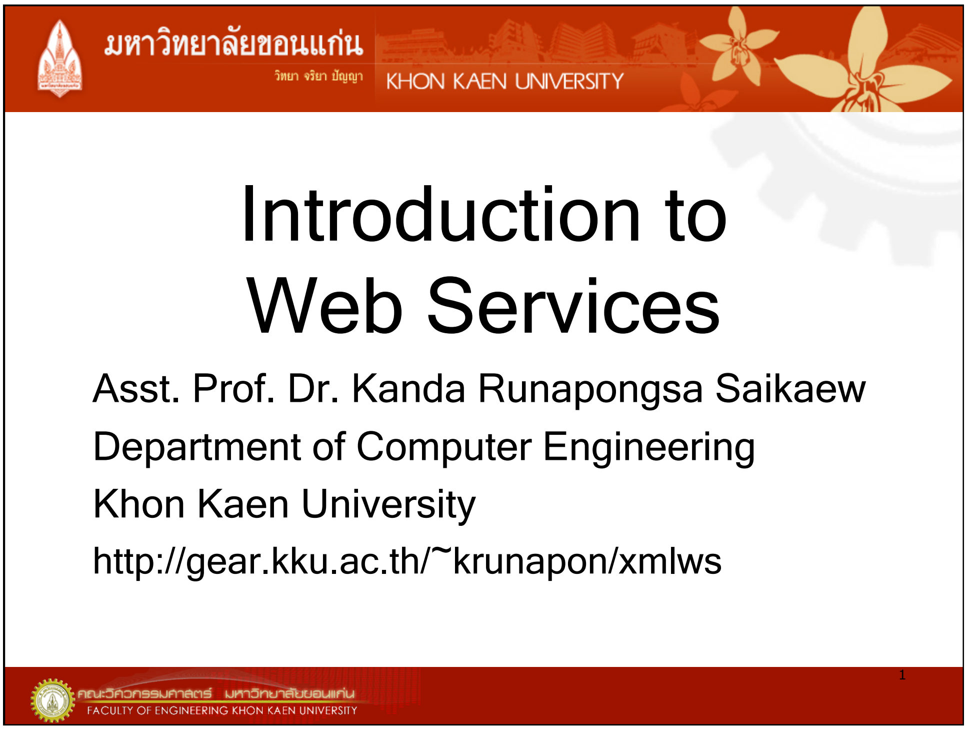

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Introduction to Web Services

Asst. Prof. Dr. Kanda Runapongsa Saikaew
Department of Computer Engineering
Khon Kaen University
http://gear.kku.ac.th/~krunapon/xmlws

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Agenda

- Web Technologies
- What are Web Services?
- Styles of Web Services
- Why Web Services?
- Web Services Architecture and Standards
- Where are Web Services?
- Web Services Development

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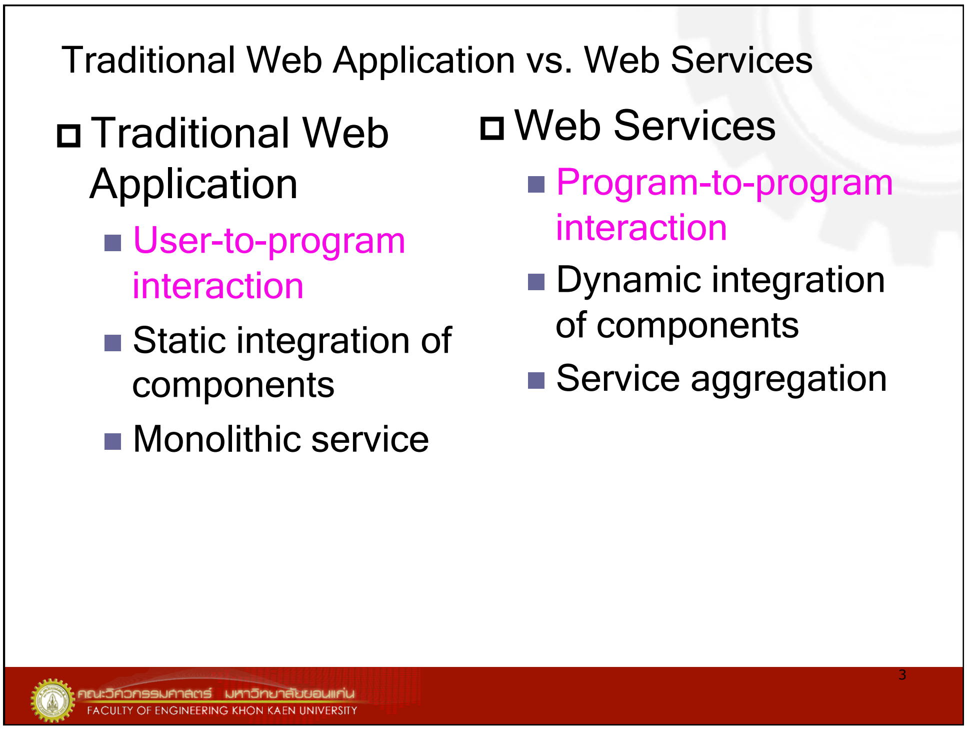
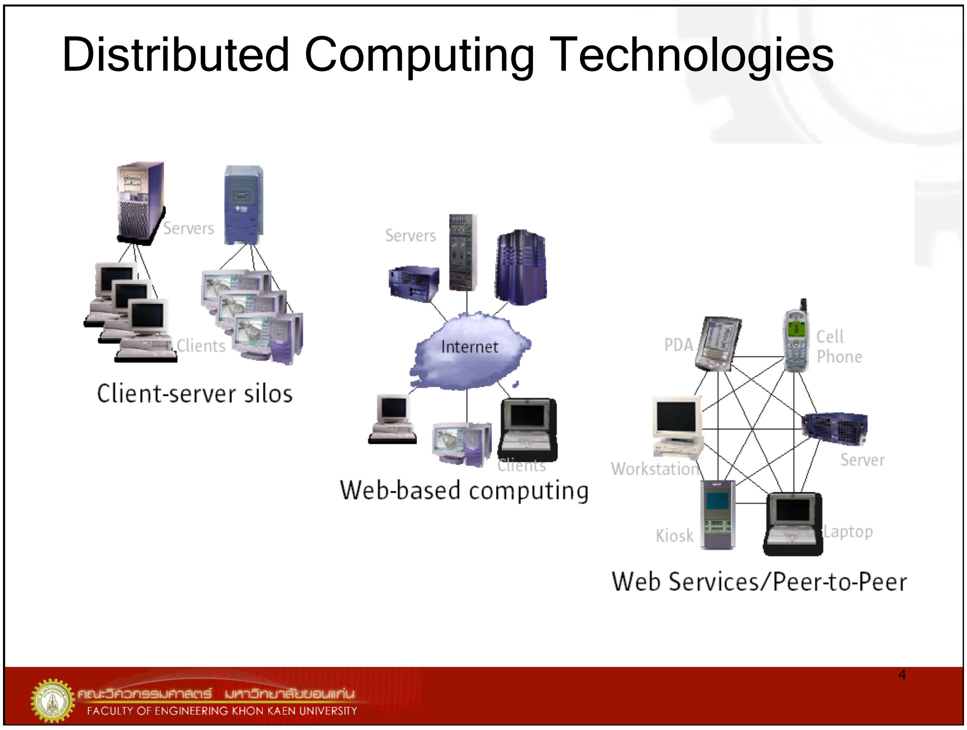
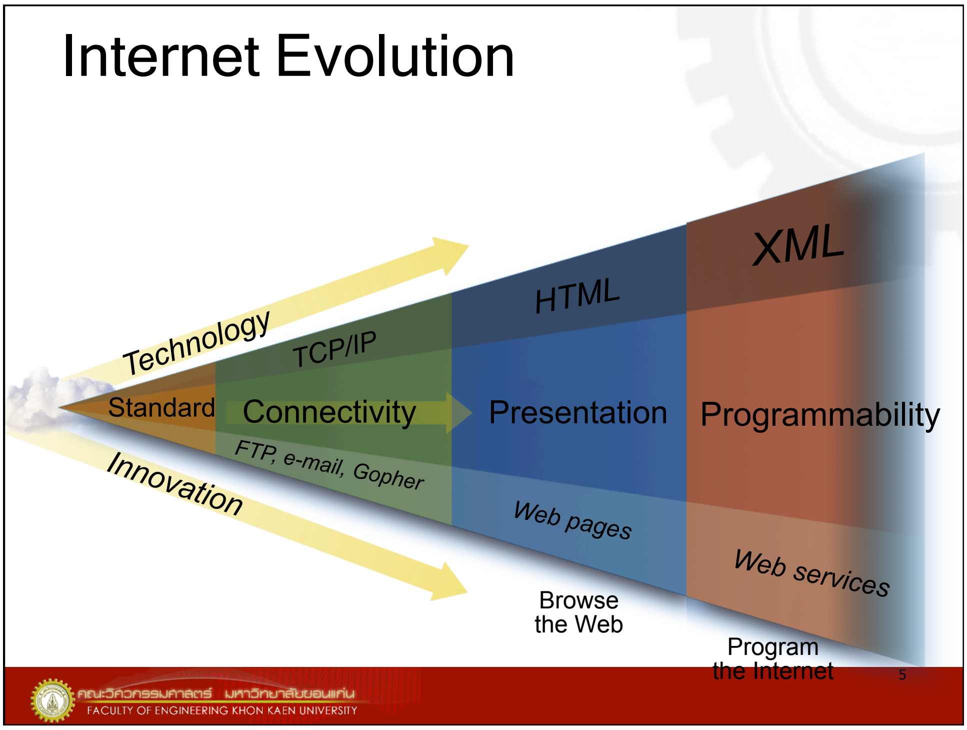


Traditional Web Application vs. Web Services

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



Distributed Computing Technologies



Internet Evolution

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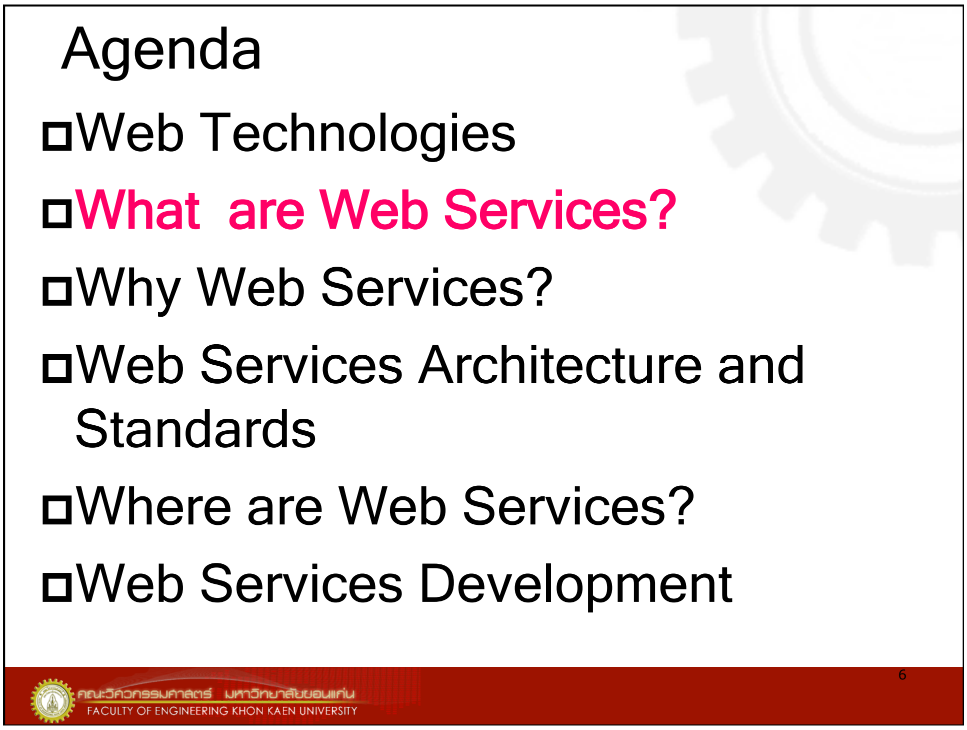

Agenda

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- □Web Services Architecture and Standards
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- □Web Services Development

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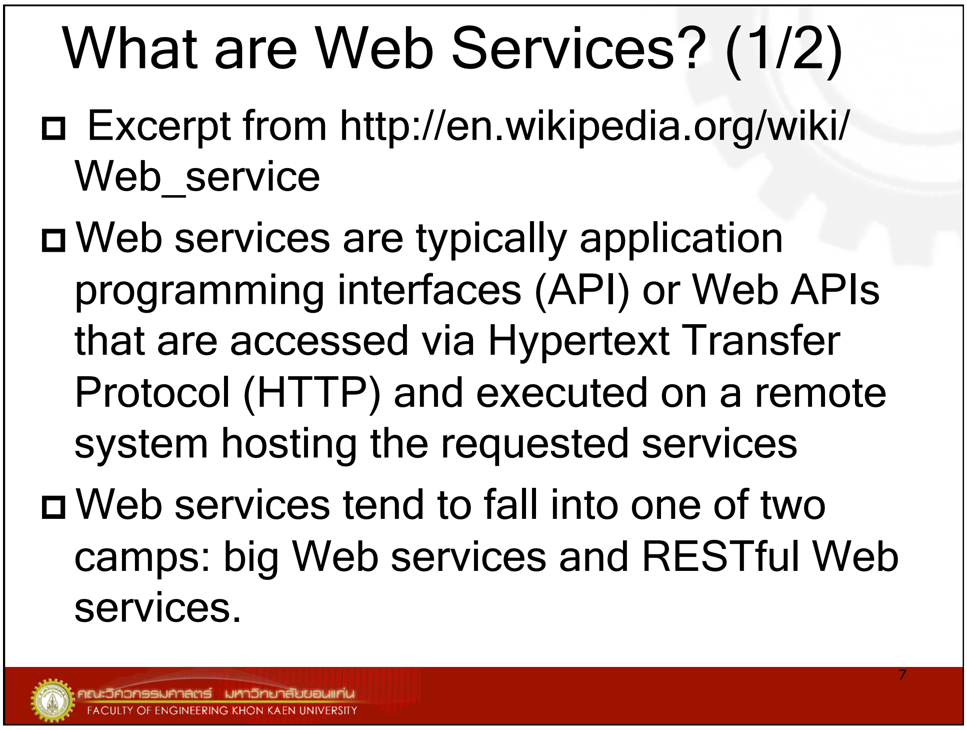

What are Web Services? (1/2)

- Excerpt from http://en.wikipedia.org/wiki/Web_service
- Web services are typically application programming interfaces (API) or Web APIs that are accessed via Hypertext Transfer Protocol (HTTP) and executed on a remote system hosting the requested services
- Web services tend to fall into one of two camps: big Web services and RESTful Web services.

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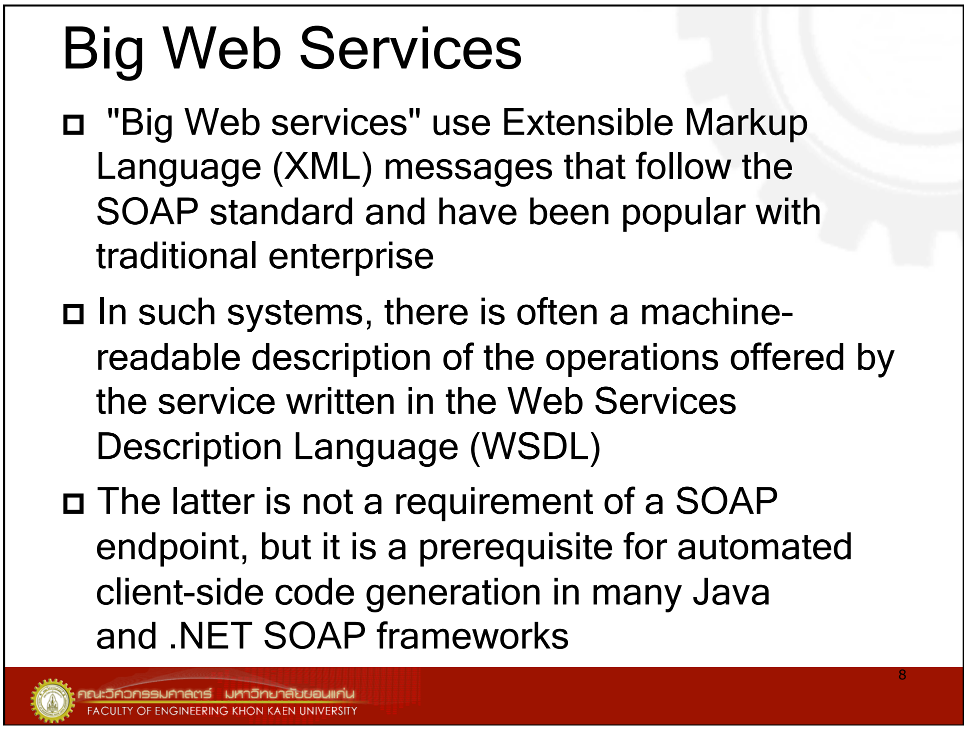

Big Web Services

- "Big Web services" use Extensible Markup Language (XML) messages that follow the SOAP standard and have been popular with traditional enterprise
- In such systems, there is often a machine-readable description of the operations offered by the service written in the Web Services Description Language (WSDL)
- The latter is not a requirement of a SOAP endpoint, but it is a prerequisite for automated client-side code generation in many Java and .NET SOAP frameworks

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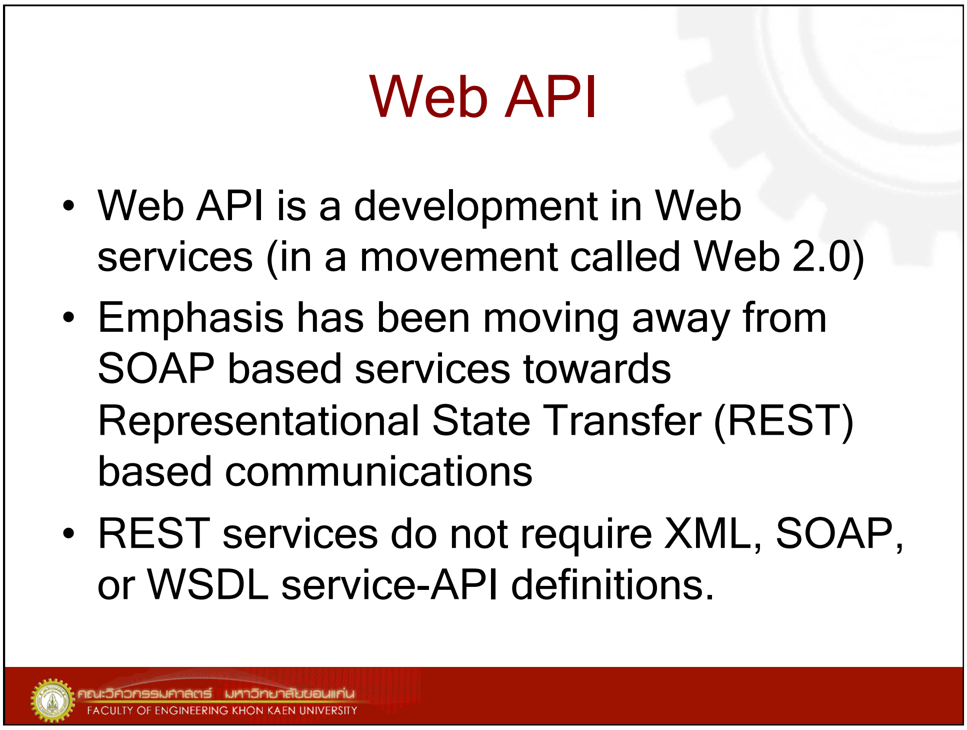
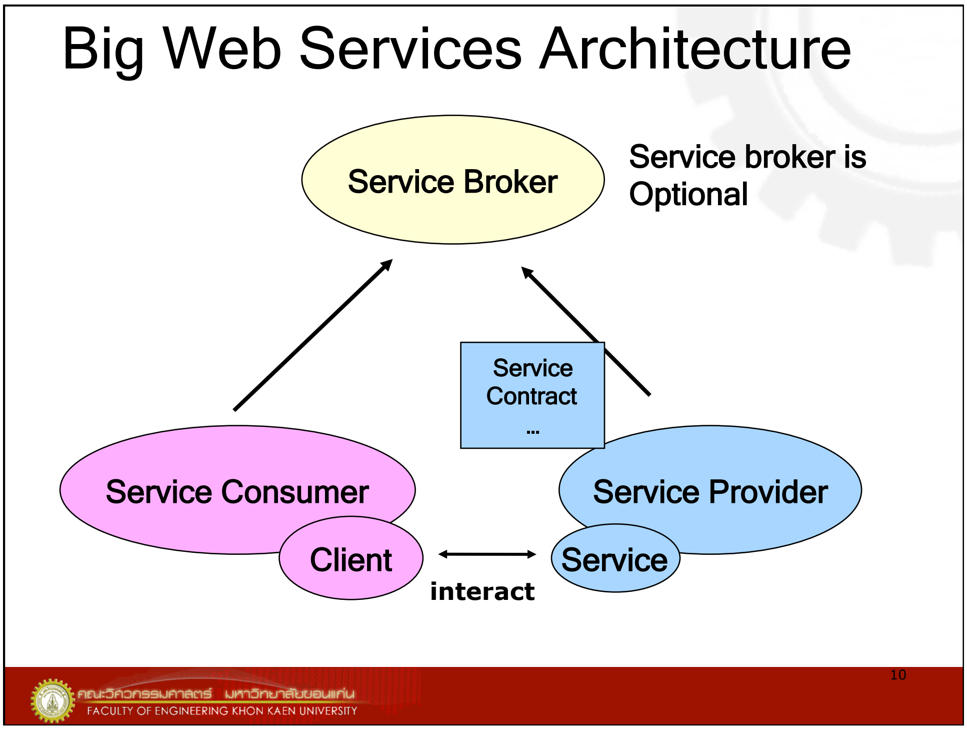
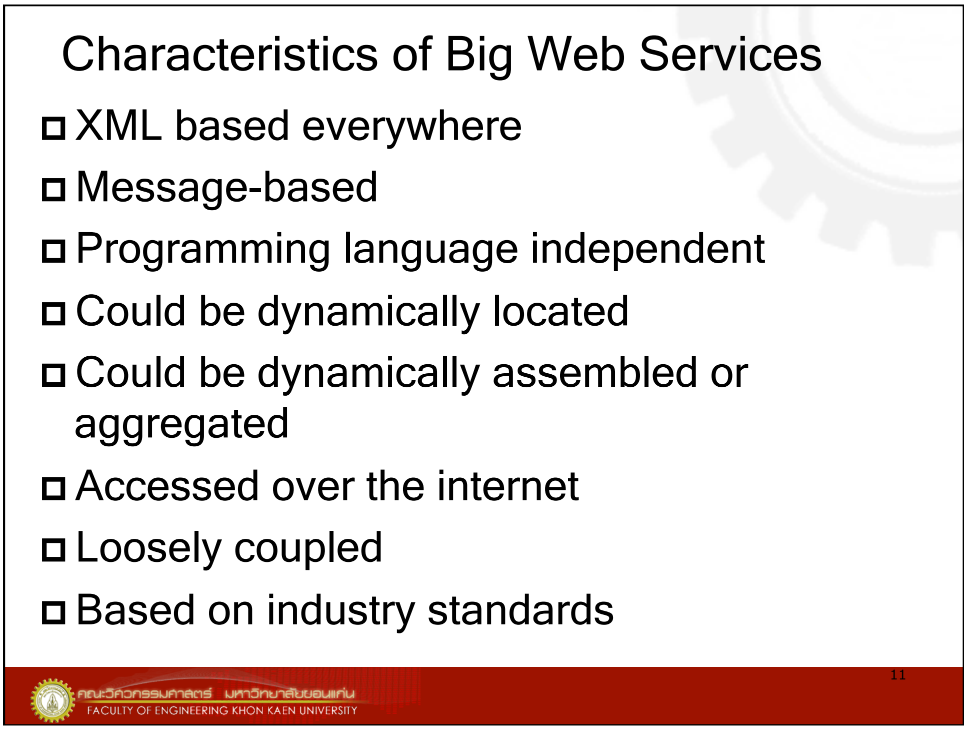


Web API

- Web API is a development in Web services (in a movement called Web 2.0)
- Emphasis has been moving away from SOAP based services towards Representational State Transfer (REST) based communications
- REST services do not require XML, SOAP, or WSDL service-API definitions.

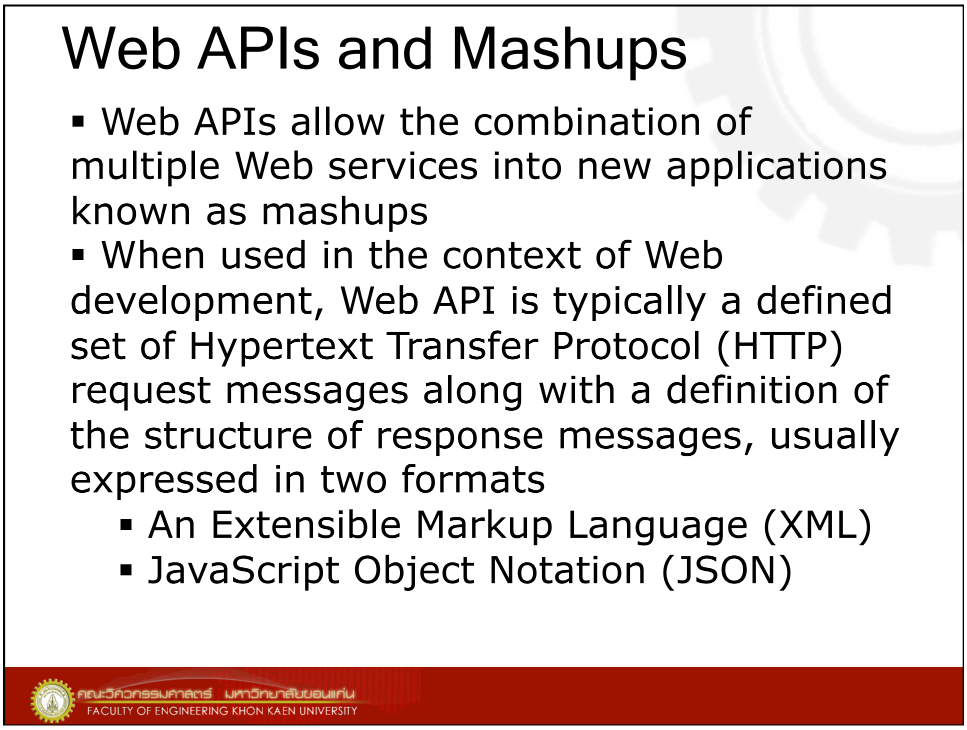


Big Web Services Architecture



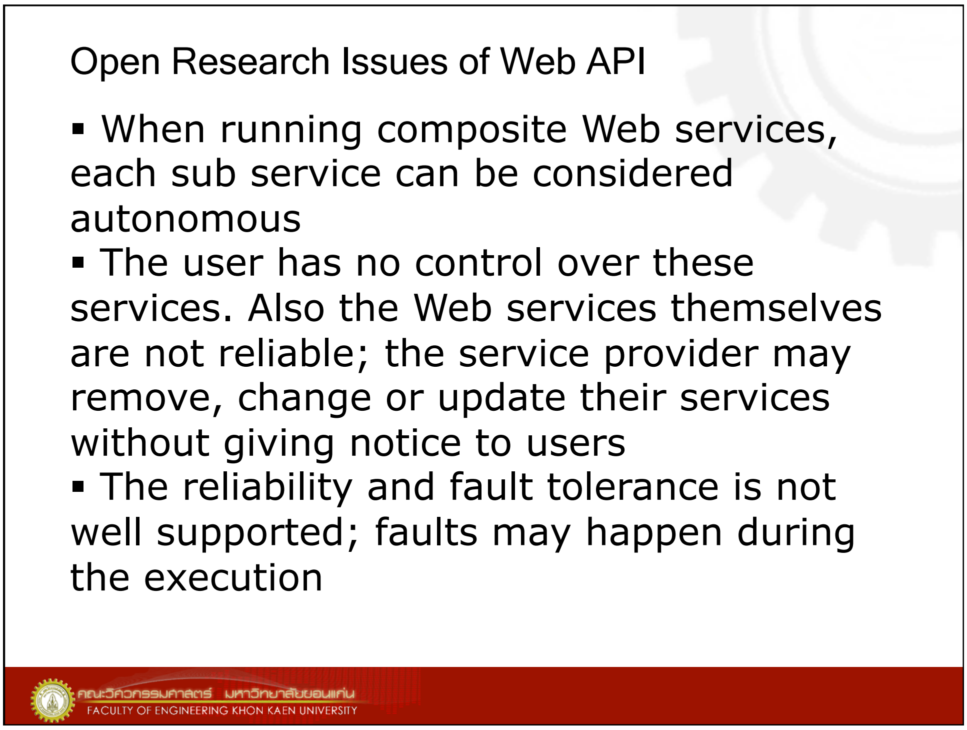
Characteristics of Big Web Services

- □ 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



Web APIs and Mashups

- Web APIs allow the combination of multiple Web services into new applications known as mashups
- When used in the context of Web development, Web API is typically a defined set of Hypertext Transfer Protocol (HTTP) request messages along with a definition of the structure of response messages, usually expressed in two formats
  - An Extensible Markup Language (XML)
  - JavaScript Object Notation (JSON)



Open Research Issues of Web API

- When running composite Web services, each sub service can be considered autonomous
- The user has no control over these services. Also the Web services themselves are not reliable; the service provider may remove, change or update their services without giving notice to users
- The reliability and fault tolerance is not well supported; faults may happen during the execution

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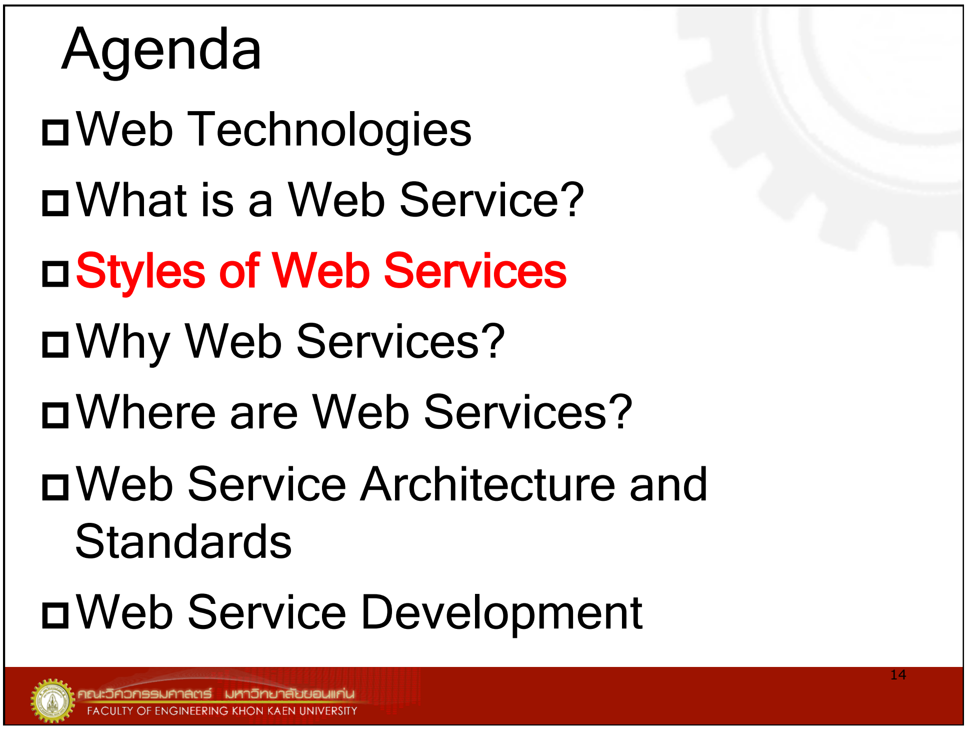

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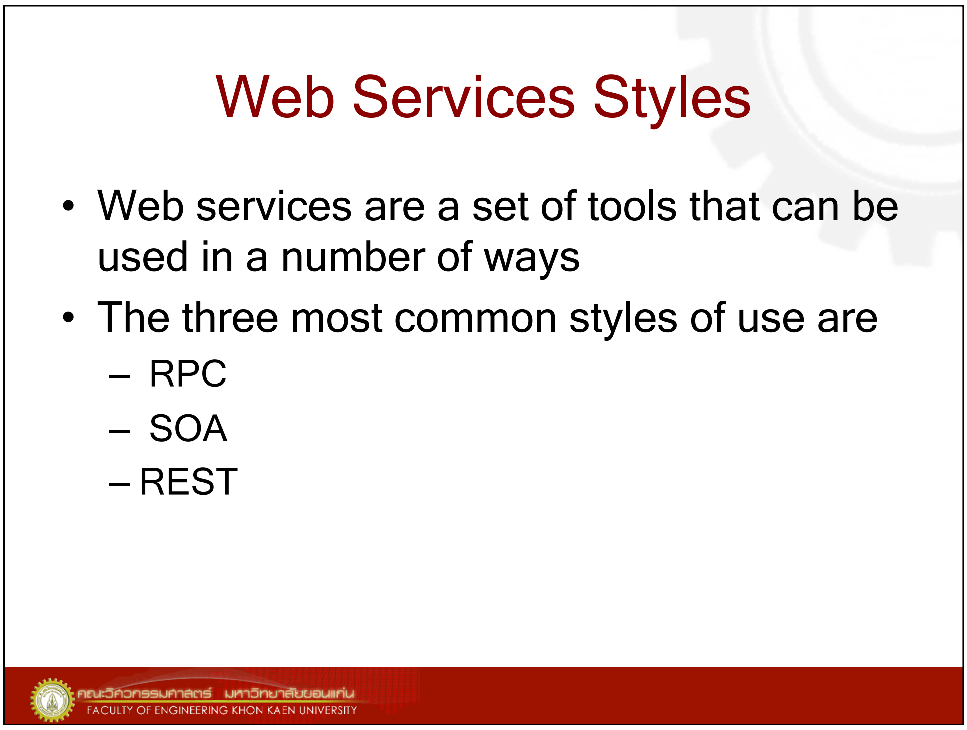

Web Services Styles

- Web services are a set of tools that can be used in a number of ways
- The three most common styles of use are
  - RPC
  - SOA
  - REST

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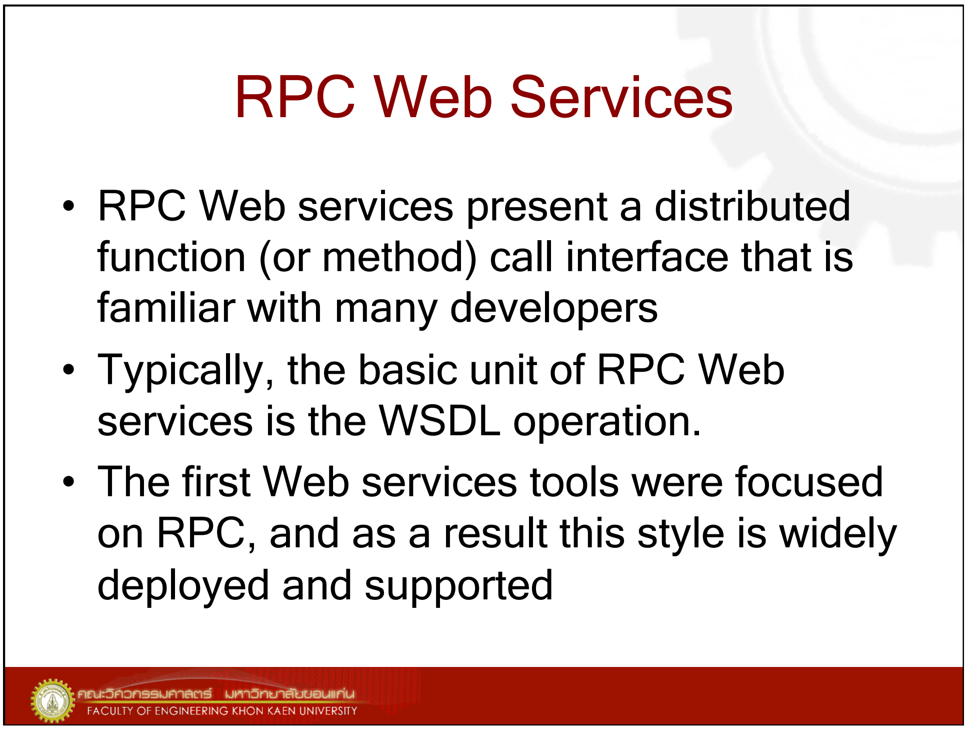

RPC Web Services

- RPC Web services present a distributed function (or method) call interface that is familiar with many developers
- Typically, the basic unit of RPC Web services is the WSDL operation.
- The first Web services tools were focused on RPC, and as a result this style is widely deployed and supported

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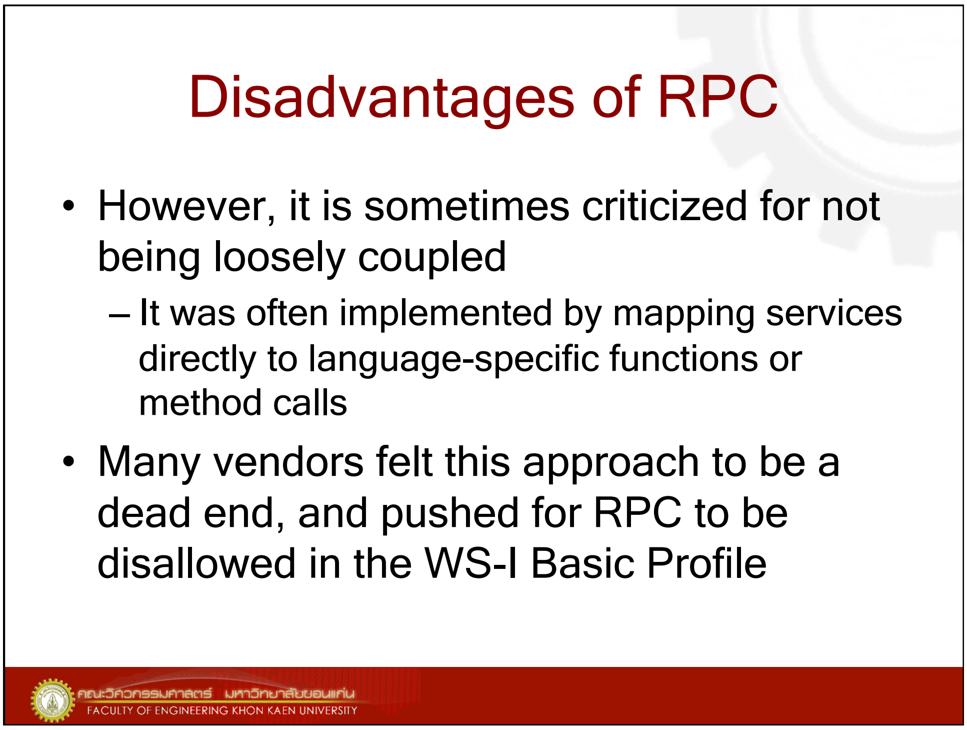

Disadvantages of RPC

- However, it is sometimes criticized for not being loosely coupled
  - It was often implemented by mapping services directly to language-specific functions or method calls
- Many vendors felt this approach to be a dead end, and pushed for RPC to be disallowed in the WS-I Basic Profile

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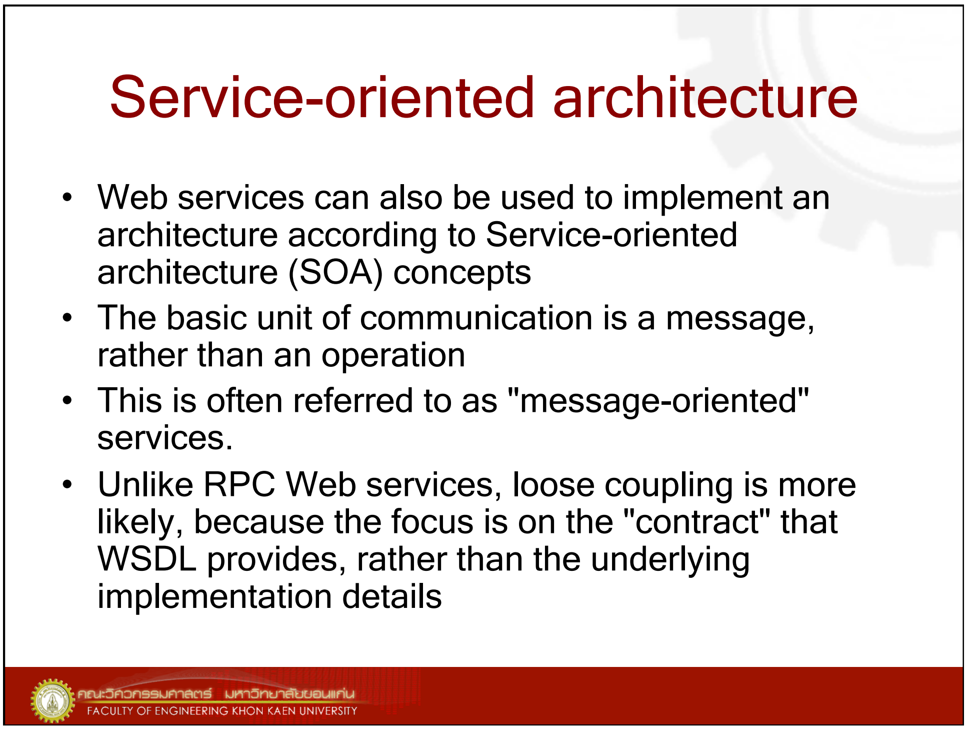

Service-oriented architecture

- Web services can also be used to implement an architecture according to Service-oriented architecture (SOA) concepts
- The basic unit of communication is a message, rather than an operation
- This is often referred to as "message-oriented" services.
- Unlike RPC Web services, loose coupling is more likely, because the focus is on the "contract" that WSDL provides, rather than the underlying implementation details

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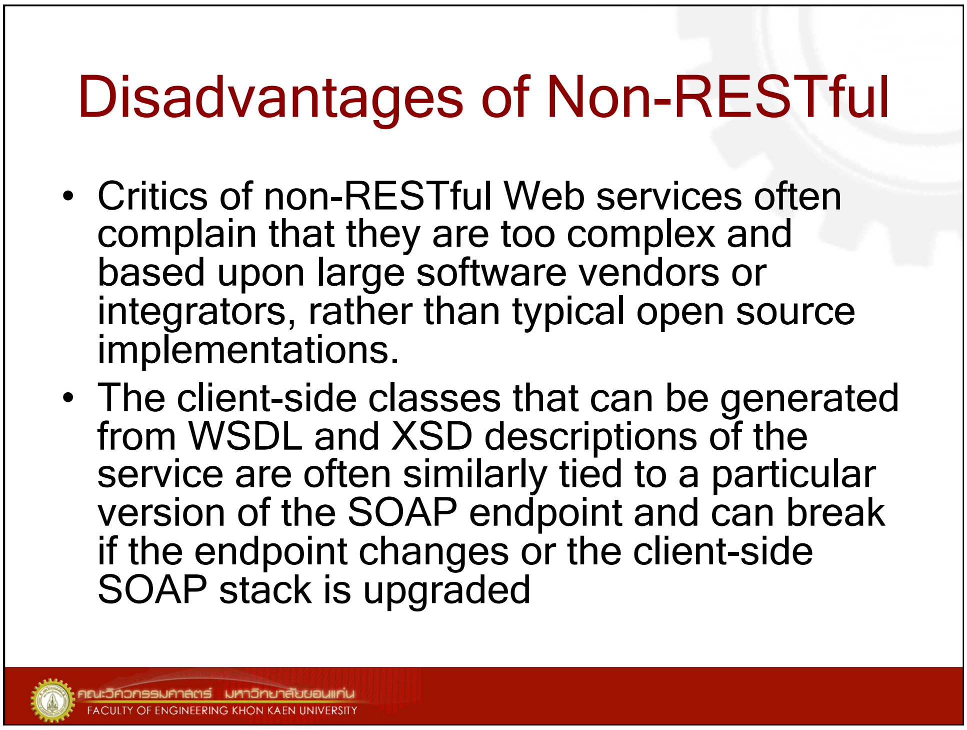
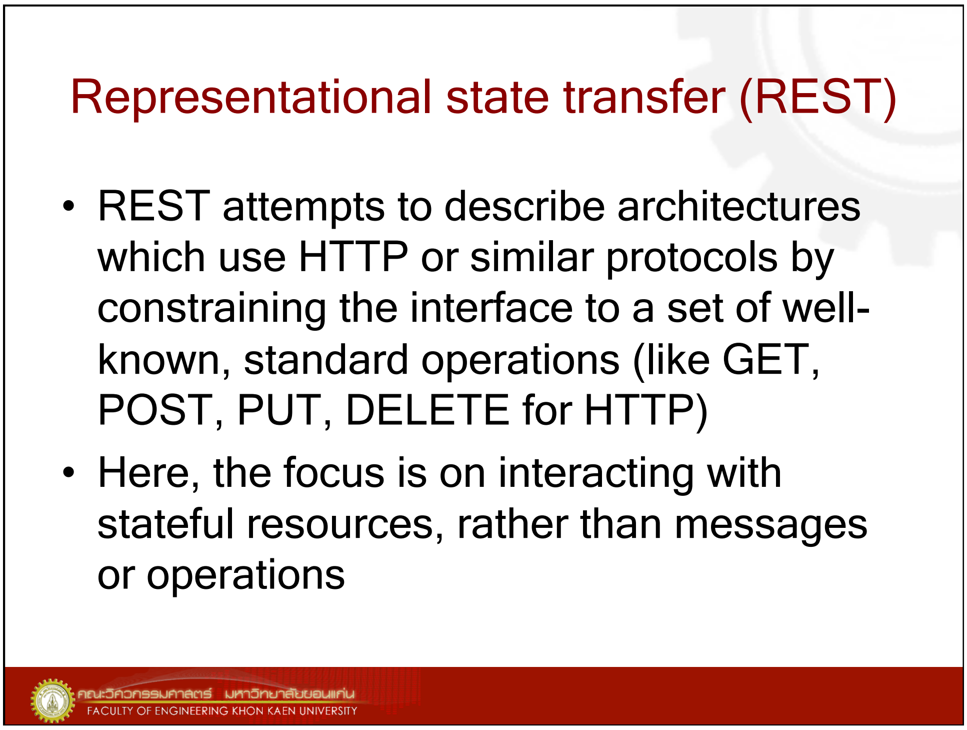


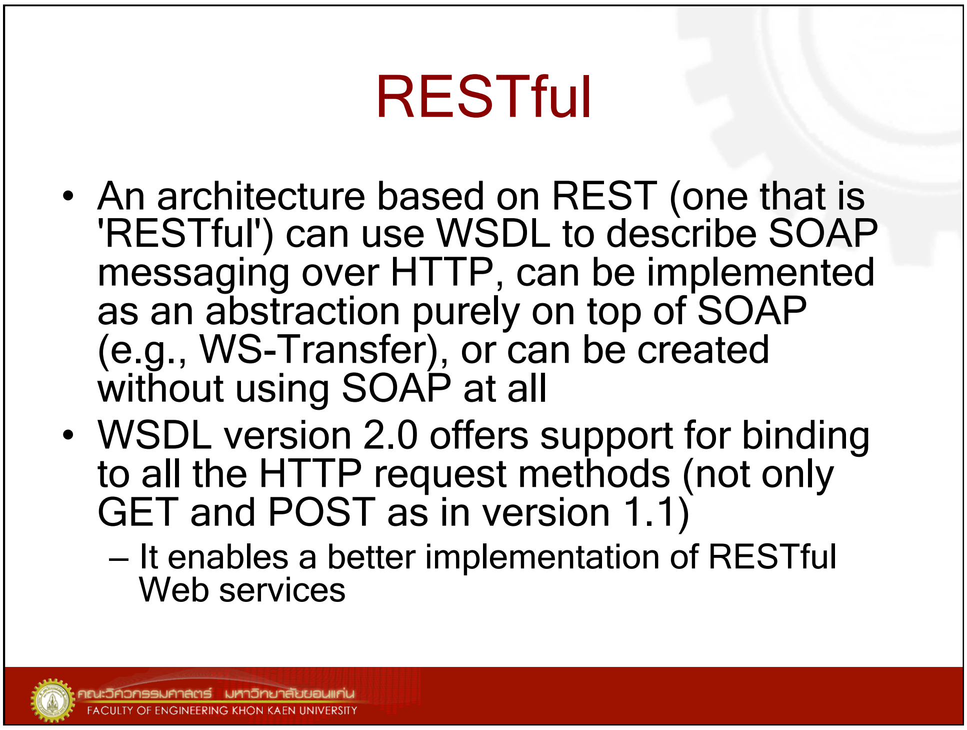
Disadvantages of Non-RESTful

- Critics of non-RESTful Web services often complain that they are too complex and based upon large software vendors or integrators, rather than typical open source implementations.
- The client-side classes that can be generated from WSDL and XSD descriptions of the service are often similarly tied to a particular version of the SOAP endpoint and can break if the endpoint changes or the client-side SOAP stack is upgraded



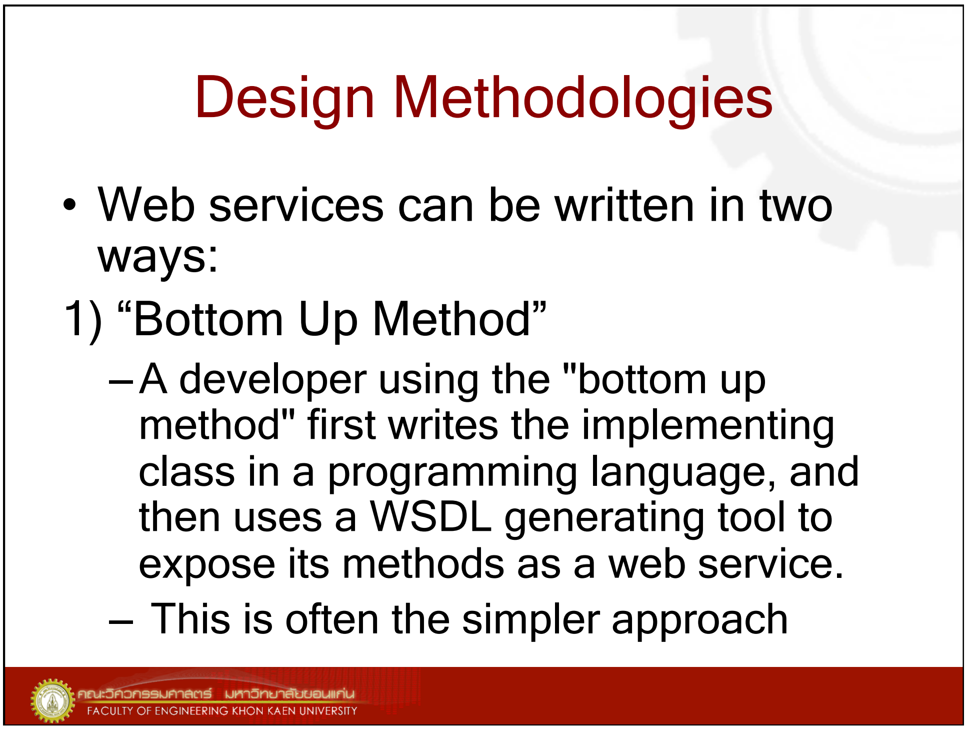
Representational state transfer (REST)

- REST attempts to describe architectures which use HTTP or similar protocols by constraining the interface to a set of well-known, standard operations (like GET, POST, PUT, DELETE for HTTP)
- Here, the focus is on interacting with stateful resources, rather than messages or operations



RESTful

- An architecture based on REST (one that is 'RESTful') can use WSDL to describe SOAP messaging over HTTP, can be implemented as an abstraction purely on top of SOAP (e.g., WS-Transfer), or can be created without using SOAP at all
- WSDL version 2.0 offers support for binding to all the HTTP request methods (not only GET and POST as in version 1.1)
  - It enables a better implementation of RESTful Web services

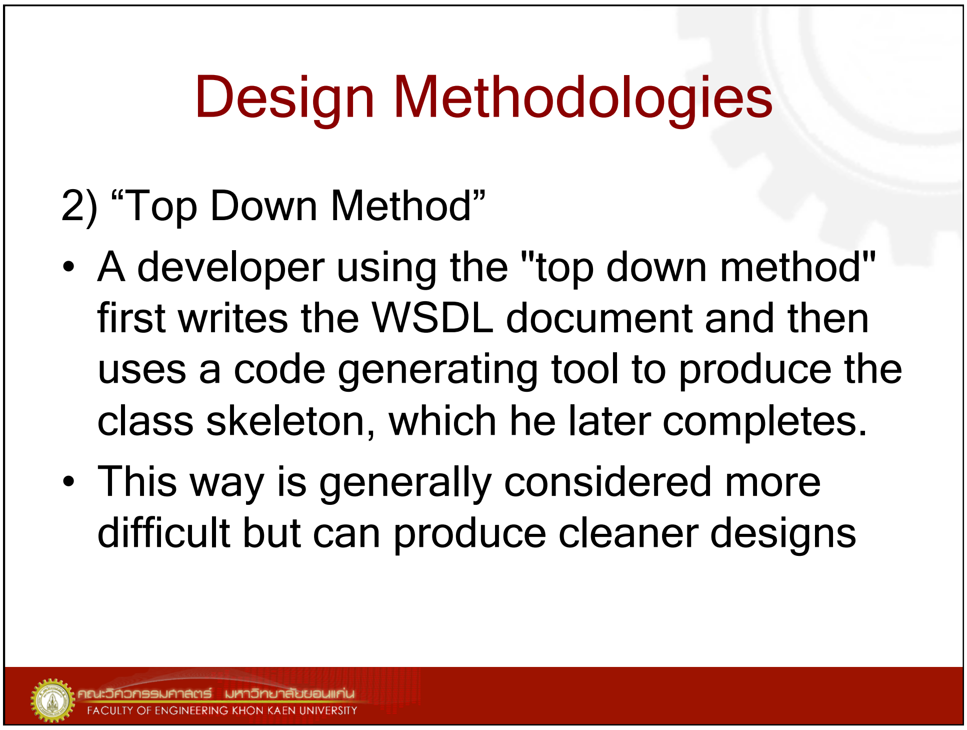


Design Methodologies

- Web services can be written in two ways:

1) “Bottom Up Method”

- A developer using the "bottom up method" first writes the implementing class in a programming language, and then uses a WSDL generating tool to expose its methods as a web service.
- This is often the simpler approach



Design Methodologies

2) “Top Down Method”

- A developer using the "top down method" first writes the WSDL document and then uses a code generating tool to produce the class skeleton, which he later completes.
- This way is generally considered more difficult but can produce cleaner designs

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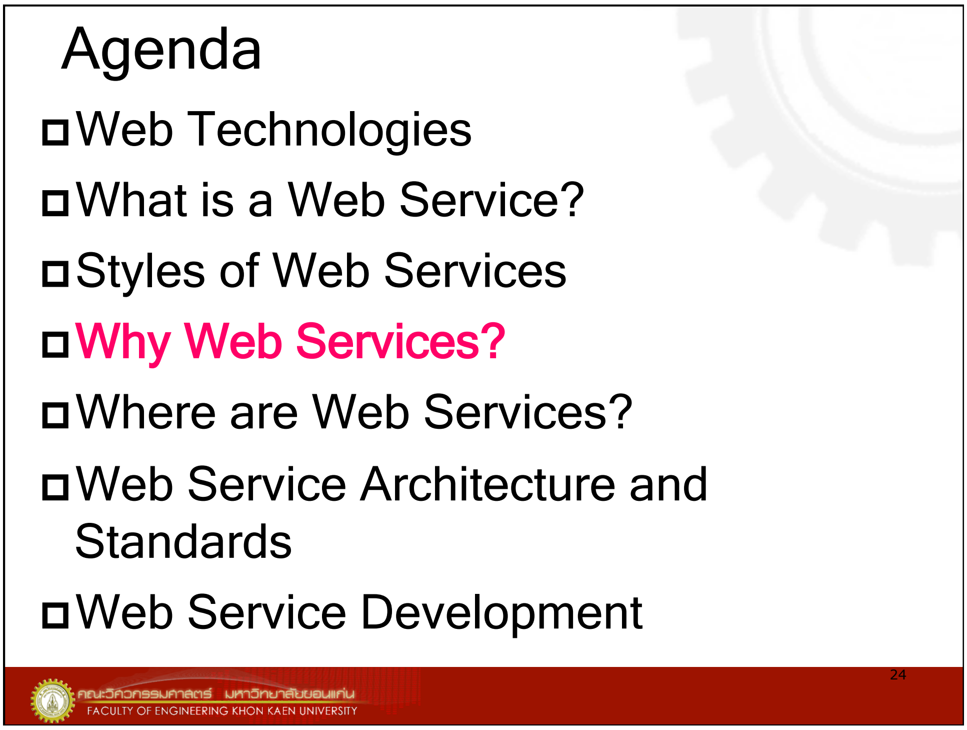

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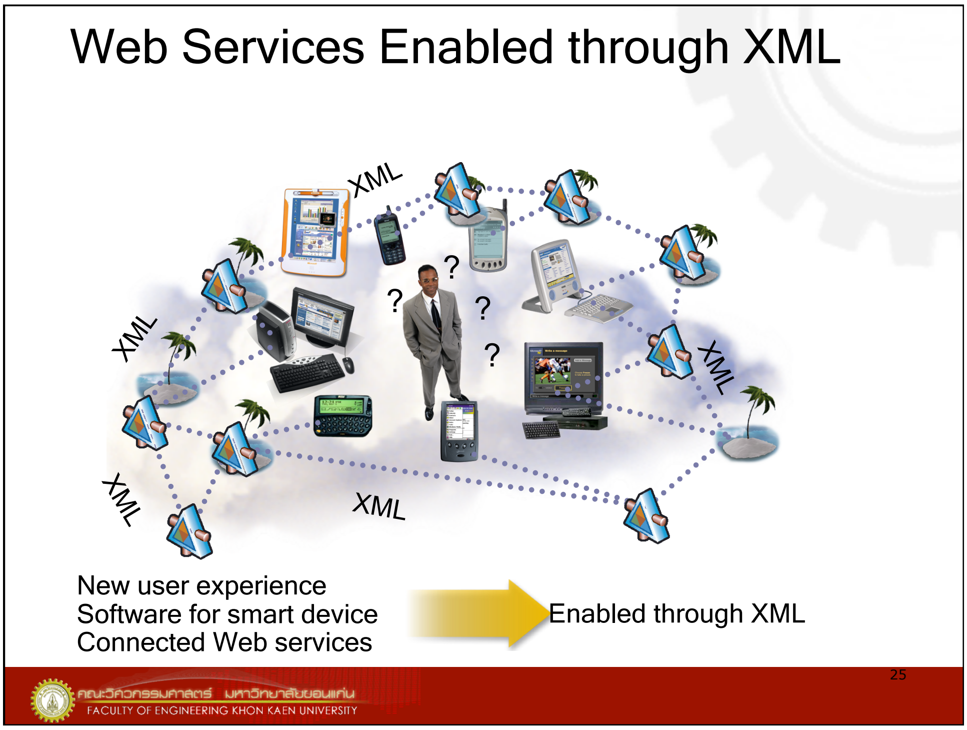
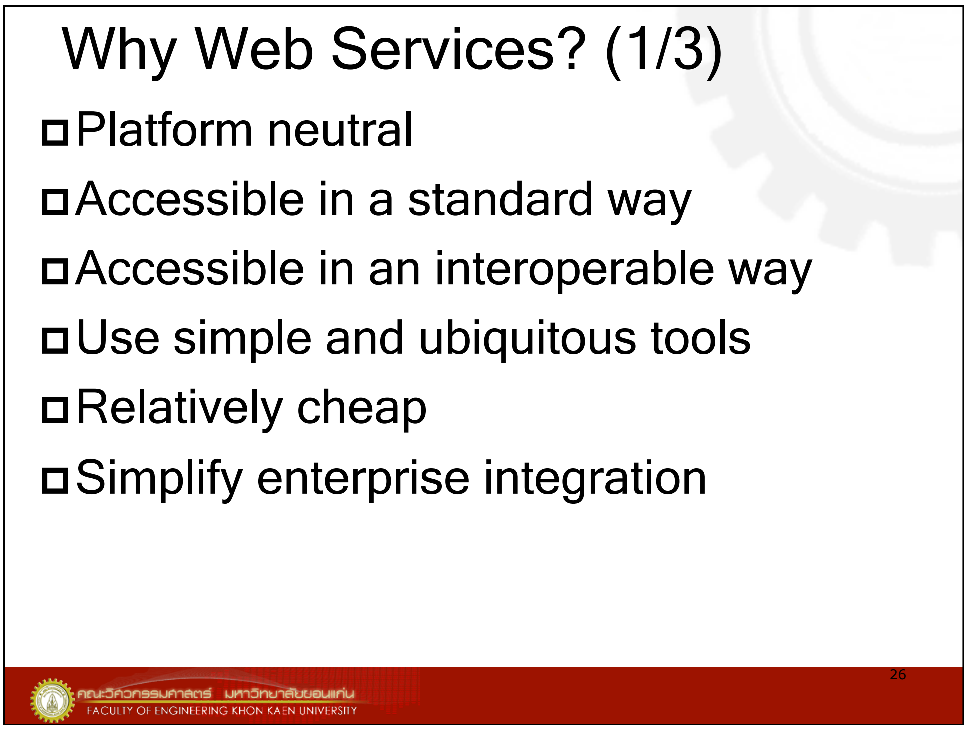


Web Services Enabled through XML

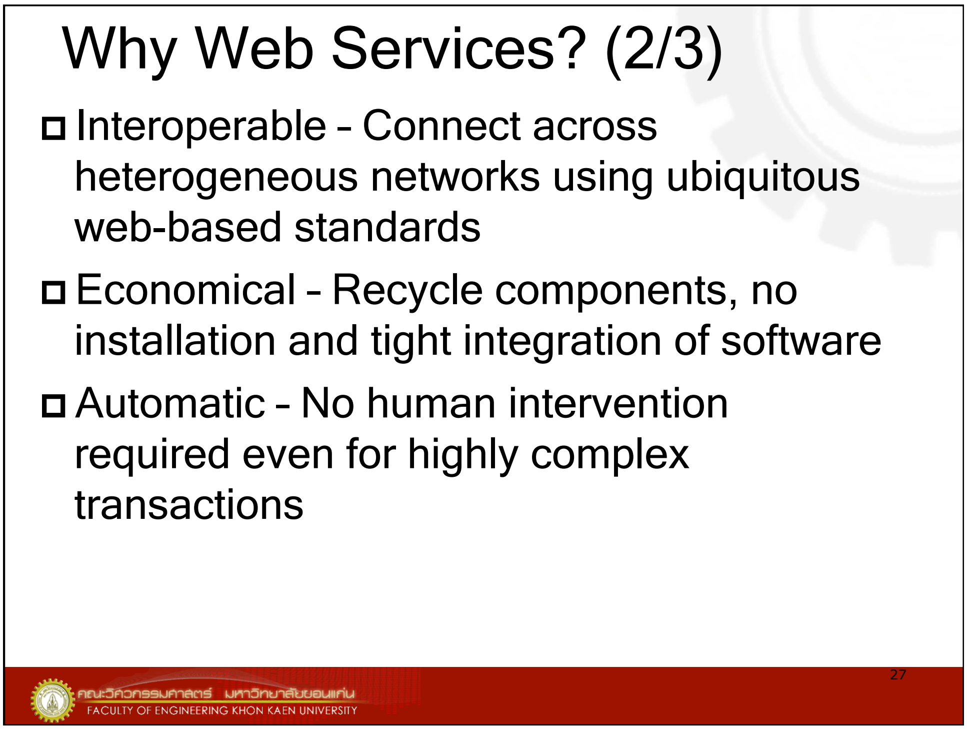
New user experience
Software for smart device
Connected Web services

Enabled through XML



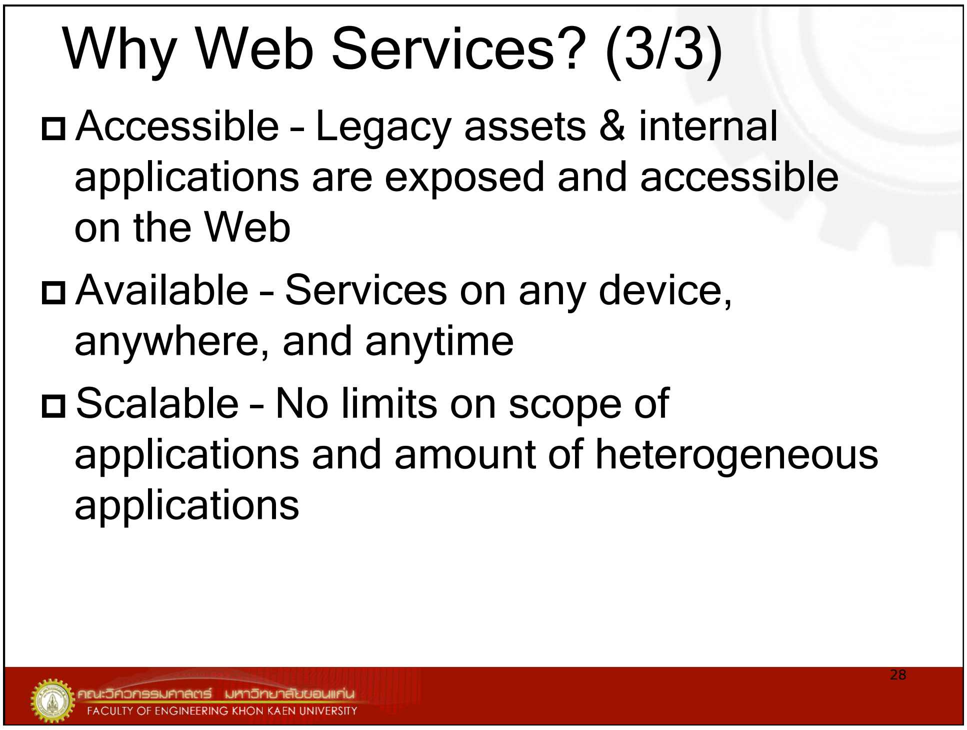
Why Web Services? (1/3)

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



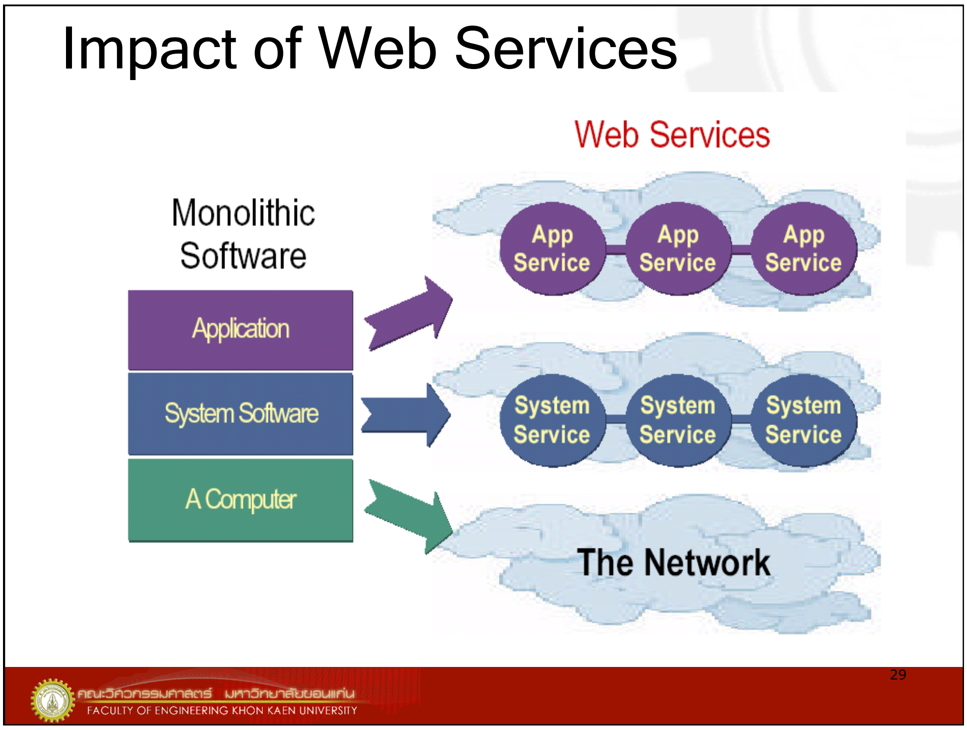
Why Web Services? (2/3)

- 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

Web Services

Monolithic Software

Application

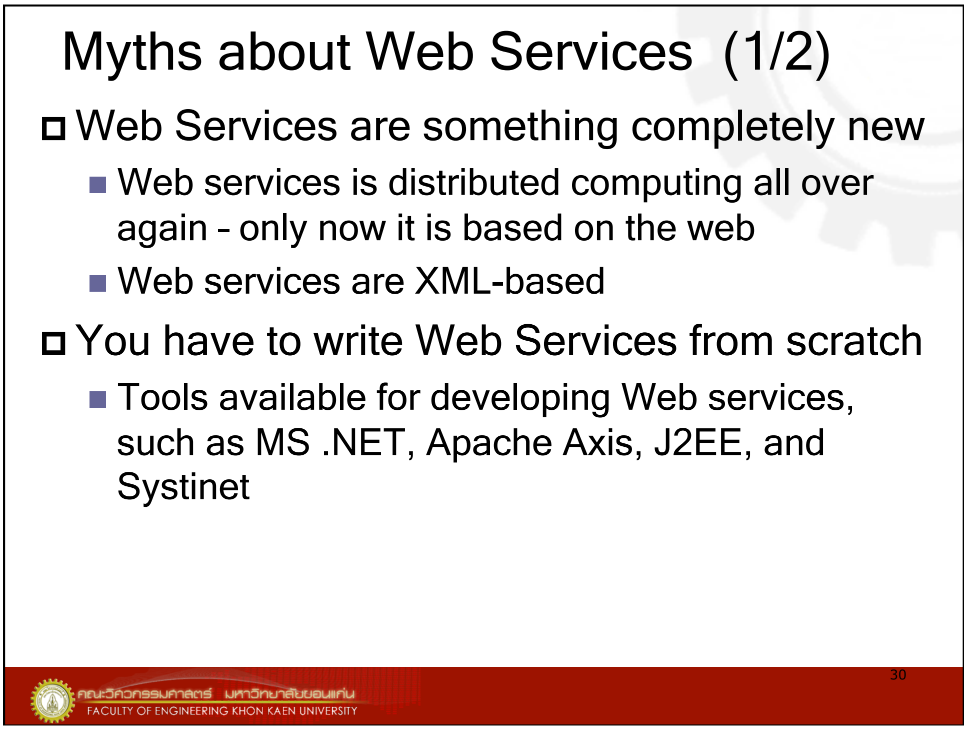
System Software

A Computer

App Service — App Service — App Service

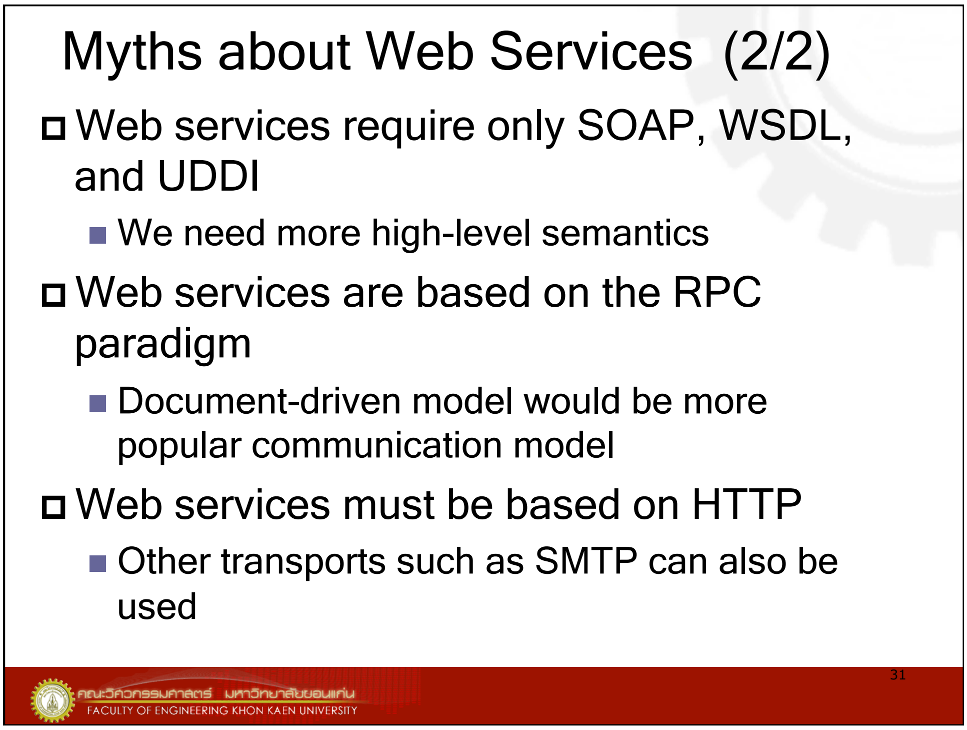
System Service — System Service — System Service

The Network



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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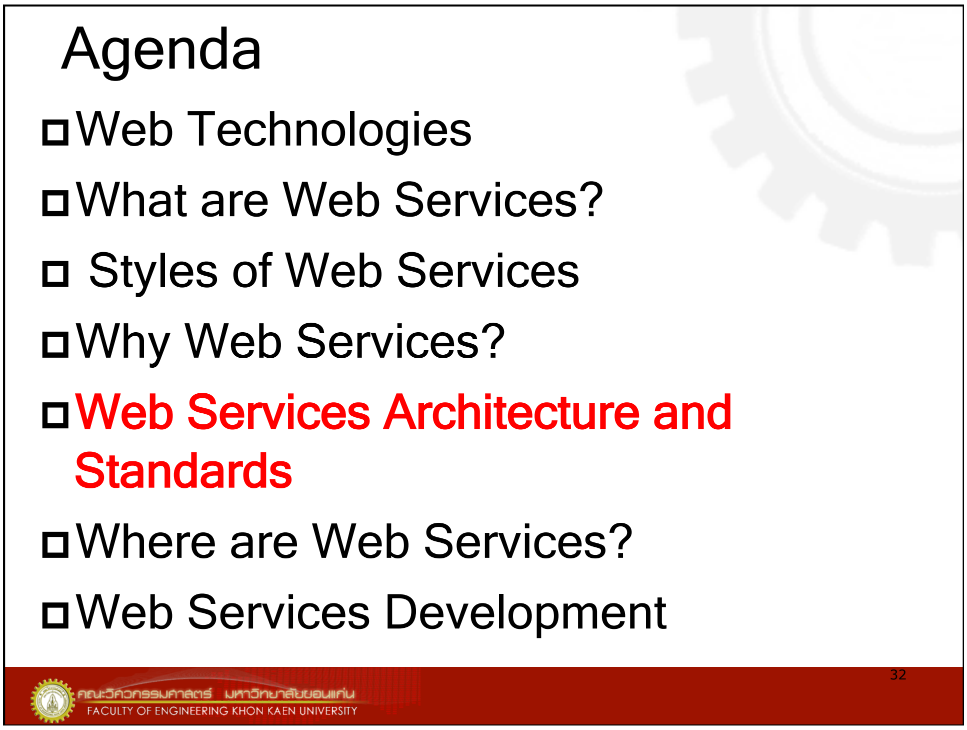

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Web Services Standards

- XML (Extensible Markup Language)
- SOAP (Simple Object Access Protocol)
- WSDL (Web Services Description Language)
- JSON (JavaScript Object Notation)

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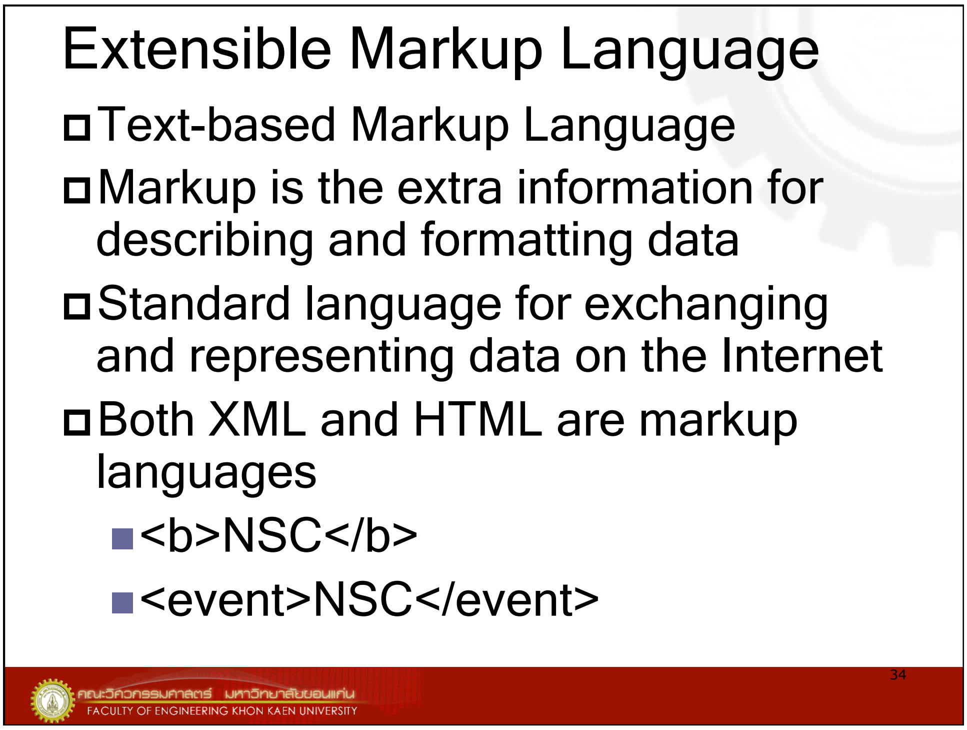

Extensible Markup Language

- 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
  - <b>NSC</b>
  - <event>NSC</event>

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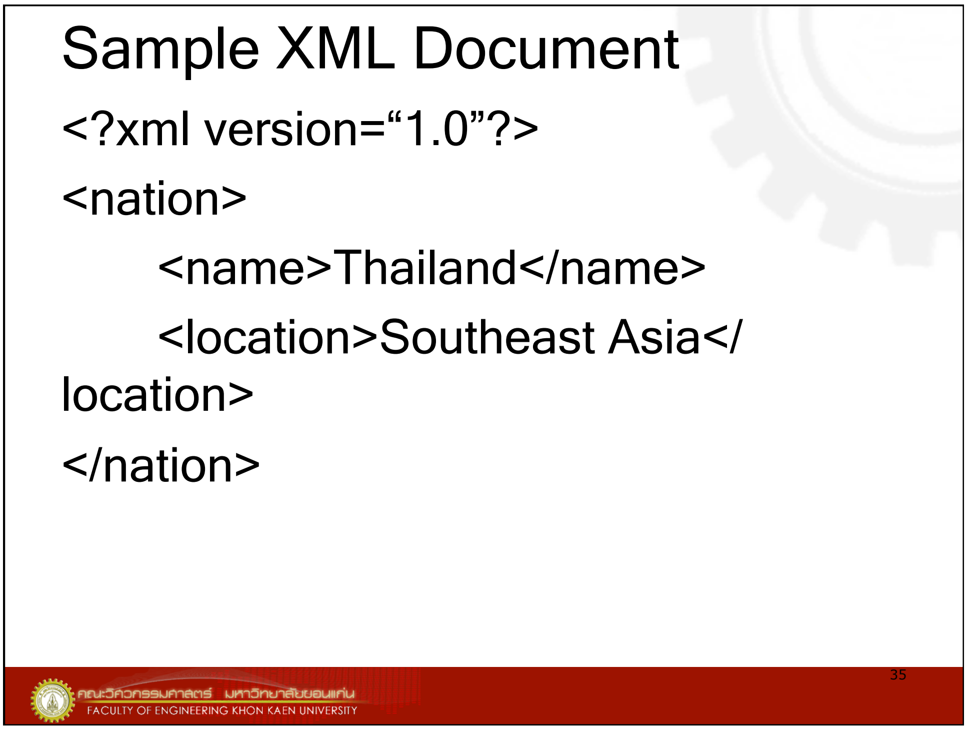

Sample XML Document

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

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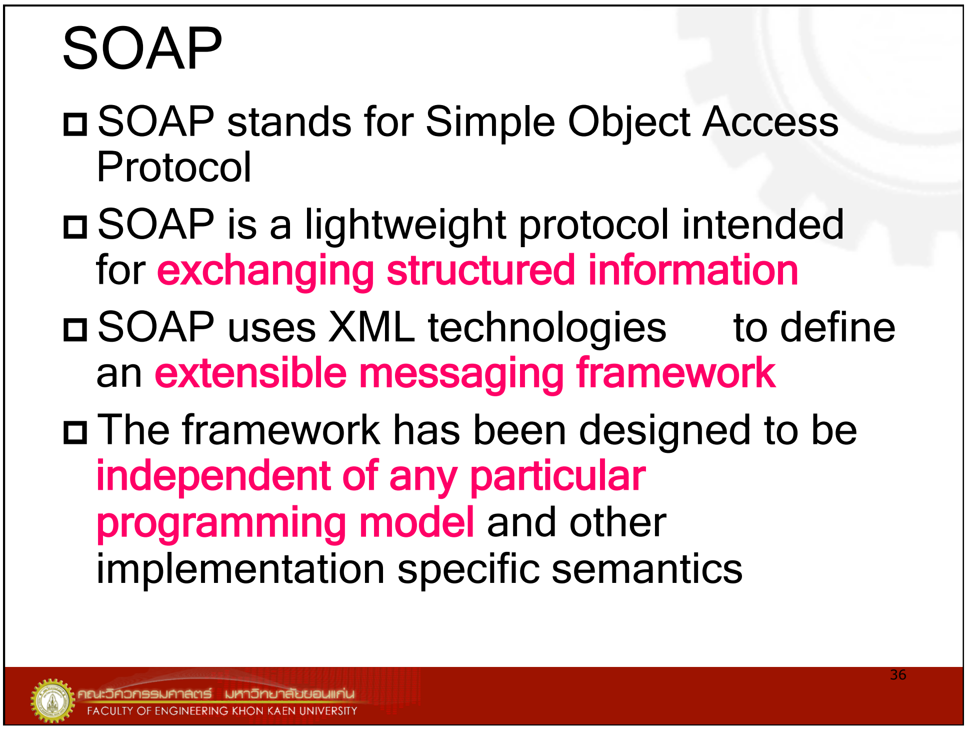

SOAP

- ◻ 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

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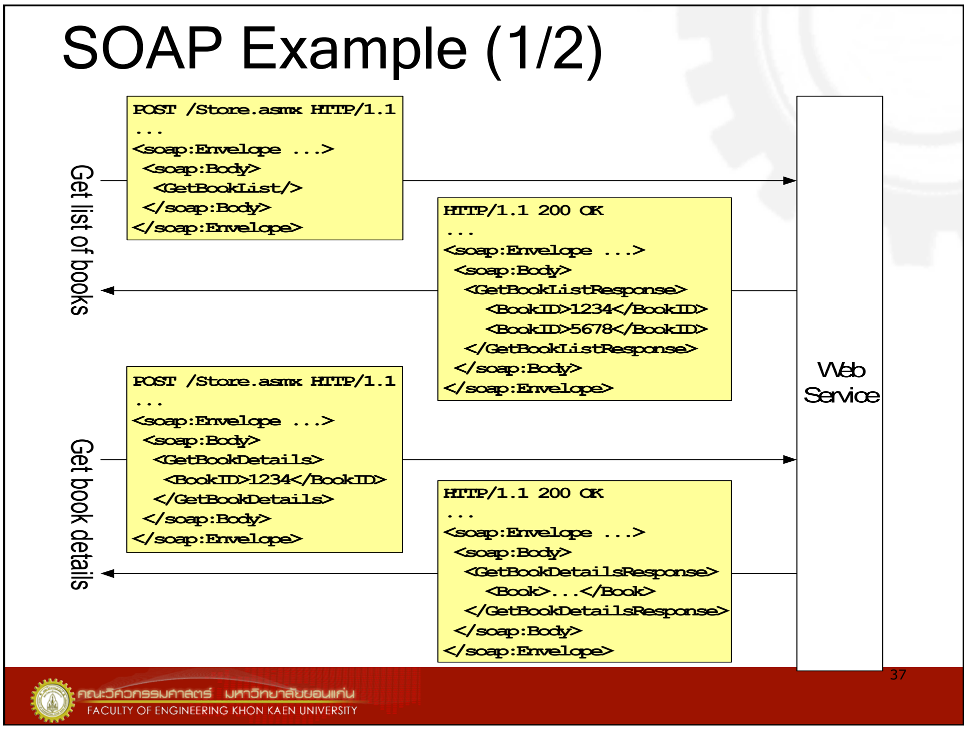

SOAP Example (1/2)

Get list of books

```
POST /Store.asmx HTTP/1.1
...
<soap:Envelope ...>
 <soap:Body>
  <GetBookList/>
 </soap:Body>
</soap:Envelope>
```

```
HTTP/1.1 200 OK
...
<soap:Envelope ...>
 <soap:Body>
  <GetBookListResponse>
    <BookID>1234</BookID>
    <BookID>5678</BookID>
  </GetBookListResponse>
 </soap:Body>
</soap:Envelope>
```

Get book details

```
POST /Store.asmx HTTP/1.1
...
<soap:Envelope ...>
 <soap:Body>
  <GetBookDetails>
   <BookID>1234</BookID>
  </GetBookDetails>
 </soap:Body>
</soap:Envelope>
```

```
HTTP/1.1 200 OK
...
<soap:Envelope ...>
 <soap:Body>
  <GetBookDetailsResponse>
    <Book>...</Book>
  </GetBookDetailsResponse>
 </soap:Body>
</soap:Envelope>
```

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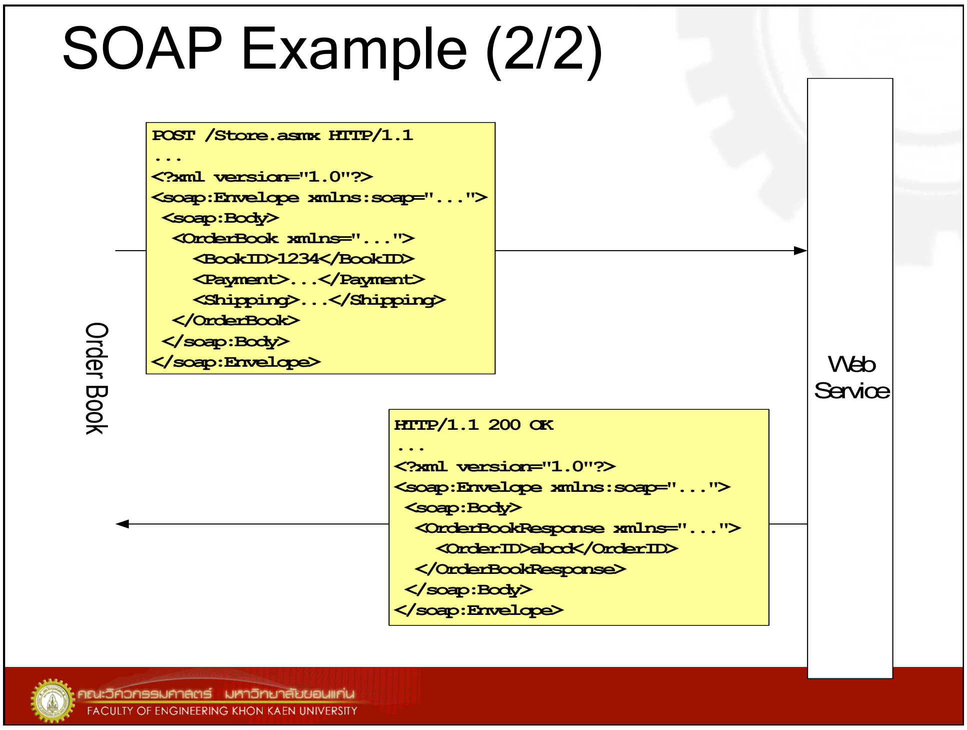

SOAP Example (2/2)

Order Book

```
POST /Store.asmx HTTP/1.1
...
<?xml version="1.0"?>
<soap:Envelope xmlns:soap="...">
 <soap:Body>
  <OrderBook xmlns="...">
    <BookID>1234</BookID>
    <Payment>...</Payment>
    <Shipping>...</Shipping>
  </OrderBook>
 </soap:Body>
</soap:Envelope>
```

```
HTTP/1.1 200 OK
...
<?xml version="1.0"?>
<soap:Envelope xmlns:soap="...">
 <soap:Body>
  <OrderBookResponse xmlns="...">
    <OrderID>abcd</OrderID>
  </OrderBookResponse>
 </soap:Body>
</soap:Envelope>
```

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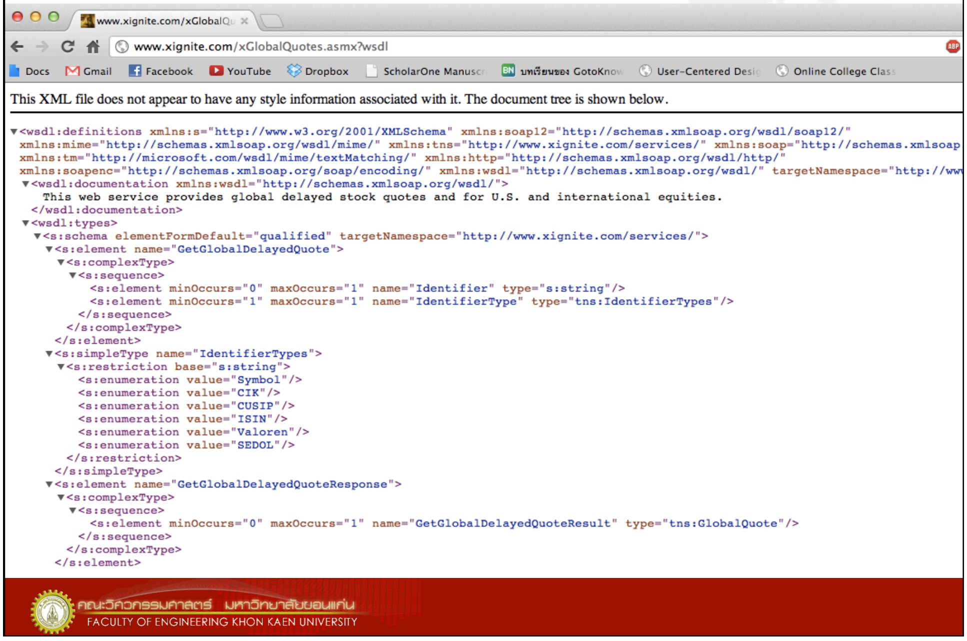
WSDL

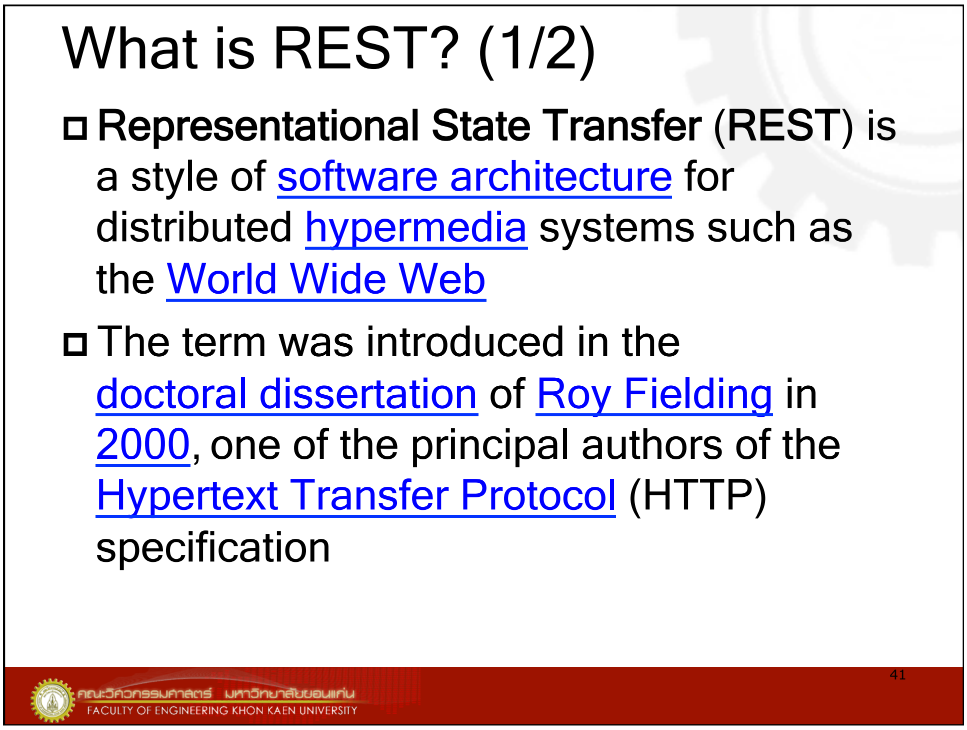
- WSDL stands for Web Services Description Language
- XML language for describing web services
- XML service is described as
  - A set of communication endpoints (ports)
- Endpoint is made of two parts
  - Abstract definition of operations and messages
  - Concrete binding to networking protocol and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

Sample WSDL



This XML file does not appear to have any style information associated with it. The document tree is shown below.

```
▼<wsdl:definitions xmlns:s="http://www.w3.org/2001/XMLSchema" xmlns:soap12="http://schemas.xmlsoap.org/wsdl/soap12/"
 xmlns:mime="http://schemas.xmlsoap.org/wsdl/mime/" xmlns:tns="http://www.xignite.com/services/" xmlns:soap="http://schemas.xmlsoap
 xmlns:tm="http://microsoft.com/wsdl/mime/textMatching/" xmlns:http="http://schemas.xmlsoap.org/wsdl/http/"
 xmlns:soapenc="http://schemas.xmlsoap.org/soap/encoding/" xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/" targetNamespace="http://ww
 ▼<wsdl:documentation xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/">
   This web service provides global delayed stock quotes and for U.S. and international equities.
  </wsdl:documentation>
 ▼<wsdl:types>
  ▼<s:schema elementFormDefault="qualified" targetNamespace="http://www.xignite.com/services/">
   ▼<s:element name="GetGlobalDelayedQuote">
    ▼<s:complexType>
     ▼<s:sequence>
        <s:element minOccurs="0" maxOccurs="1" name="Identifier" type="s:string"/>
        <s:element minOccurs="1" maxOccurs="1" name="IdentifierType" type="tns:IdentifierTypes"/>
      </s:sequence>
     </s:complexType>
    </s:element>
   ▼<s:simpleType name="IdentifierTypes">
    ▼<s:restriction base="s:string">
      <s:enumeration value="Symbol"/>
      <s:enumeration value="CIK"/>
      <s:enumeration value="CUSIP"/>
      <s:enumeration value="ISIN"/>
      <s:enumeration value="Valoren"/>
      <s:enumeration value="SEDOL"/>
     </s:restriction>
    </s:simpleType>
   ▼<s:element name="GetGlobalDelayedQuoteResponse">
    ▼<s:complexType>
     ▼<s:sequence>
        <s:element minOccurs="0" maxOccurs="1" name="GetGlobalDelayedQuoteResult" type="tns:GlobalQuote"/>
      </s:sequence>
     </s:complexType>
    </s:element>
```



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

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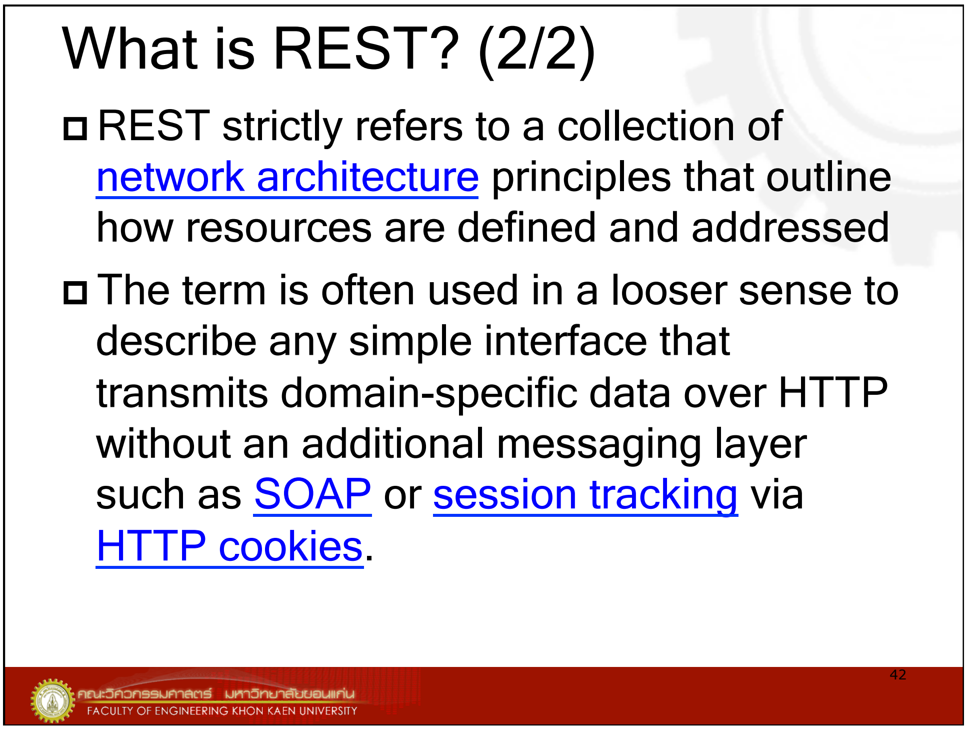

What is REST? (2/2)

- 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.

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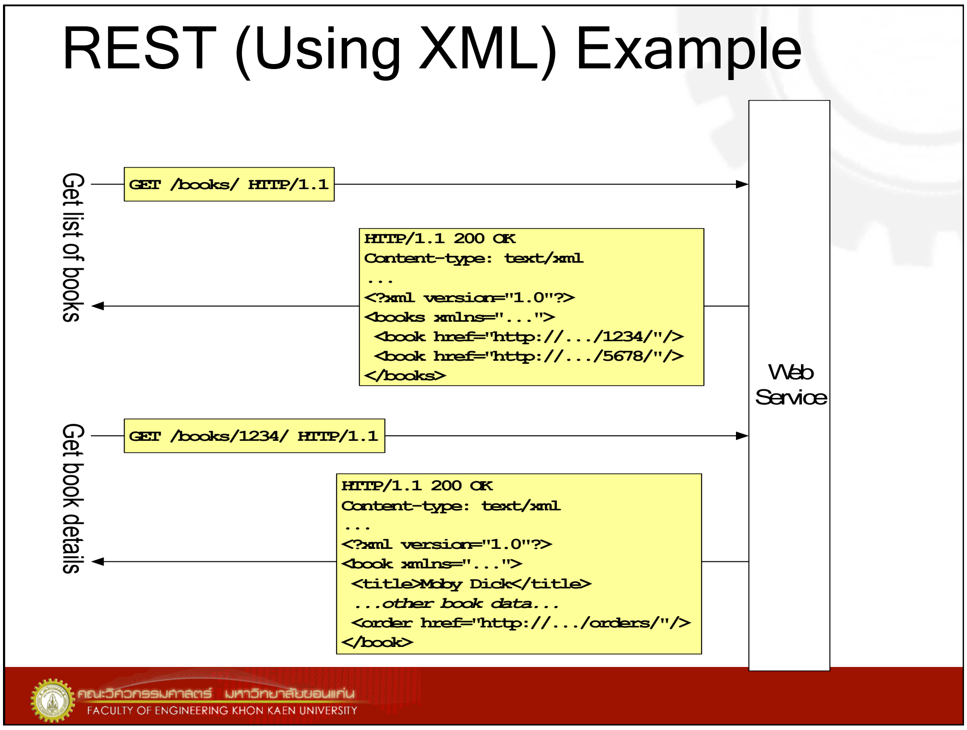


REST (Using XML) Example

Get list of books

```
GET /books/ HTTP/1.1
```

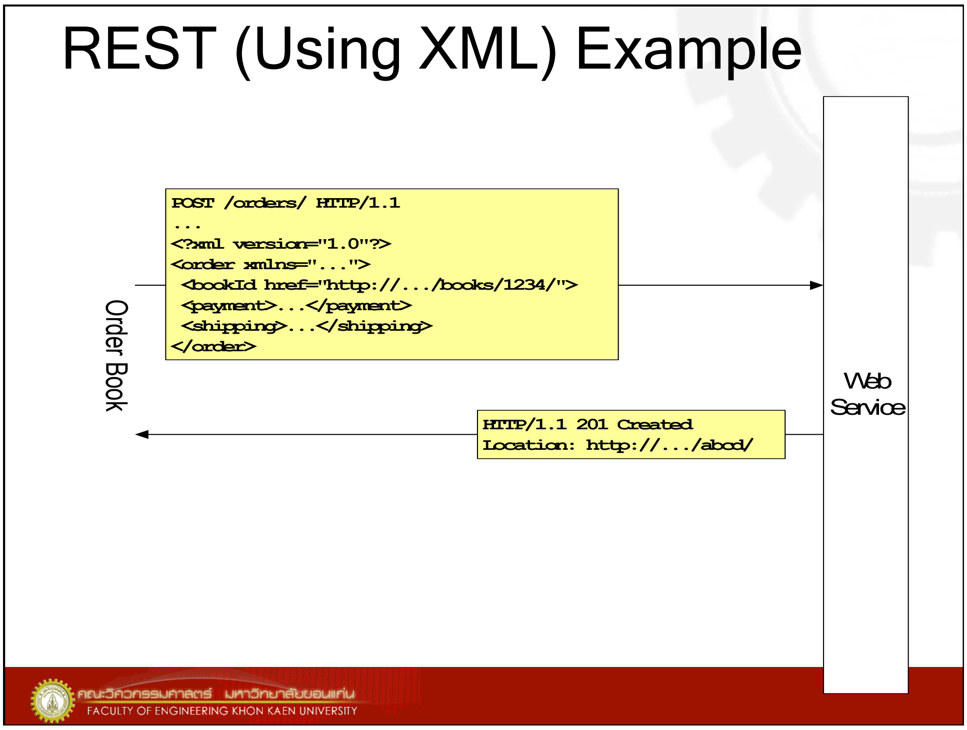
```
HTTP/1.1 200 OK
Content-type: text/xml
...
<?xml version="1.0"?>
<books xmlns="...">
 <book href="http://.../1234/"/>
 <book href="http://.../5678/"/>
</books>
```

Get book details

```
GET /books/1234/ HTTP/1.1
```

```
HTTP/1.1 200 OK
Content-type: text/xml
...
<?xml version="1.0"?>
<book xmlns="...">
 <title>Moby Dick</title>
 ...other book data...
 <order href="http://.../orders/"/>
</book>
```

Web Service



REST (Using XML) Example

Order Book

```
POST /orders/ HTTP/1.1
...
<?xml version="1.0"?>
<order xmlns="...">
 <bookId href="http://.../books/1234/">
 <payment>...</payment>
 <shipping>...</shipping>
</order>
```

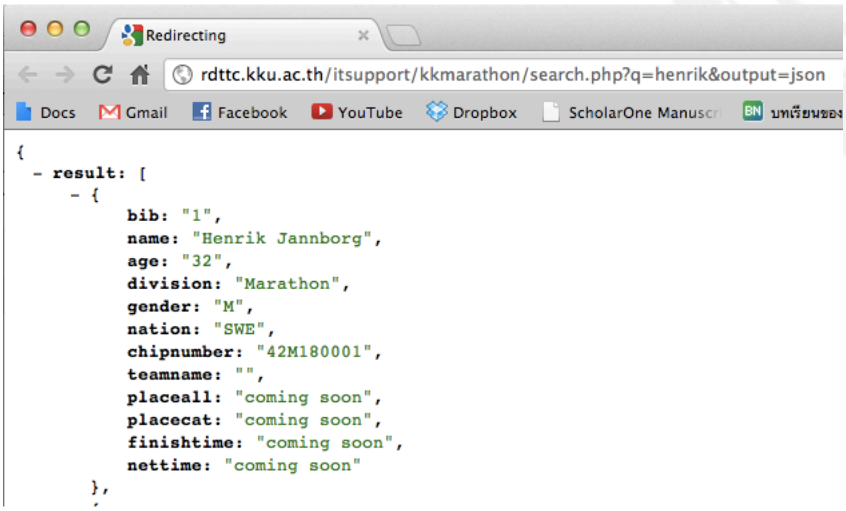
```
HTTP/1.1 201 Created
Location: http://.../abcd/
```

Web Service

JSON

- JSON (JavaScript Object Notation) is a lightweight data-interchange format. It is easy for humans to read and write
- It is easy for machines to parse and generate.
- JSON is a text format that is completely language independent
- JSON is built on two structures:
  - A collection of name/value pairs
  - An ordered list of values

REST (Using JSON) Example



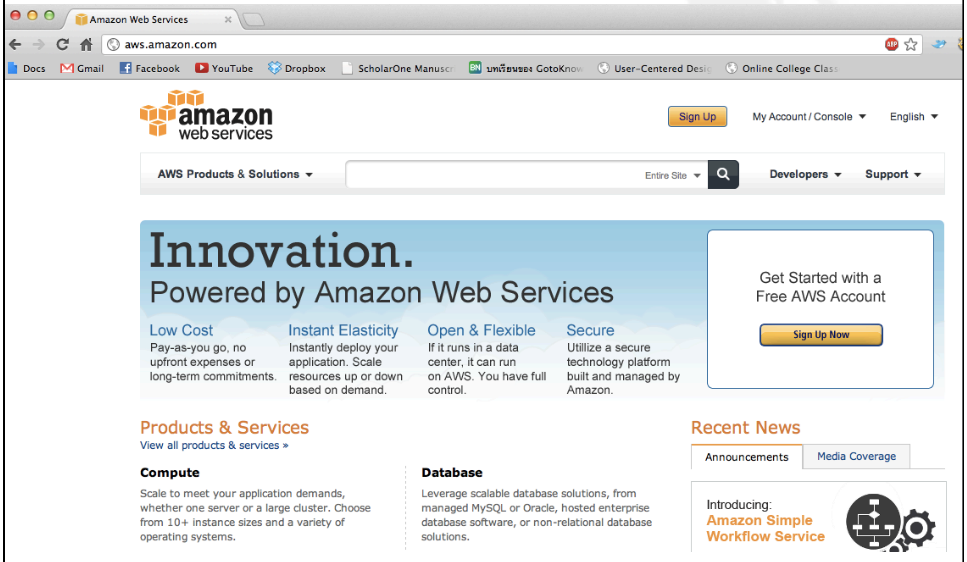
rdttc.kku.ac.th/itsupport/kkmarathon/search.php?q=henrik&output=json

```
{
  - result: [
     - {
           bib: "1",
           name: "Henrik Jannborg",
           age: "32",
           division: "Marathon",
           gender: "M",
           nation: "SWE",
           chipnumber: "42M180001",
           teamname: "",
           placeall: "coming soon",
           placecat: "coming soon",
           finishtime: "coming soon",
           nettime: "coming soon"
       },
```

Agenda

- Web Technologies
- What are Web Services?
- Styles of Web Services
- Why Web Services?
- Web Services Architecture and Standards
- Where are Web Services?
- Web Services Development

Amazon Web Services



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Instantly deploy your application. Scale resources up or down based on demand.

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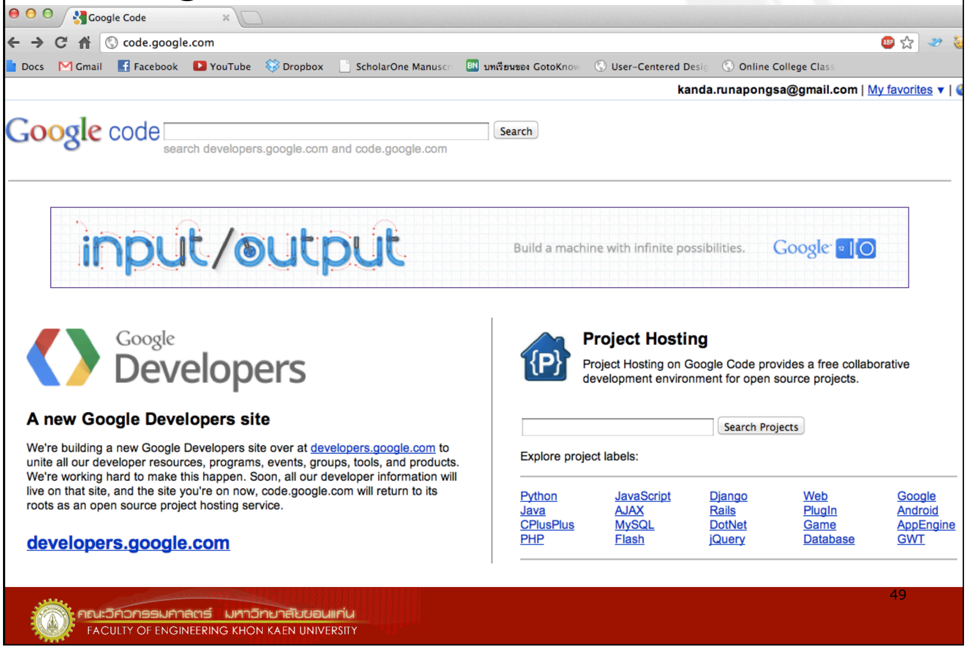
Google Code



Google Developers

A new Google Developers site

We're building a new Google Developers site over at developers.google.com to unite all our developer resources, programs, events, groups, tools, and products. We're working hard to make this happen. Soon, all our developer information will live on that site, and the site you're on now, code.google.com will return to its roots as an open source project hosting service.

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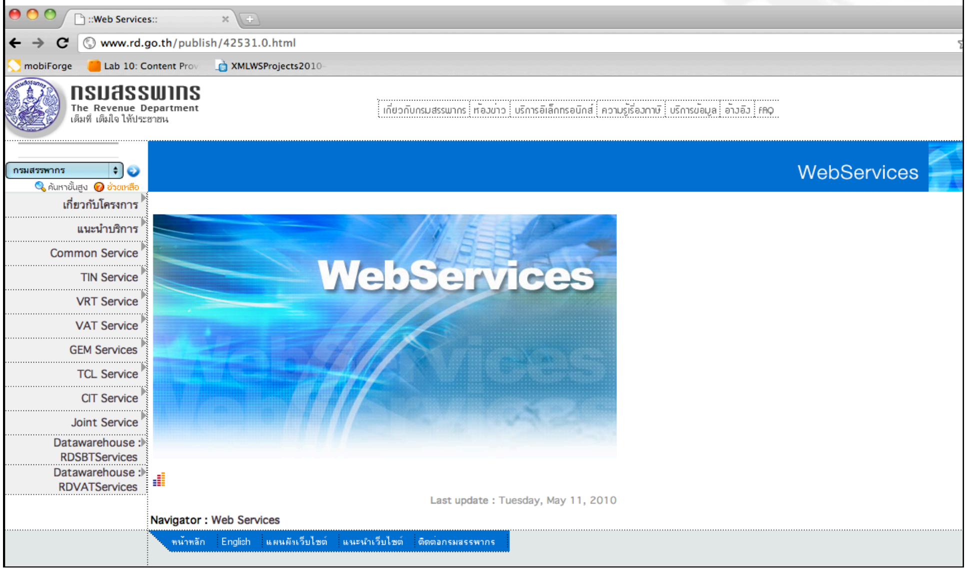
e-Revenue Web Services (1/2)

- http://www.rd.go.th/publish/42531.0.html


::Web Services::
www.rd.go.th/publish/42531.0.html
mobiForge
Lab 10: Content Prov
XMLWSProjects2010
กรมสรรพากร
The Revenue Department
เต็มที่ เต็มใจ ให้ประชาชน
เกี่ยวกับกรมสรรพากร | ห้องข่าว | บริการอิเล็กทรอนิกส์ | ความรู้เรื่องภาษี | บริการข้อมูล | อ้างอิง | FAQ
กรมสรรพากร
ค้นหาขั้นสูง
ช่วยเหลือ
WebServices
เกี่ยวกับโครงการ
แนะนำบริการ
Common Service
TIN Service
VRT Service
VAT Service
GEM Services
TCL Service
CIT Service
Joint Service
Datawarehouse : RDSBTServices
Datawarehouse : RDVATServices
WebServices
หน้าหลัก | English | แผนผังเว็บไซต์ | แนะนำเว็บไซต์ | ติดต่อกรมสรรพากร

Last update : Tuesday, May 11, 2010

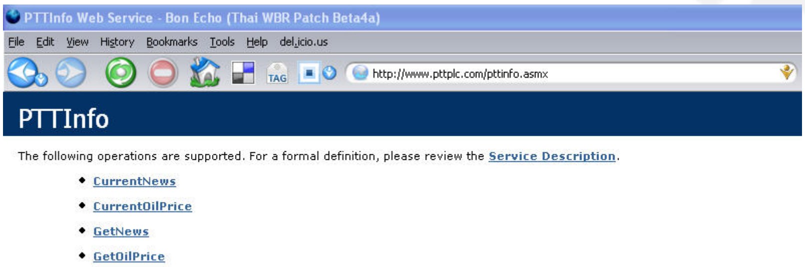
Navigator : Web Services

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


PTTInfo Web Service - Bon Echo (Thai WBR Patch Beta4a)
File Edit View History Bookmarks Tools Help del.icio.us
TAG
http://www.pttplc.com/pttinfo.asmx

PTTInfo

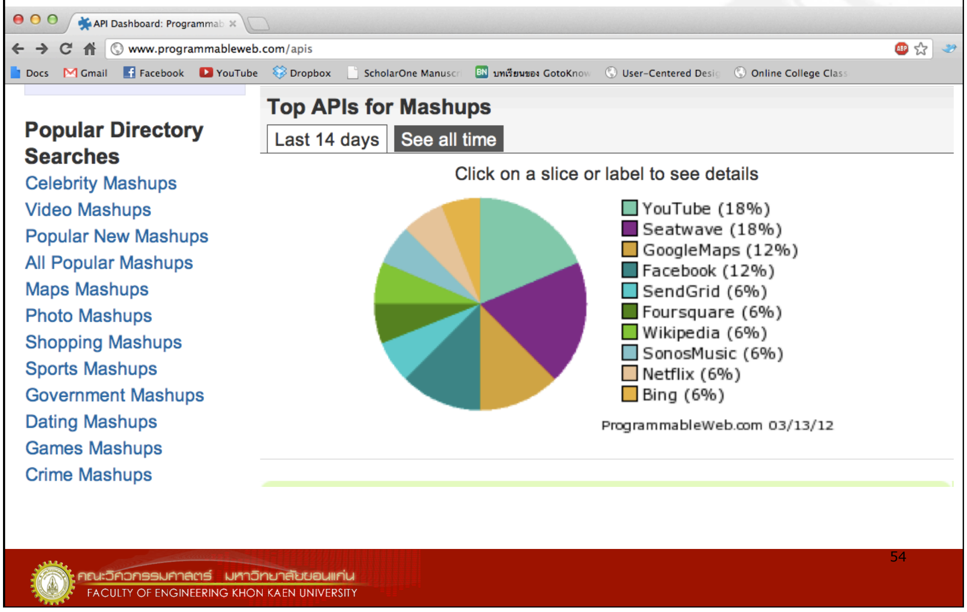
The following operations are supported. For a formal definition, please review the Service Description.

- CurrentNews
- CurrentOilPrice
- GetNews
- GetOilPrice

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

Search for Web APIs and Mashups



Popular Directory Searches

- Celebrity Mashups
- Video Mashups
- Popular New Mashups
- All Popular Mashups
- Maps Mashups
- Photo Mashups
- Shopping Mashups
- Sports Mashups
- Government Mashups
- Dating Mashups
- Games Mashups
- Crime Mashups

Top APIs for Mashups

Last 14 days | See all time

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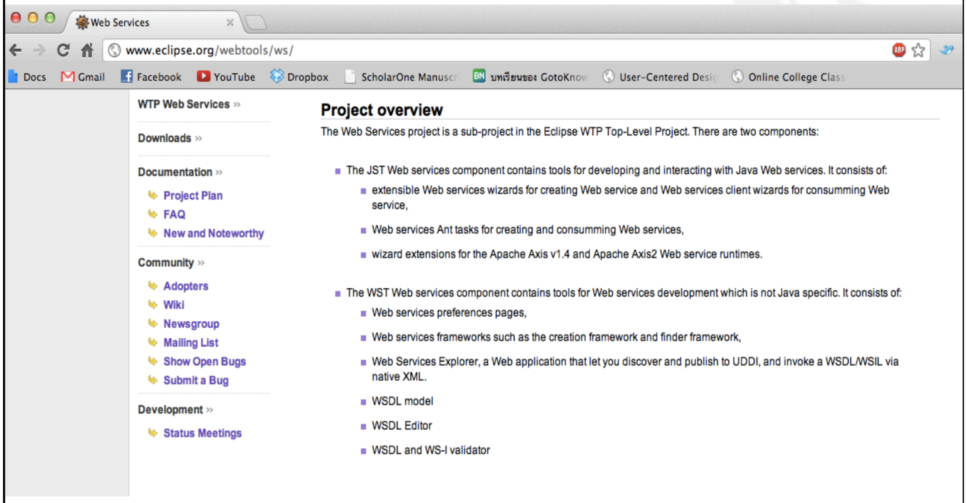
ProgrammableWeb.com 03/13/12

Agenda

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

Eclipse Web Tools Platform (WTP) Project

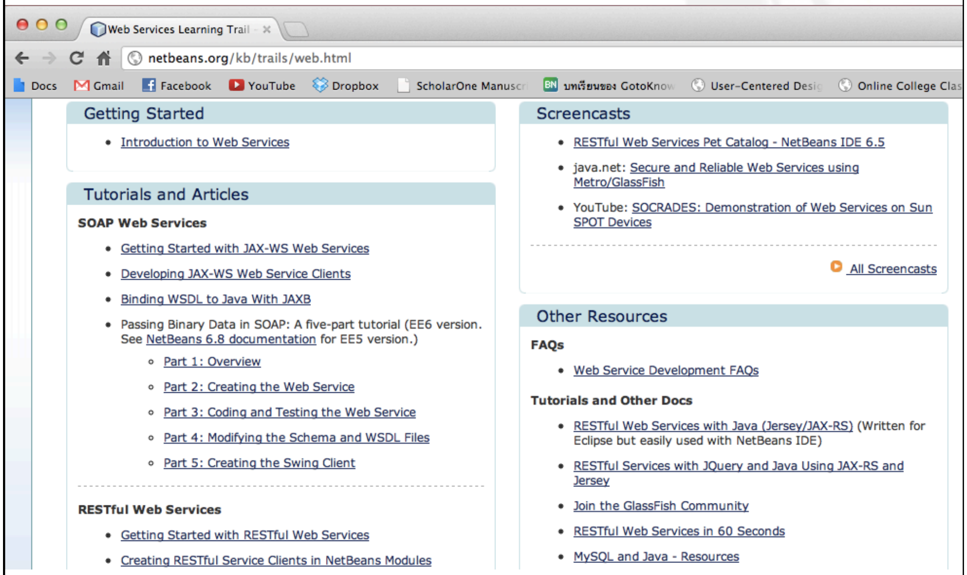


Project overview

The Web Services project is a sub-project in the Eclipse WTP Top-Level Project. There are two components:

- The JST Web services component contains tools for developing and interacting with Java Web services. It consists of:
  - extensible Web services wizards for creating Web service and Web services client wizards for consumming Web service,
  - Web services Ant tasks for creating and consumming Web services,
  - wizard extensions for the Apache Axis v1.4 and Apache Axis2 Web service runtimes.
- The WST Web services component contains tools for Web services development which is not Java specific. It consists of:
  - Web services preferences pages,
  - Web services frameworks such as the creation framework and finder framework,
  - Web Services Explorer, a Web application that let you discover and publish to UDDI, and invoke a WSDL/WSIL via native XML.
  - WSDL model
  - WSDL Editor
  - WSDL and WS-I validator

NetBeans



Getting Started

- Introduction to Web Services

Tutorials and Articles

SOAP Web Services

- Getting Started with JAX-WS Web Services
- Developing JAX-WS Web Service Clients
- Binding WSDL to Java With JAXB
- Passing Binary Data in SOAP: A five-part tutorial (EE6 version. See NetBeans 6.8 documentation for EE5 version.)
    - Part 1: Overview
    - Part 2: Creating the Web Service
    - Part 3: Coding and Testing the Web Service
    - Part 4: Modifying the Schema and WSDL Files
    - Part 5: Creating the Swing Client

RESTful Web Services

- Getting Started with RESTful Web Services
- Creating RESTful Service Clients in NetBeans Modules

Screencasts

- RESTful Web Services Pet Catalog - NetBeans IDE 6.5
- java.net: Secure and Reliable Web Services using Metro/GlassFish
- YouTube: SOCRADES: Demonstration of Web Services on Sun SPOT Devices

All Screencasts

Other Resources

FAQs

- Web Service Development FAQs

Tutorials and Other Docs

- RESTful Web Services with Java (Jersey/JAX-RS) (Written for Eclipse but easily used with NetBeans IDE)
- RESTful Services with JQuery and Java Using JAX-RS and Jersey
- Join the GlassFish Community
- RESTful Web Services in 60 Seconds
- MySQL and Java - Resources

Summary

- Web services technology exists for making different systems seamlessly work together
    - XML and JSON are the languages of exchange data
- Web services have been developed and used extensively in many countries
- Thailand should develop and employ Web services technology more for the benefits of sharing and exchanging data as well as increasing the number of mobile apps

References (1/2)

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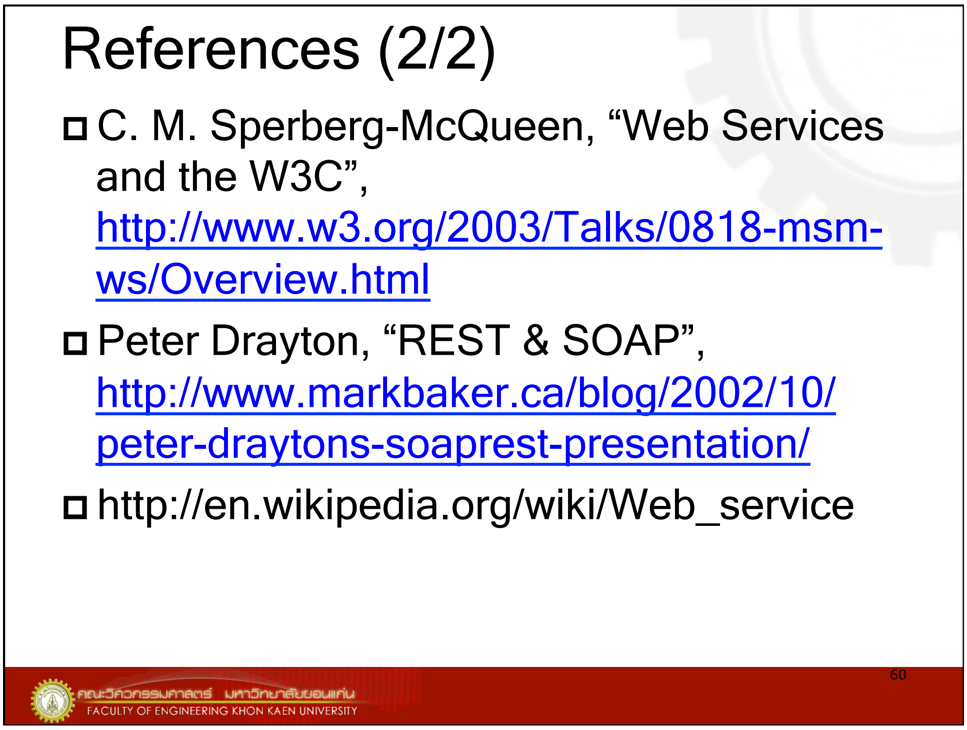
- Hugo Haas, W3C, “Designing the architecture for Web Services”, http://www.w3.org/2003/Talks/0521-hh-wsa/
- Sang Shin, “Web Services and SOA Programming”, http://www.javapassion.com/webservices/
- Wikipedia, “Representational State Transfer”, http://en.wikipedia.org/wiki/Representational_State_Transfer
- Java-Source.net, “Open Source Web Services Tools in Java”, http://java-source.net/open-source/web-services-tools



References (2/2)

- C. M. Sperberg-McQueen, “Web Services and the W3C”, http://www.w3.org/2003/Talks/0818-msm-ws/Overview.html
- Peter Drayton, “REST & SOAP”, http://www.markbaker.ca/blog/2002/10/peter-draytons-soaprest-presentation/
- http://en.wikipedia.org/wiki/Web_service