - Description Framework (WSDL).
 - Security Framework (WS-Security).
 - Discovery Framework (UDDI/ Local WSIL).
 - Transaction (WS-Transaction).
 - Assertions & Authorization (SAML).
 - Choreography & Workflows (BPEL4WS, WSCI)
 - Reliability (WS-Reliability)
 - And many more in the list..



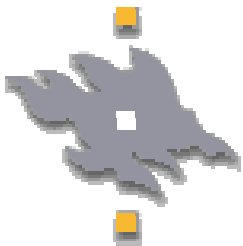
Web Services Basic Technologies



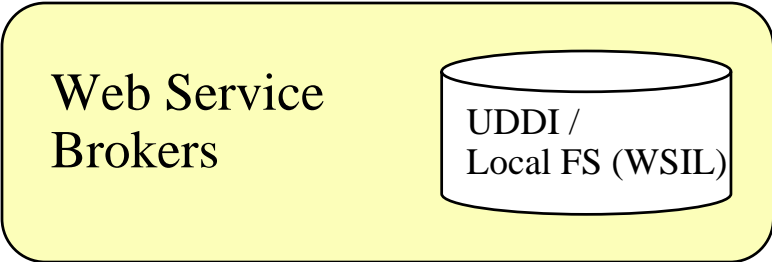


Web Services Architecture

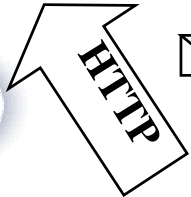
- The basic Web Service Architecture is defined around three main roles for its participants
 - **Web Services Client (WSC):** The Web Service (WS) consuming client system.
 - **Web Services Providers (WSP):** are participants who desire to publish their service as a Web Service
 - **Web Services Brokers (WSB):** Provide WSC a discovery mechanism to find the required service and at the same time provided WSP means of publish and manage the description about the hosted WS.



Web Services Architecture

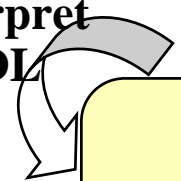


Find and Discover Service Description

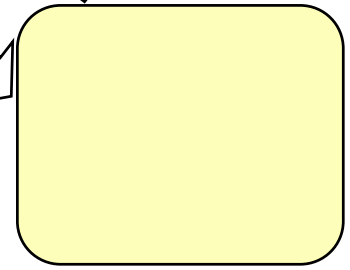


Publish & Manage Service Descriptions

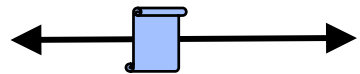
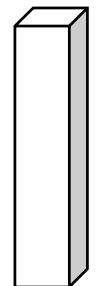
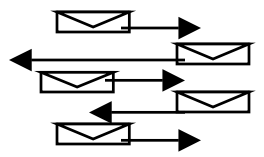
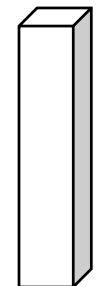
Interpret WSDL



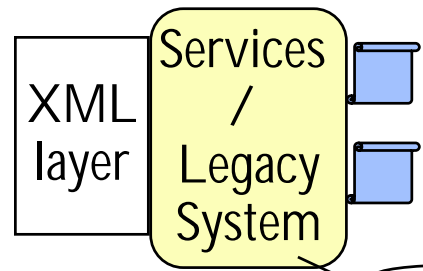
Web Service Consumer



FETCH WSDL



WSDL Document

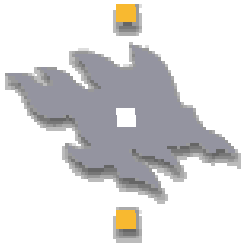


Web Services Provider

 **SOAP Message**

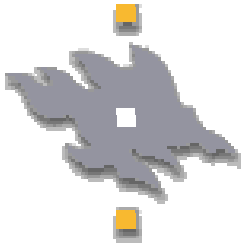
 **Intermediaries**

 **WSDL Document**
Department of Computer Science



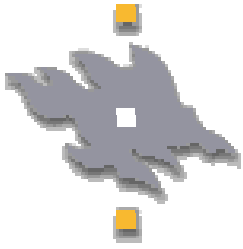
Benefits of Web Services

- Allows **loose coupling** between systems willing to communicate and collaborate.
- Enables agreement on a standard set of protocols
- Open Architecture and applications communications protocols
- **Removes platform dependencies** between the communicating systems
- Introduces **rapid services development**
- **Reduces** Integration costs and **speedens** the integration process
- **Low entry barrier**
- Enable **wider utilization** of the services as it does not dictate a platform specific requirements on the consuming clients.
- Continue to **utilize legacy** systems



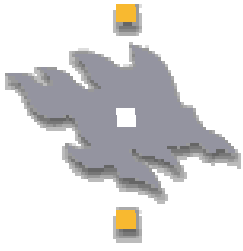
Web Services Hype

- Automatic Business Integration: A Piece of software will automatically discover, access, integrate and invoke new services from unknown companies dynamically without the need for human intervention.
- Seamlessly discover the required services and integrate into existing solutions.
- "Silver bullet", solves all the integration problems that we ever faced in distributed and heterogeneous systems.
- Is ready and available for immediate system development
- Inter-operable and a light weight protocol
- Simple and easy to utilize



Web Services Hype [Contd..]

- A very low learning curve
- Decreases integration cost drastically
- Easy management of services
- Web Services is disruptive technology
- Web Service technologies is revolutionary in nature



Web Services in Reality

- Simple Set of core specifications
 - Communications
 - Message formats
 - Interface Description
 - Publishing & Discovery
- Complexity left out to be dealt by platforms
- A lot of open issues left to be addressed by the infrastructure hosting the web services
- A race for owning IPRs and and proposing new specifications
 - A very complex set of higher level specifications with potential threat for :
 - Inter-operability
 - Easy of development and learning
 - Web Services Manageability
 - Web Services architectures and hosting environments