Introduction to Web Services

Asst. Prof. Dr. Kanda Runapongsa Saikaew
(krunapon@kku.ac.th)
Department of Computer Engineering
Khon Kaen University

Agenda

- Web Technologies
- What is a Web Service?
- Why Web Services?
- Web Services Architecture and Standards
- Where are Web Services?
- Web Services Development

Web Applications (1/2)

- Application delivered to users from a web server over a network such as the World Wide Web or an intranet
- Users usually access Web application via the Web browser
- Human interaction with programs
  - HTML forms
  - Web programming

Web Applications (2/2)

Static Web

HTML

Dynamic Web

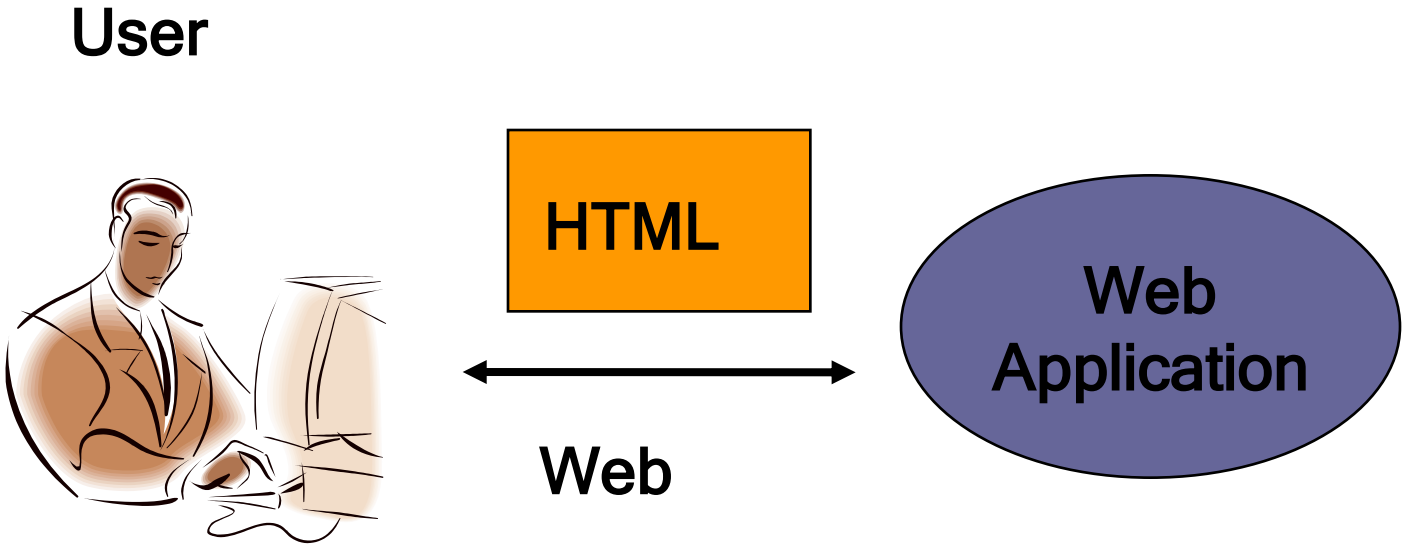
Client Side

- JavaScript
- VBScript

Server Side

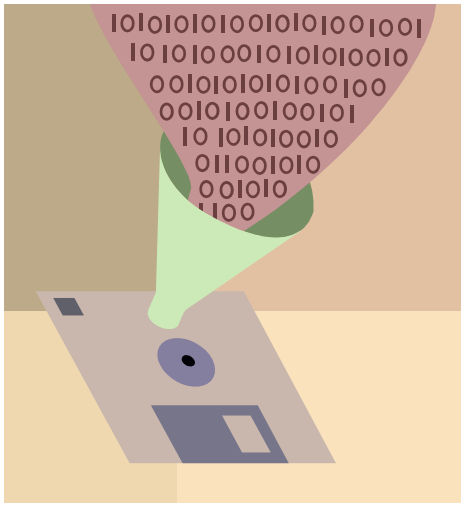
- ASP
- PHP
- JSP

Traditional Web Interaction



Web Services Interaction

Application



XML

Web

Web Service

Web Application vs. Web Services

- Web Application
  - HTML
  - User-to-program interaction
  - Static integration of components
  - Monolithic service
- Web Services
  - XML
  - Program-to-program interaction
  - Dynamic integration of components
  - Service aggregation

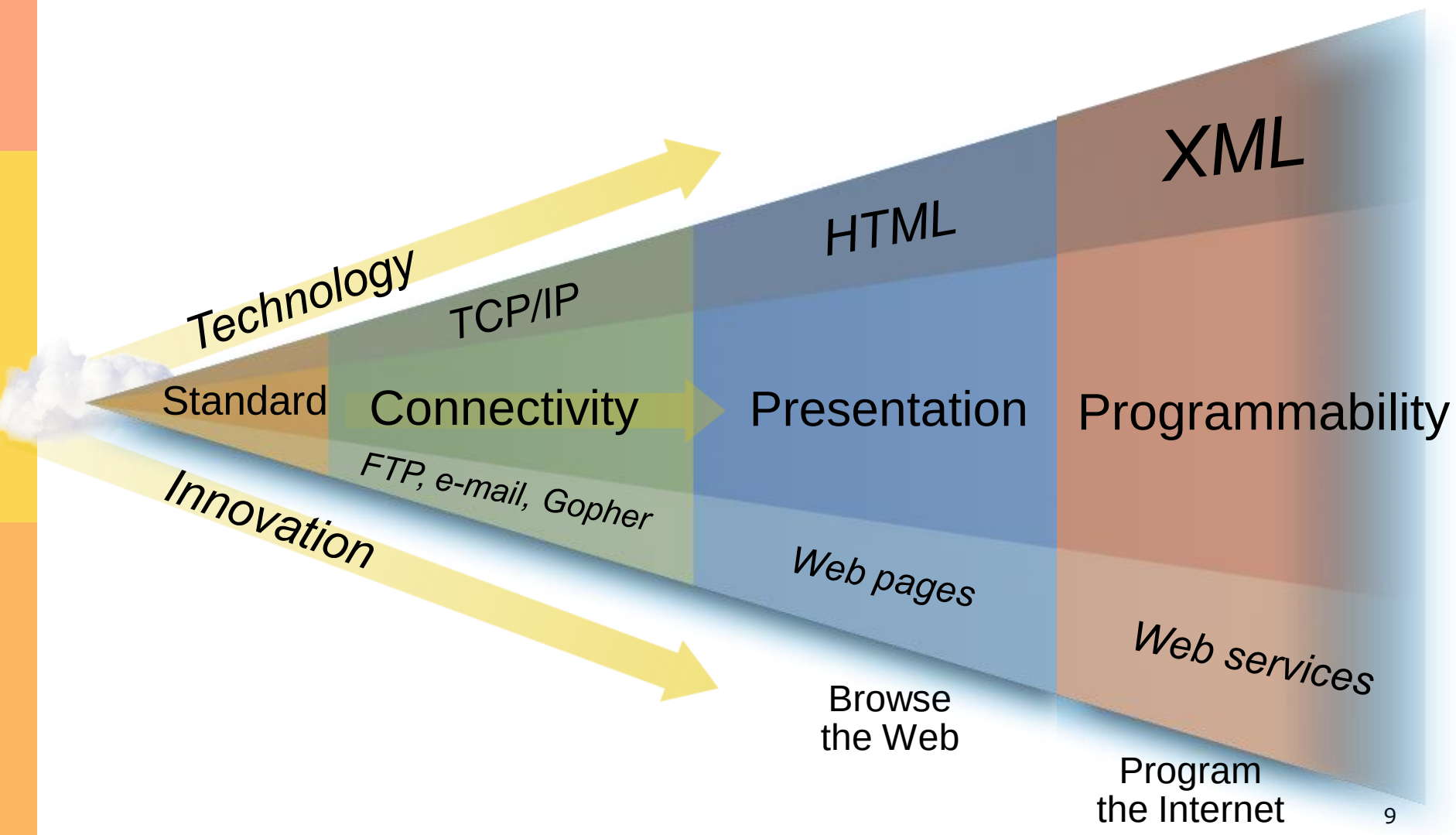
Distributed Computing Technologies

Client-server silos

Web-based computing

Web Services/Peer-to-Peer

Internet Evolution



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- **What is a Web Service?**
- Why Web Services?
- Web Services Architecture and Standards
- Where are Web Services?
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Where do Web Services come from?

- This is not certain, but the term Web Services appears to have originated as an answer to the question “What are you developing SOAP for?”
- The main evidence for this is the chaotic nature of replies to the question “What is a Web Service?”

What are Web Services? (1/5)

- The term Web Services refers to an architecture that allows applications to talk to each other. Period. End of statement
  - By Adam Bosworth

What are Web Services? (2/5)

- Web Services are enabling technologies that facilitate the assembly and integration of applications in order to create new, more meaningful and/or more user-specific applications, all at the speed of the Internet.
  - By HEKATE (Higher Education Knowledge and Technology Exchange), "Web Services Enabling Technology for Application Integration and Assembly"

What are Web Services? (3/5)

- Basically, Web Services are a means of allowing applications to talk to one another using XML (Extensible Markup Language) messages sent via the standard Web protocol of HTTP (HyperText Transfer Protocol is used to request Web pages from Web servers, and combines it with XML to pass structured information back and forth between computers).
  - By http://www.convergemag.com/magazine/story.phtml?id=30079

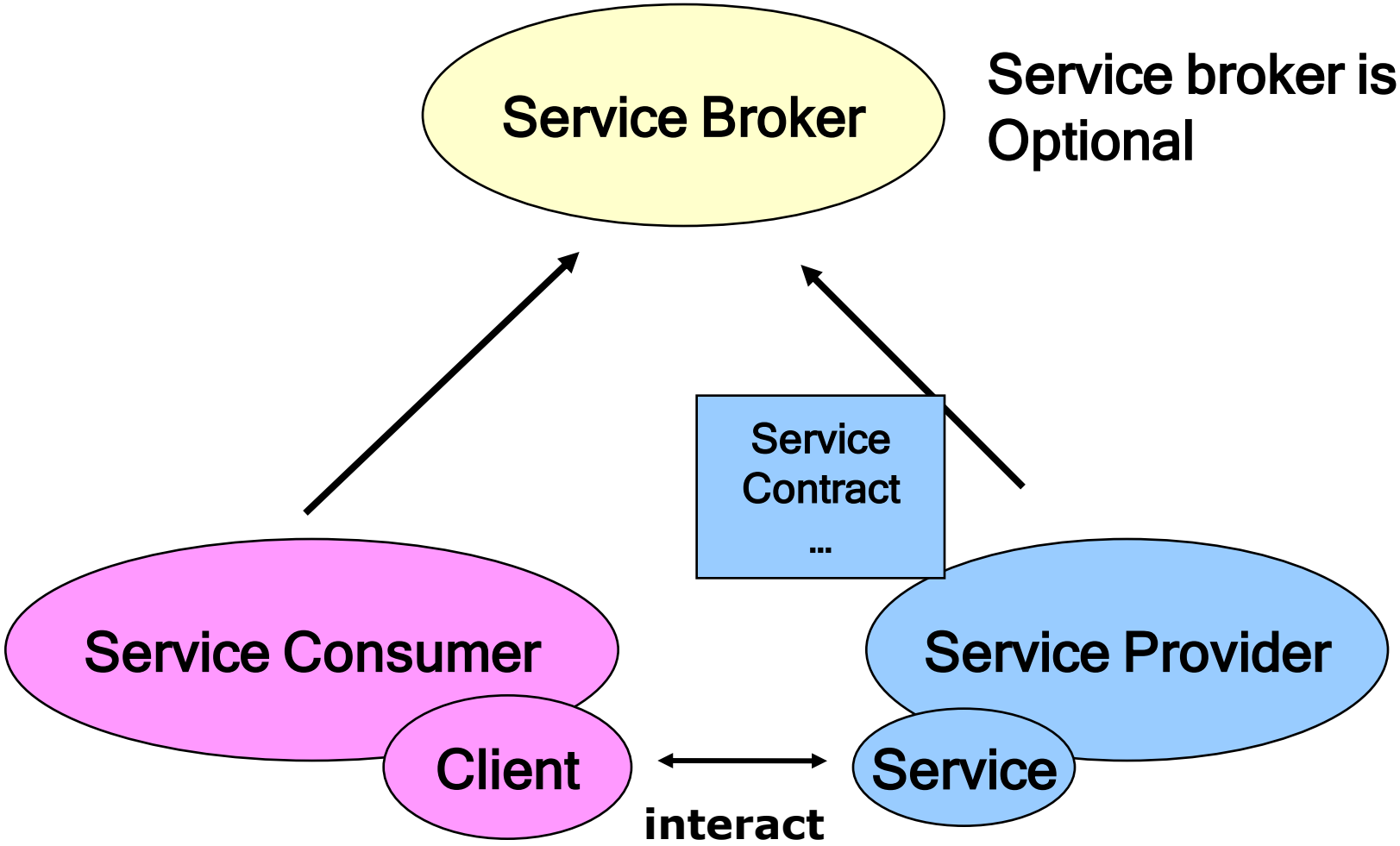
What are Web Services? (4/5)

- [1] A Web service is a software system identified by a URI [RFC 2396], 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.
- [2] A collection of EndPoints. [WSD Reqs]
  - By W3C Web Services Glossary

What are Web Services (5/5)

- Distributed system
- In which applications communicate with applications
- via XML messages
  - By C. M. Sperberg-McQueen, W3C
- Everything else follows from this. Most obviously:
  - messaging (e.g. SOAP, XML)
  - description (e.g. WSDL, XML Schema)
  - discovery (e.g. UDDI)
  - security (e.g. TLS, SSL)

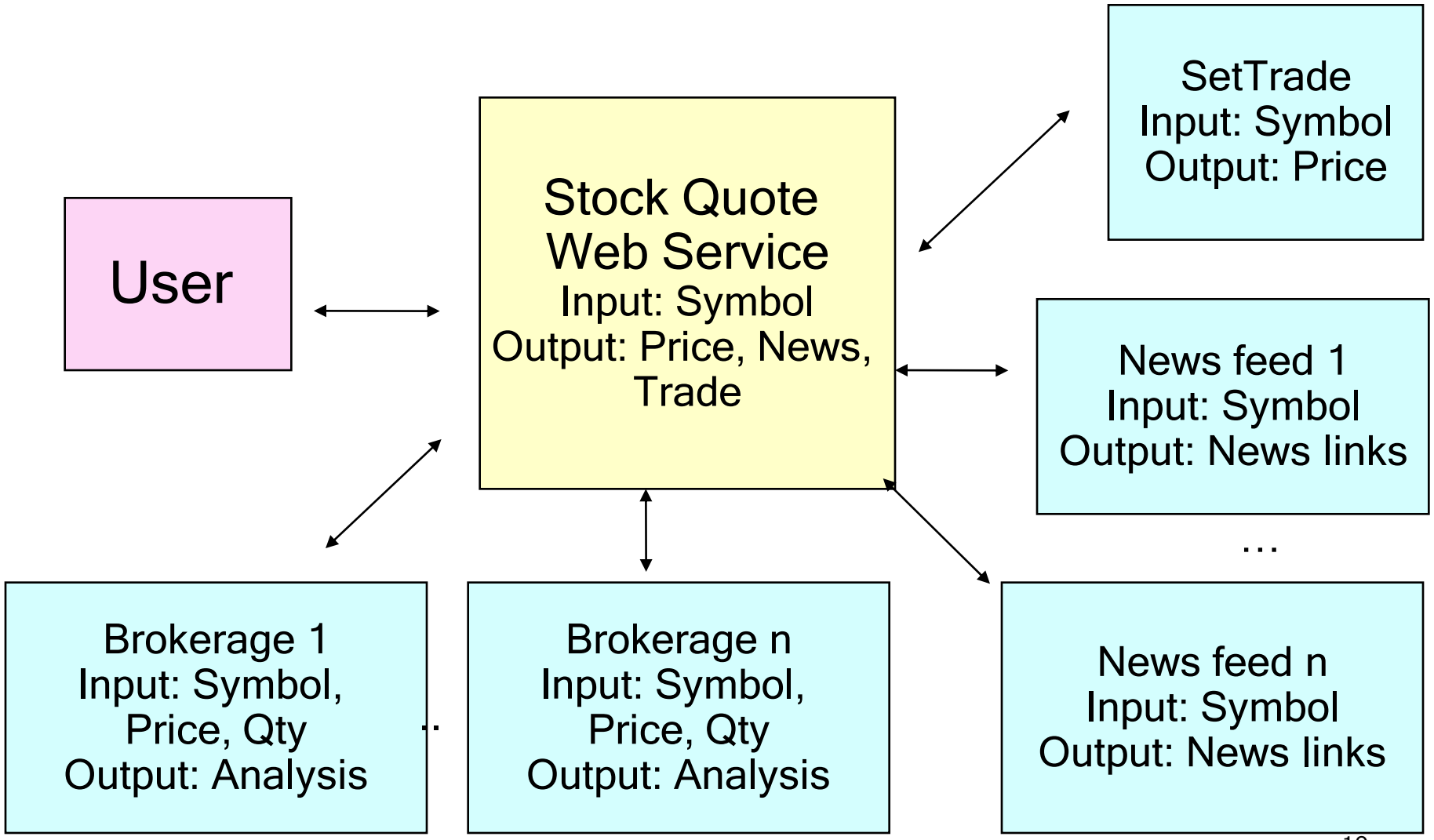
Service-Oriented Architecture



Characteristics of Web Services

- XML based everywhere
- Message-based
- Programming language independent
- Could be dynamically located
- Could be dynamically assembled or aggregated
- Accessed over the internet
- Loosely coupled
- Based on industry standards

Sample Web Service



Sample Web Services Usage Scenario

- E-commerce: order books, office supplies, other products
- Track packages: UPS, FedEx
- Weather forecast
- Search location on Maps
- Telephone redirection, customizable rules and messages

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Web Services Enabled through XML

New user experience
Software for smart device
Connected Web services

Enabled through XML

Why Web Services? (1/3)

- Platform neutral
- Accessible in a standard way
- Accessible in an interoperable way
- Use simple and ubiquitous tools
- Relatively cheap
- Simplify enterprise integration

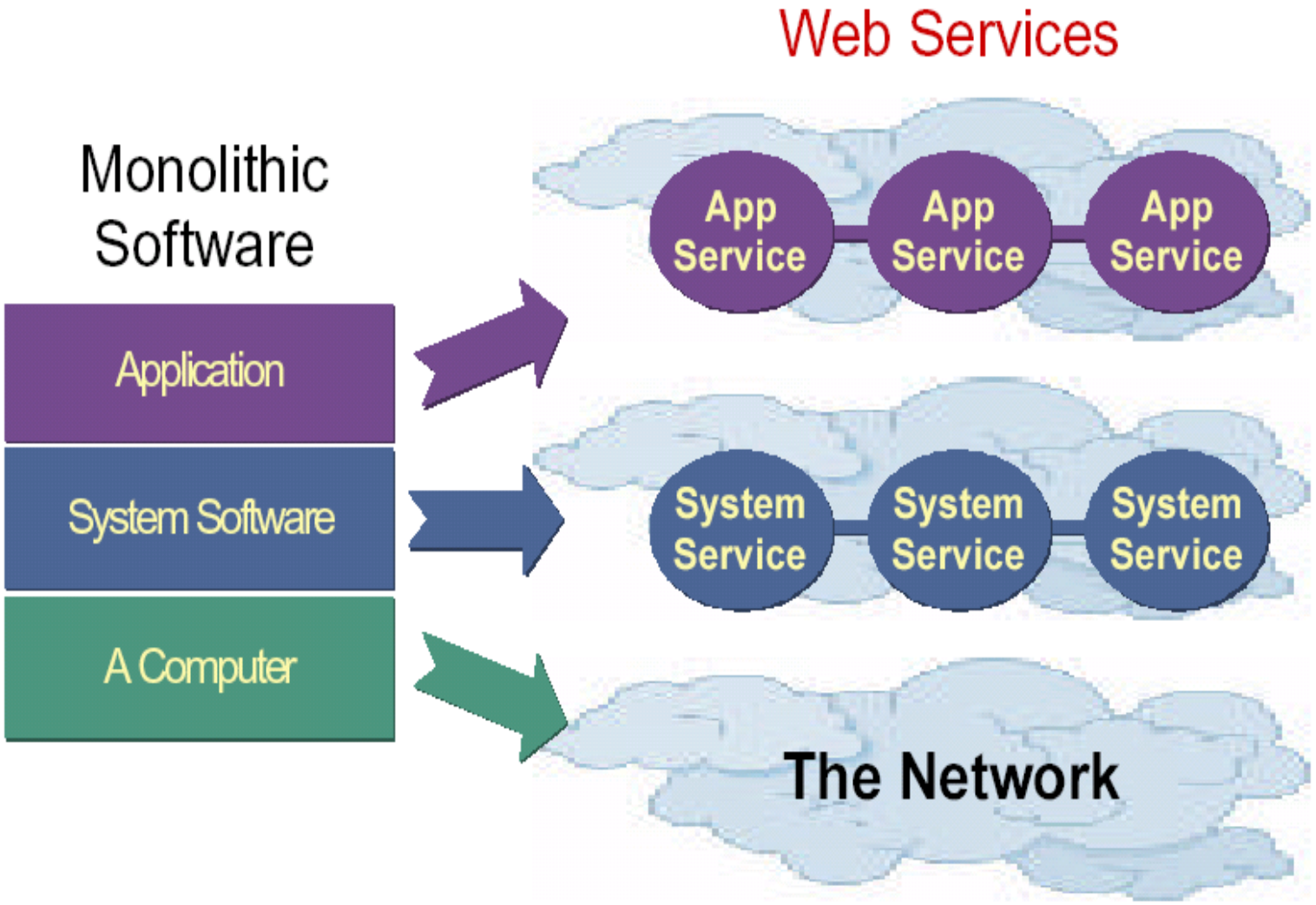
Why Web Services? (2/3)

- Interoperable – Connect across heterogeneous networks using ubiquitous web-based standards
- Economical – Recycle components, no installation and tight integration of software
- Automatic – No human intervention required even for highly complex transactions

Why Web Services? (3/3)

- Accessible – Legacy assets & internal applications are exposed and accessible on the Web
- Available – Services on any device, anywhere, and anytime
- Scalable – No limits on scope of applications and amount of heterogeneous applications

Impact of Web Services



Myths about Web Services (1/2)

- Web Services are something completely new
  - Web services is distributed computing all over again – only now it is based on the web
  - Web services are XML-based
- You have to write Web Services from scratch
  - Tools available for developing Web services, such as MS .NET, Apache Axis, J2EE, and Systinet

Myths about Web Services (2/2)

- Web services require only SOAP, WSDL, and UDDI
  - We need more high-level semantics
- Web services are based on the RPC paradigm
  - Document-driven model would be more popular communication model
- Web services must be based on HTTP
  - Other transports such as SMTP can also be used

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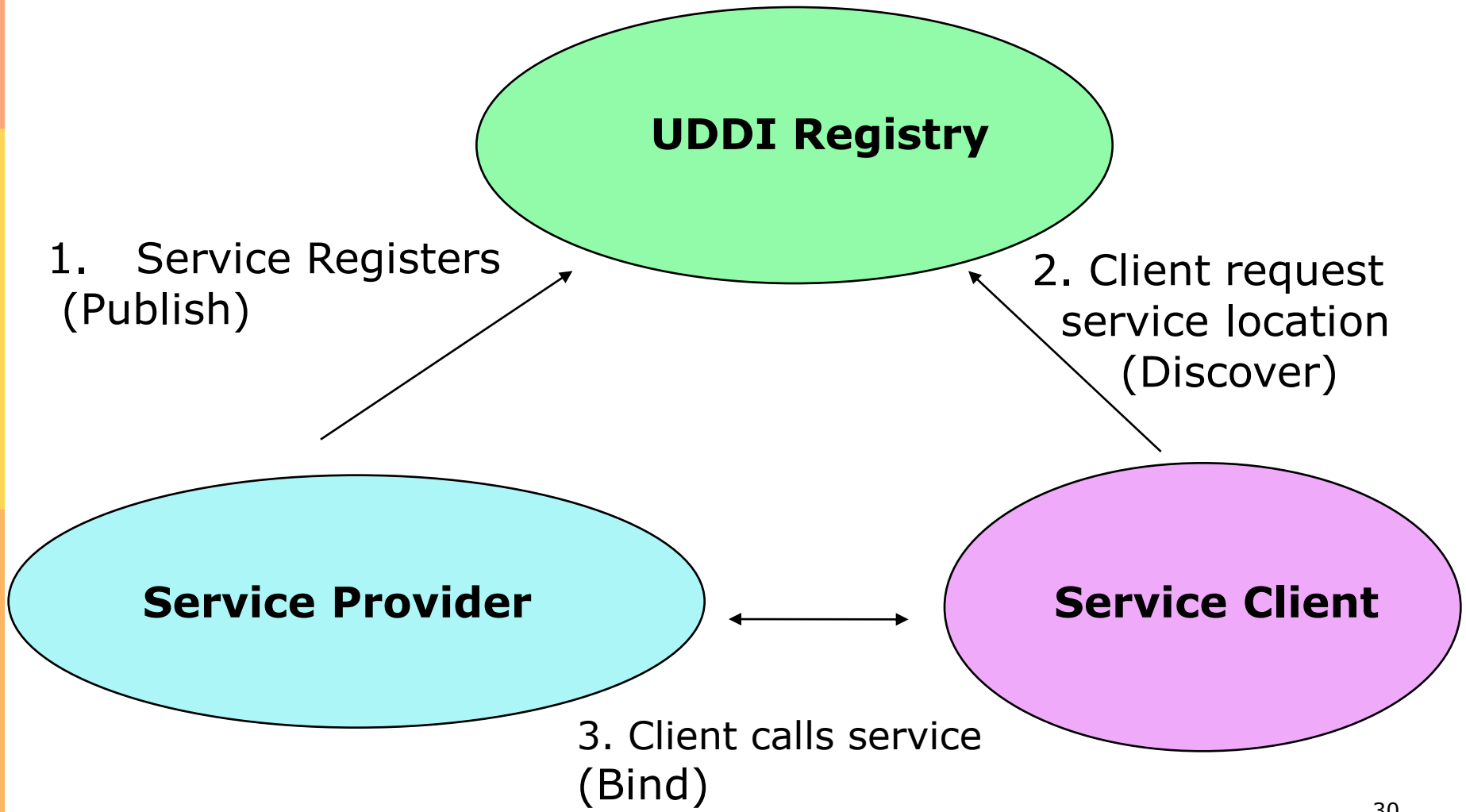
Web Services Architecture



Operation Models for Web Services (1/3)

- Web Service Provider
  - Creates the Web service typically as SOAP-based service interfaces
  - Deploys the service and makes them available for invocation over a network
  - Describes the Web service as a WSDL-based service description
  - Registers the WSDL-based service description with a service broker, which is typically a UDDI registry

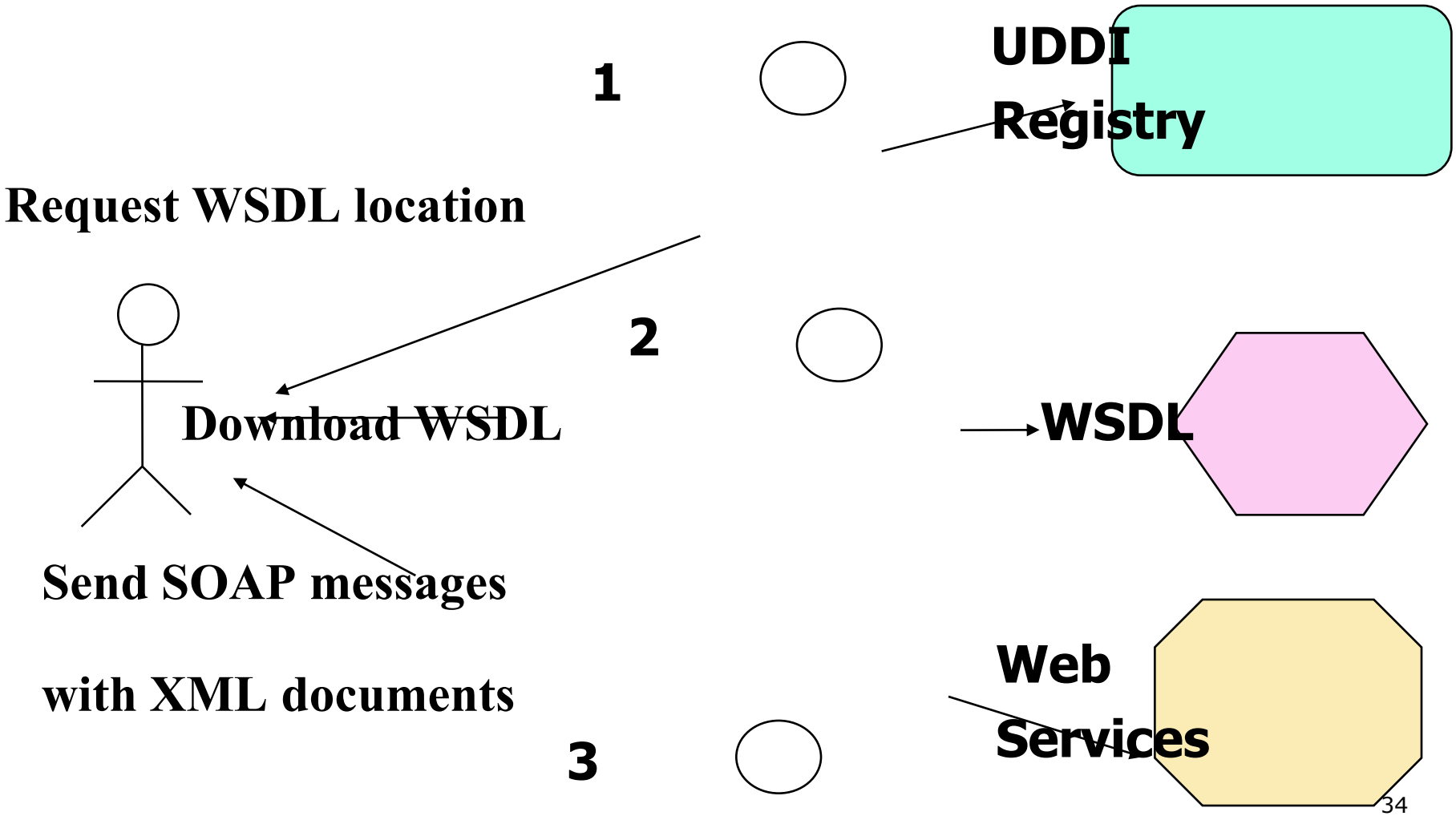
Operation Models for Web Services (2/3)

- Registry
  - Stores the service description as binding templates and URLs to WSDLs located in the service provider environment
  - List various service types, descriptions, and locations of the services that help the service requesters find and subscribe to the required services

Operation Models for Web Services (3/3)

- Service Clients
  - Locates the required services by querying the UDDI registry
  - Obtains the binding information and the URLs to identify the service provider
  - Invokes the service provider
  - Retrieves the WSDL Service description for those registered services
  - Communicate with the service provider
  - Exchange data or message by invoking the available services in the service container

Web Services Interaction Diagram



Web Services Standards

- XML (Extensible Markup Language)
- SOAP (Simple Object Access Protocol)
- WSDL (Web Services Description Language)
- UDDI (Universal Description and Discovery Integration)

Extensible Markup Language

- Text-based Markup Language
- Markup is the extra information for describing and formatting data
- Standard language for exchanging and representing data on the Internet
- Both XML and HTML are markup languages
  - NSC
  - <event>NSC</event>

Sample XML Document

```
<?xml version="1.0"?>
<nation>
    <name>Thailand</name>
    <location>Southeast
Asia</location>
</nation>
```

Desirable Features of XML (1/2)

- Simple and extensible
- License-free
- Platform independent
- International language support
- Read and edit XML using any standard text-editing tool
- Several applications and usage

Desirable Features of XML (2/2)

- Easy data exchange
- Customizing Markup Languages
  - ebXML (Electronic Business Markup Language)
- Self-describing
  - Make automation of data processing possible
- Validation
  - Apply semantic rules to specify the structure of document for validation

XML Applications

- System independent and vendor independent
- Has metadata markup and is deliverable via the Web
- There are style sheets for views and transforms information
- XML enables integration of legacy systems and new systems

Web Services Standards

- XML (Extensible Markup Language)
- SOAP (Simple Object Access Protocol)
- WSDL (Web Services Description Language)
- UDDI (Universal Description and Discovery Integration)

What is SOAP?

- SOAP stands for Simple Object Access Protocol
- SOAP is a lightweight protocol intended for **exchanging structured information**
- SOAP uses XML technologies to define an **extensible messaging framework**
- The framework has been designed to be **independent of any particular programming model** and other implementation specific semantics

Web Services Standards

- XML (Extensible Markup Language)
- SOAP (Simple Object Access Protocol)
- **WSDL (Web Services Description Language)**
- UDDI (Universal Description and Discovery Integration)

What is WSDL?

- WSDL stands for Web Services Description Language
- **XML language for describing web services**
- XML service is described as
  - A set of communication endpoints (ports)
- Endpoint is made of two parts
  - Abstract definition of operations and messages
  - Concrete binding to networking protocol and message format

Web Services Standards

- XML (Extensible Markup Language)
- SOAP (Simple Object Access Protocol)
- WSDL (Web Services Description Language)
- UDDI (Universal Description and Discovery Integration)

What is UDDI?

- UDDI stands for Universal Description, Discovery and Integration
- Programmatic registration and discovery of business entities and their Web services
- Based on SOAP, HTML, and XML
- Registry data
  - Business registrations
  - Service type definitions

What is REST? (1/2)

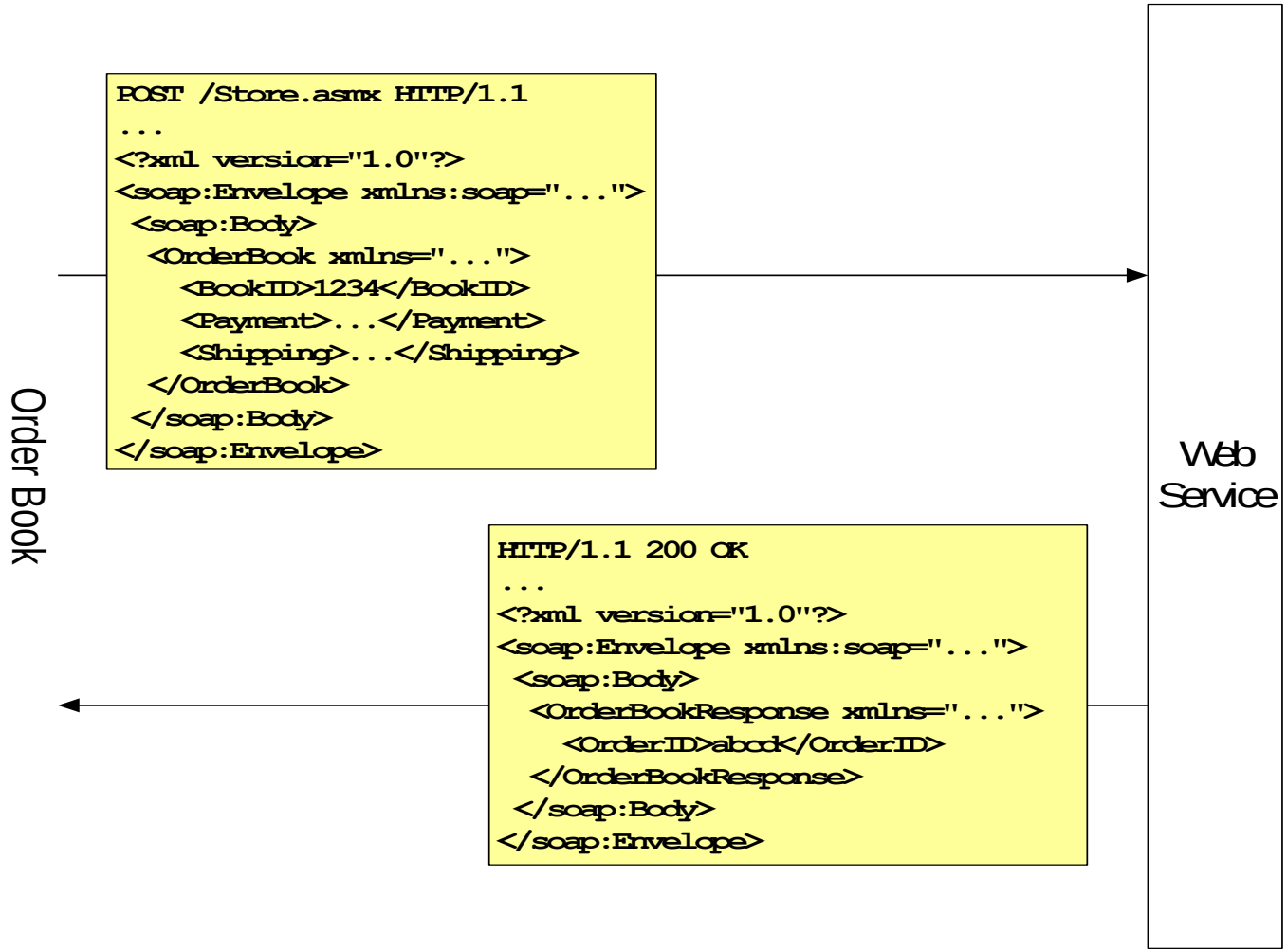
- **Representational State Transfer** (**REST**) is a style of software architecture for distributed hypermedia systems such as the World Wide Web
- The term was introduced in the doctoral dissertation of Roy Fielding in 2000, one of the principal authors of the Hypertext Transfer Protocol (HTTP) specification

What is REST? (2/2)

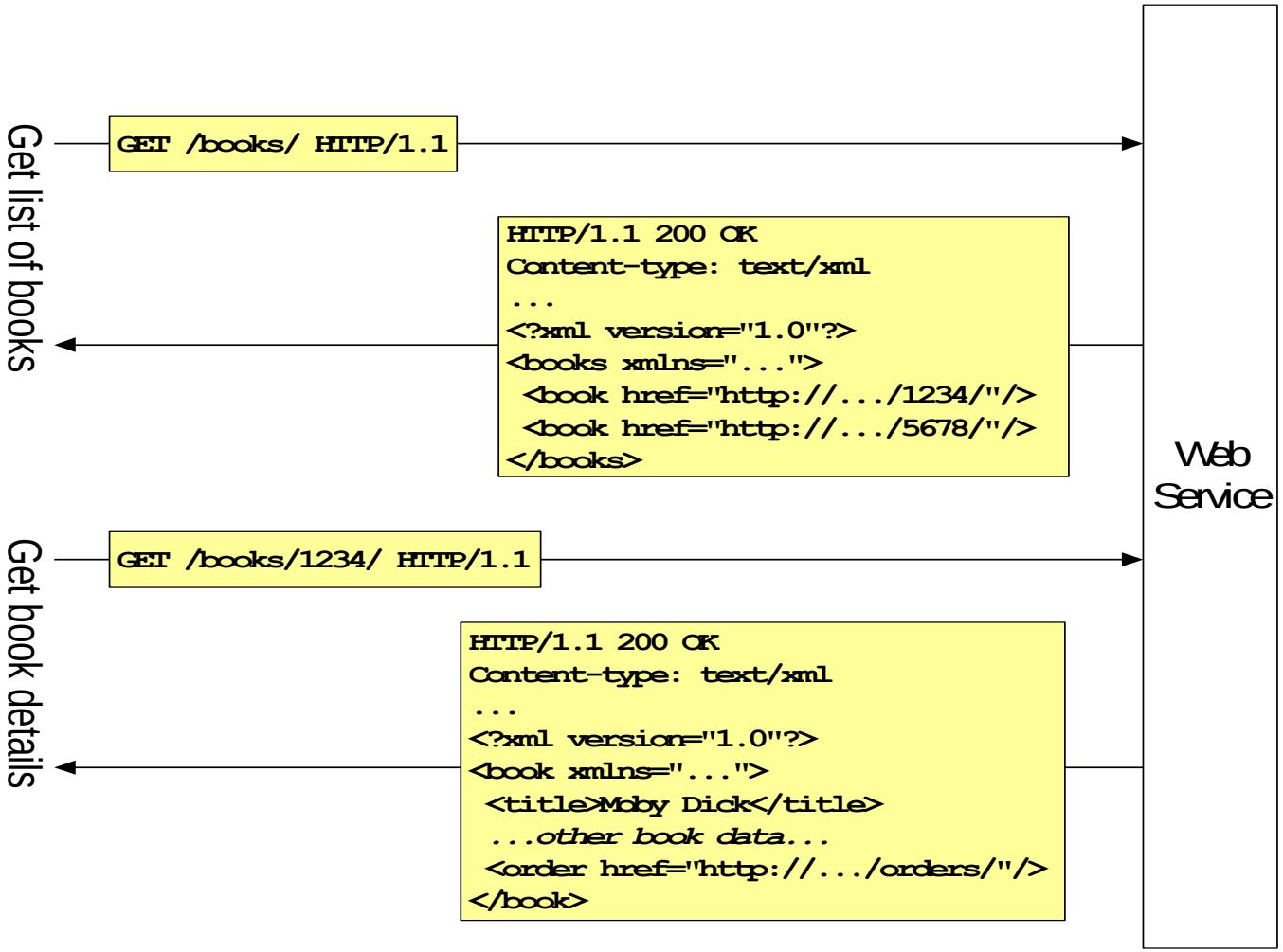
- REST strictly refers to a collection of network architecture principles that outline how resources are defined and addressed
- The term is often used in a looser sense to describe any simple interface that transmits domain-specific data over HTTP without an additional messaging layer such as SOAP or session tracking via HTTP cookies.

SOAP Example (1/2)

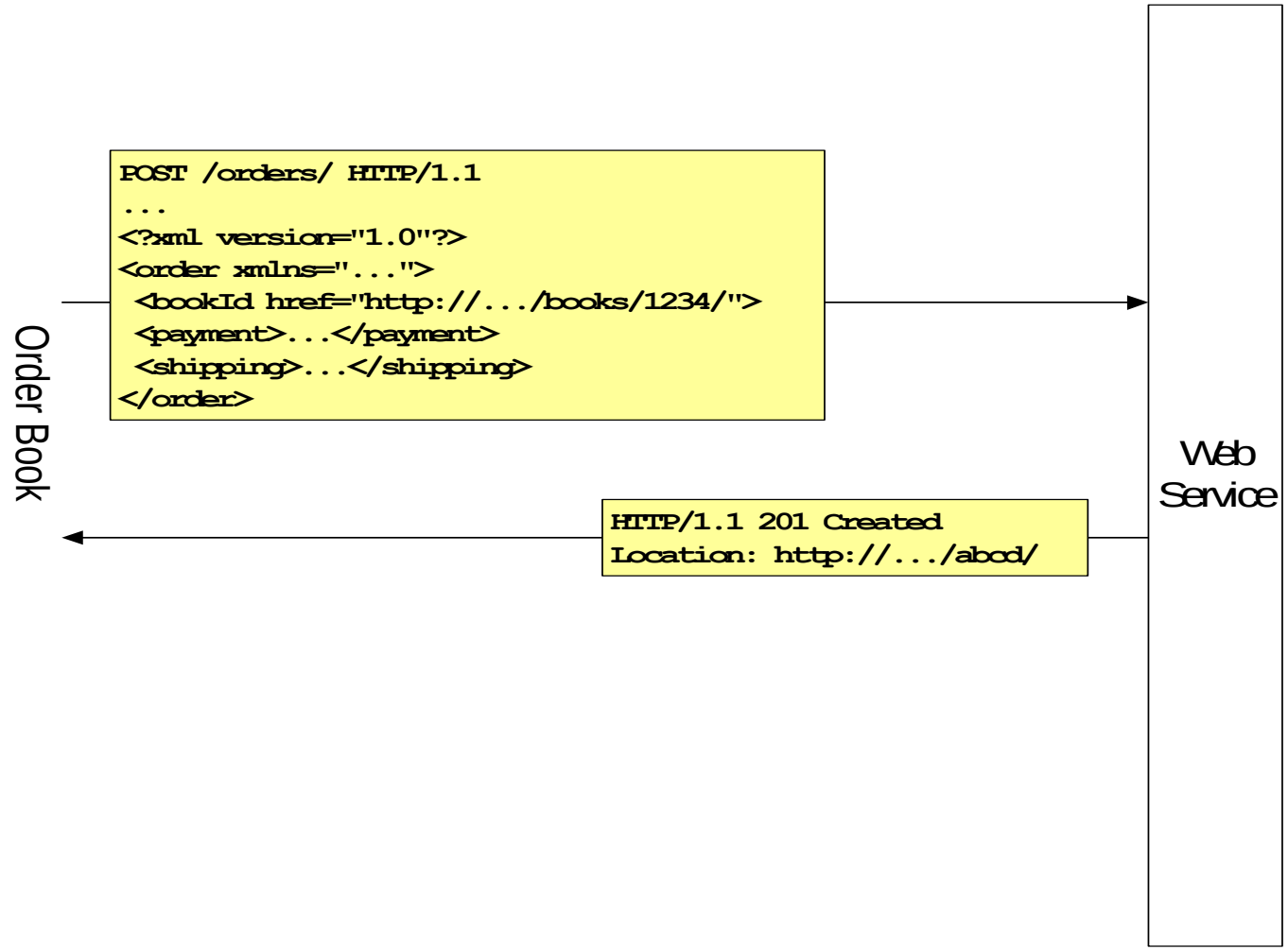
SOAP Example (2/2)



REST Example (1/2)



REST Example (2/2)



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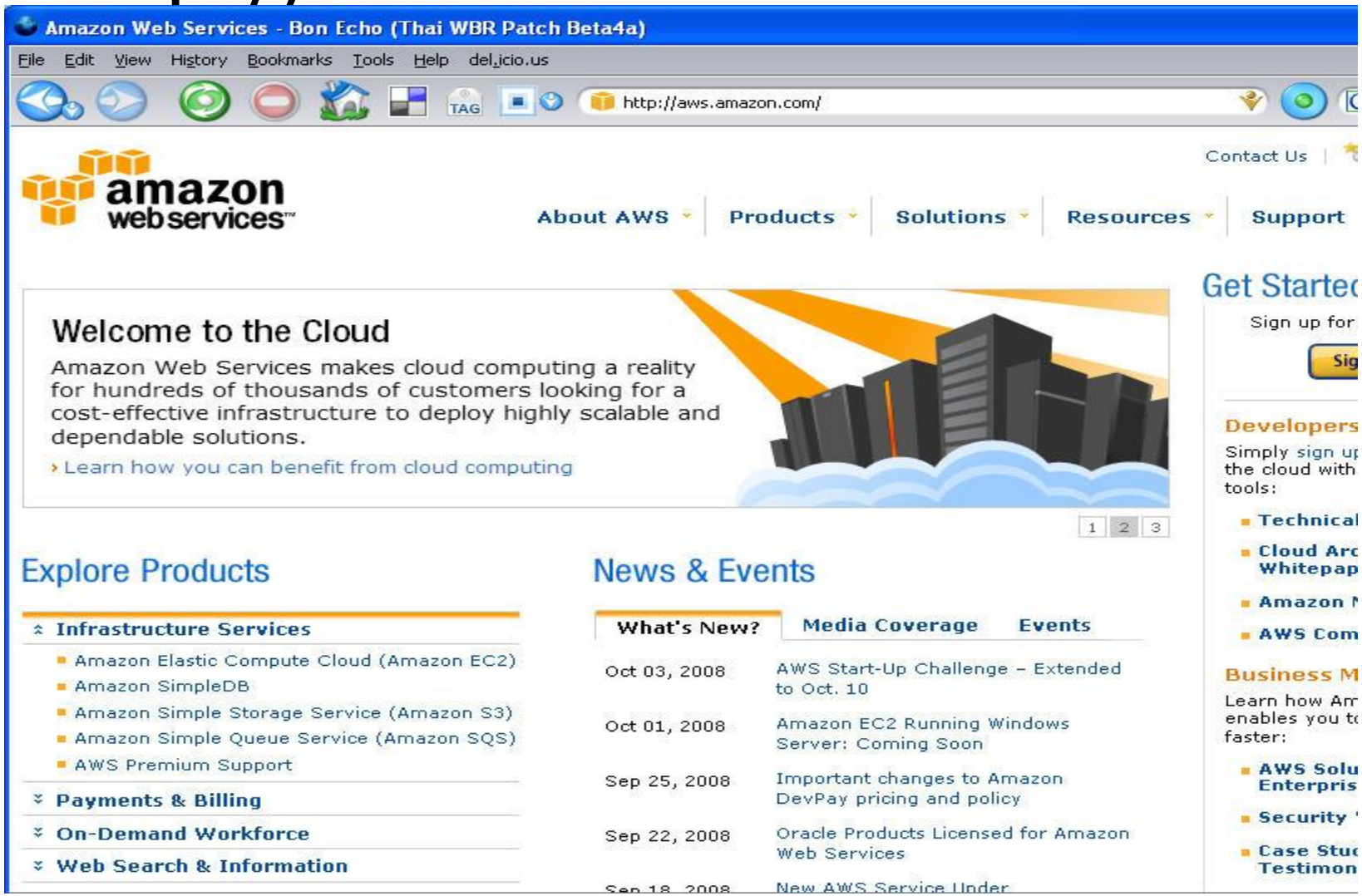
Amazon Web Services

http://aws.amazon.com



Amazon Web Services Products

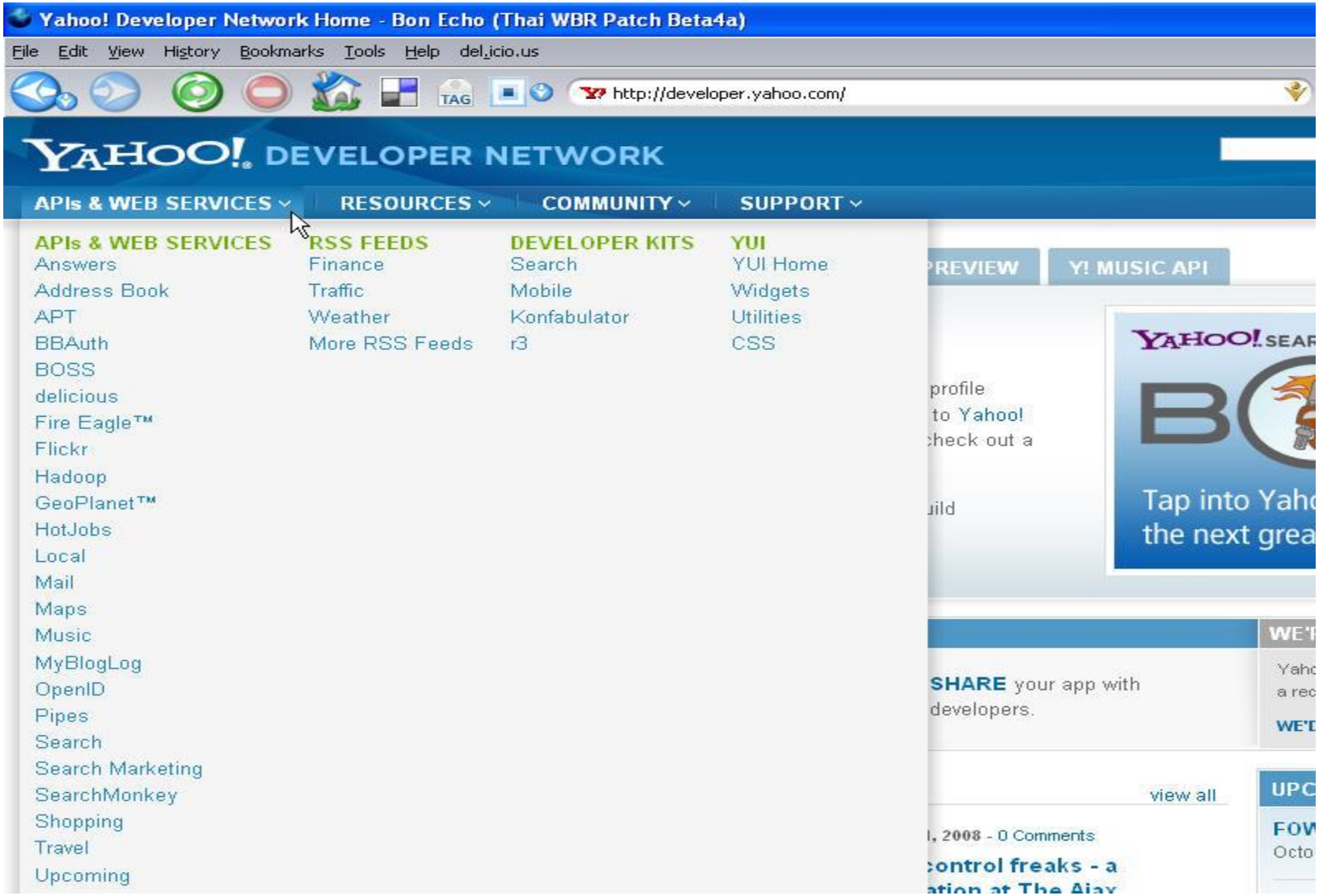
- Infrastructure Services
  - Amazon Simple Storage Service
- Payments & Billing
  - Amazon Flexible Payments Service
- On-Demand Workforce
  - Amazon Mechanical Turk
- Web Search & Information
  - Alexa Web Information Service
- Amazon Fulfillment & Associates
  - Amazon Associates Web Service

AWS Solution

- Application Hosting
  - Using Amazon Simple Storage Service (Amazon S3)
  - Examples: AdaptiveBlue, LiveLeader, Smartsheet
- E-Commerce
  - Using Amazon Flexible Payments Service
  - Examples: GMP Services, Associate-O-Matic
- High Performance Computing
  - Using Amazon Elastic Computing
  - Examples: Washingtonpost.com
- On-Demand Workforce
  - Using Amazon Mechanical Turk
  - Examples: Casting Words, Hit-Builder

Yahoo! Developer Network

http://developer.yahoo.com

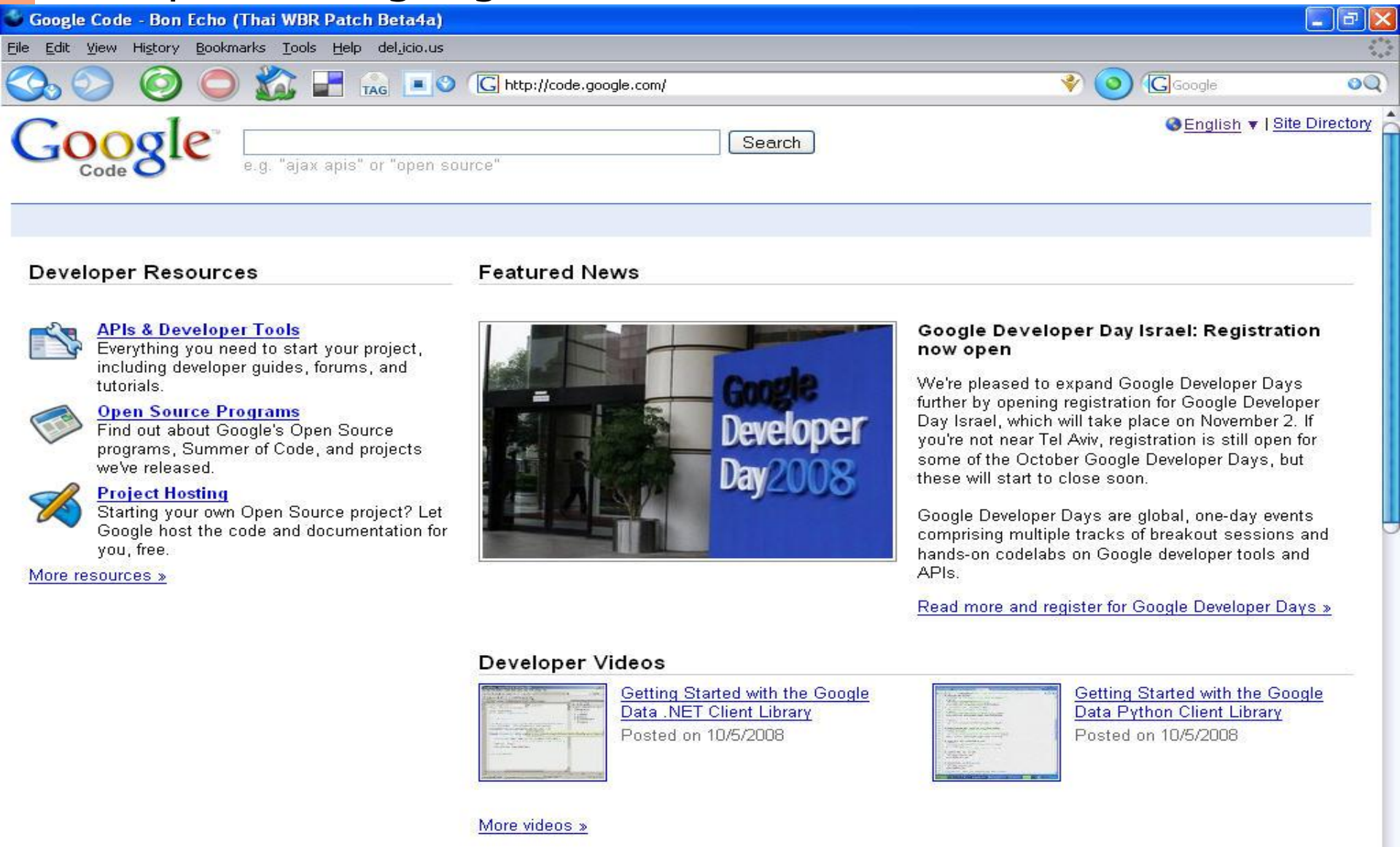


Yahoo! Developer Network

- Yahoo! Answers Web Services APIs
  - Search for expert advice on any topic, from within your very own site
- Yahoo! Local Web Services
  - Local business information and user reviews
- Yahoo! Delicious API
  - Read/write access to your Delicious bookmarks and tags via an HTTP-based interface

Google Code

http://code.google.com



Google APIs (1/2)

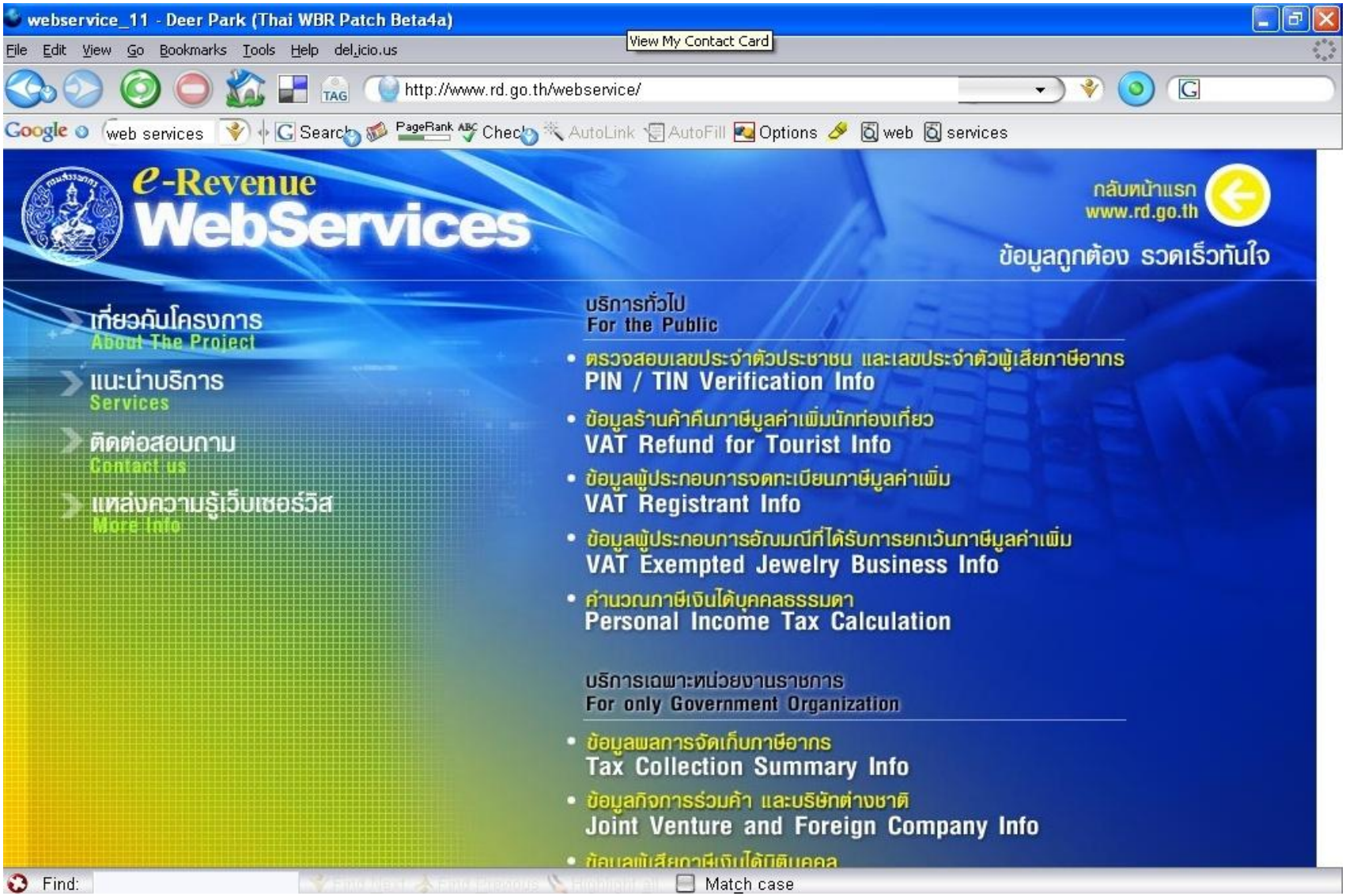
- APIs & Developer Tools
  - Android
    - Build mobile apps for Android, a software stack mobile devices
  - Google Data APIs
    - A simple, standard protocol for reading and writing data on the web
  - Blogger Data API
    - Enable your apps to view and update Blogger content
  - Feedburner APIs
    - Interact with FeedBurner's feed management and awareness-generating capabilities.

Google APIs (2/2)

- Google AdSense API
  - Generate revenue for you and your users by placing ads on your website.
- Google AdWords API
  - Automate and streamline your campaign management activities
- Google Calendar APIs and Tools
  - Create and manage events, calendars, and gadgets for Google Calendar.
- Google Checkout API
  - Start selling on your website.

e-Revenue Web Services (1/2)

- http://www.rd.go.th/webservice/



e-Revenue Web Services (2/2)

- Create service oriented organization by providing professional services to citizens to improve efficiency and fairness in tax collection
- Serve as a catalyst in driving e-services / e-commerce take up via business partnership
- Sample services: PIN/TIN Verification Info, VAT Refund for Tourist info

PTT Information Web Services (1/2)

http://www.pttplc.com/pttinfo.asmx

PTT Information Web Services (2/2)

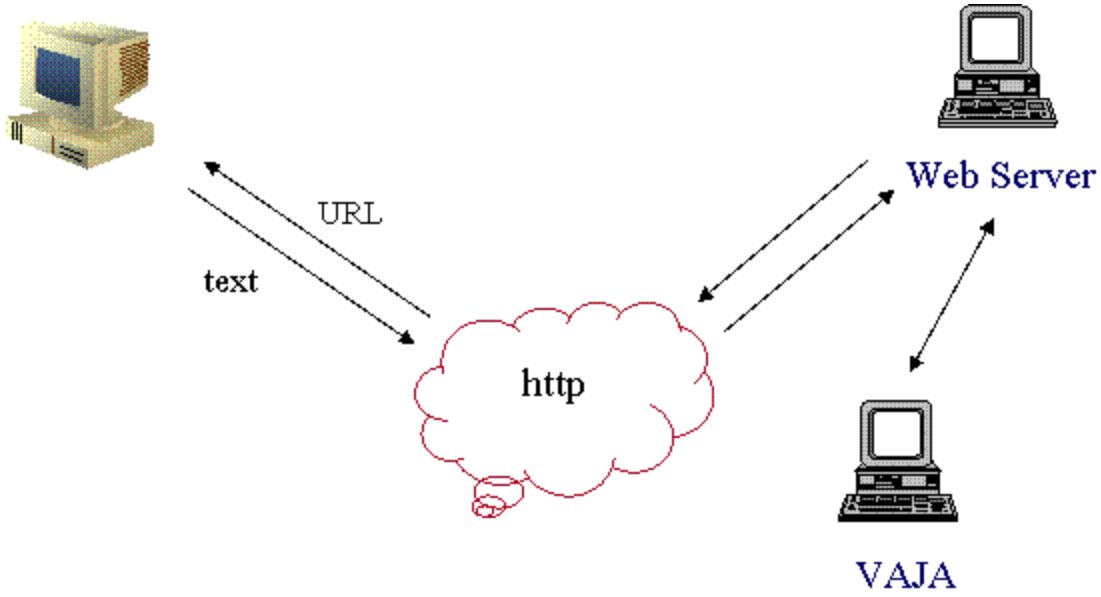
- The users can get the information about oil price and news related to oil
- Support these five operations
  - GetOilPrice
  - CurrentOilPrice
  - GetNews
  - CurrentNews

NECTEC Speech Technology Web Services (1/2)

http://vaja.nectec.or.th/ws/vaja-webservice.html

NECTEC Speech Technology Web Services (2/2)

- VAJA Web Service
  - Convert text to speech using Vaja program
- iSpeech Web Service
  - Convert speech to text using iSpeech program



Search for Web Services (1/2)

- XMethods
  - http://www.xmethods.com
- Mindreef
  - http://www.mindreef.net/tide/index.mrj
- SOAPClient
  - http://www.soapclient.com/
- WebServiceX.net
  - http://www.webservicex.net/WS/wscatlist.aspx

Search for Web Services (2/2)

- Pete Cashmore's Mashable
  - http://mashable.com/
- Emily Chang's eHub
  - http://www.emilychang.com/go/ehub
- ProgrammabWeb – Mashups, APIs, and the Web as Platform
  - http://www.programmableweb.com
- Web Services Search Engine
  - http://seekda.com

Web Services Resources in Thailand

- Web Services Forum at KKU
  - http://campus.en.kku.ac.th/forums
- XML and Web Services Course at KKU
  - http://gear.kku.ac.th/~krunapon/xmlws
- Thai Java Developers
  - http://www.thaijavadev.com/
- Web Services Contest in National Software Const organized by NECTEC
  - http://www.hpcc.nectec.or.th/wiki/index.php/Web_Services_Contest
- Narisa.com
  - http://www.narisa.com

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Open Source Web Services Tools in Java (1/4)

- Axis: the third generation of Apache SOAP
  - http://ws.apache.org/axis2/
  - A simple stand-alone server
  - A server which plugs into servlet engines such as Tomcat
  - Extensive support for the WSDL
  - Emitter tooling that generates Java classes from WSDL
  - A tool for monitoring TCP/IP packets

Open Source Web Services Tools in Java (3/4)

- Apache CXF: An Open Source Service Framework
  - Apache CXF is an open source services framework
  - CXF helps you build and develop services using frontend programming APIs, like JAX-WS
  - These services can speak a variety of protocols such as SOAP, XML/HTTP, RESTful HTTP, or CORBA and work over a variety of transports such as HTTP, JMS or JBI
  - http://cxf.apache.org/

Open Source Web Services Tools in Java (4/4)

- XINS is an open-source Web Services framework supporting HTTP protocols such as REST, SOAP, XML-RPC, JSON, JSON-RPC and more.
- From the specifications written in simple XML, XINS generates the Client API (.jar), the Java server code template (.war), the WSDL and the documentation of the specification in HTML (with the test forms) or in OpenDocument format
- http://xins.sourceforge.net/

Commercial Web Services Development Tools

- IBM WebSphere Software
  - http://www-01.ibm.com/software/websphere/
- MS .NET
  - http://msdn.microsoft.com/webservices/
- webMethods
  - http://www.webmethods.com

Eclipse Web Tools Platform (WTP) Project

- Extends the Eclipse platform with tools for developing Web and Java EE applications
- It includes source and graphical editors for a variety of languages, wizards and built-in applications to simplify development, and tools and APIs to support deploying, running, and testing apps
- http://www.eclipse.org/webtools/

NetBeans

- A free, open-source Integrated Development Environment for software developers
- You get all the tools you need to create professional desktop, enterprise, web, and mobile applications with the Java language, C/C++, and Ruby
- Support JAX-WS Web Services and RESTful Web Services
- http://www.netbeans.org/

Summary

- Web services technology exists for making different systems seamlessly work together
  - XML is the language of exchange data
  - Web service standards are open standards
- Web services have been developed and used extensively in many countries
- Thailand should develop and employ Web services technology more for the benefits of more effective management and business profits

References (1/2)

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