



Introducing ArcWebSM Services

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Introducing ArcWeb Services

Introduction Imagine you own a chain of coffeehouses, but your potential customers do not know where to find your stores. You want your customers to be able to type their home address into a Web site and get directions to the five closest locations. Traditionally, only large companies could afford the major investments in geoprocessing software, data, and computer systems. Now, with the advent of ArcWebSM Services—delivered as individual services, packages, or complete applications—all you need is an Internet connection to build your own store locator.

ArcWeb Services Overview ArcWeb Services are ESRI's family of geographic information system (GIS) Web services products, which deliver data and functionality via the Internet. ArcWeb Services offer a way for developers to include GIS content and capabilities in their applications without having to host the data or develop the necessary tools themselves. ArcWeb Services provide geospatial functionality such as routing, mapping, and geocoding coupled with a rich collection of reliable, up-to-date data.

ArcWeb Services are available as individual services, service packages, and service applications. Individual ArcWeb Services are ArcGISTM software-ready commercial map services or data sets that may be used individually or combined with others. ArcWeb Services packages are suites of complementary functionality and data that are bundled together and ready for use in any Web-based application. ArcWeb Services applications are complete products built using ArcWeb Services to meet specific business needs.

This technical paper introduces the three types of ArcWeb Services and the tools used with this new technology.

Individual ArcWeb Services ESRI offers ArcWeb Services from many of the world's leading commercial data publishers. These Web services represent some of the most current and comprehensive geographic data available anywhere. Individual ArcWeb Services can be accessed as either an image or feature service, which provides additional functionality. You can use ArcWeb Services as background layers for other local data, or you can interact with the data in much the same way as you would with a local source.

ArcWeb Services Packages ArcWeb Services packages are suites of complementary data and functionality bundled together. For example, the ArcWeb USA service package contains data and services for the United States, encompassing street mapping, census demographics, routing, and more. ArcWeb USA also provides access to additional tools including Geographic Data Technology, Inc. (GDT), U.S. street map, United States Geological Survey (USGS) relief map, census population density map, Federal Emergency Management Agency (FEMA) flood hazard data, and Sagent AddressBroker geocoding engine. This package provides all the components needed to create a store locator, census reporter, and much more.

ArcWeb Services Applications

Any application that uses one or many ArcWeb Services can be considered an ArcWeb Services application. They are usually built with a particular task in mind, ready for a specific business need.

ArcWeb Services Components

To fully understand ArcWeb Services, you must first understand their underlying structure. All ArcWeb Services are written in XML, a markup language used to describe data.

XML

XML is not a programming language, it is a markup language. This means that XML does not *do* anything, it merely describes data. XML is a concise way to transfer information across the Internet. Below is a letter marked up with XML.

```
<letter>
  <to>Molly</to>
  <from>Marcy</from>
  <date>8/28/02</date>
  <body>Don't forget about the big party this weekend!</body>
</letter>
```

You may notice that this code does not contain any information about how to display the letter; this is taken care of by software on either end.

ArcWeb Services Protocols

XML is the language used by all ArcWeb Services, but they utilize two distinct protocols. A protocol is an agreement between computers on how they will communicate. People make similar agreements all the time. In the United States, the first time people meet they usually shake hands and introduce themselves. After that, they greet each other by simply saying "Hi." Similarly, by following a standard protocol, or agreement, computers have a series of predetermined behaviors to use each time they interact. Computers must be using the same protocol, or communication will be difficult, if not impossible. Such incompatibility might be similar to an American meeting an English-speaking Japanese for the first time. If the American extended a hand and the Japanese bowed, their protocols are at odds with each other. Even though they both speak English, their conversation may never take place.

ArcXML

ArcXML is ESRI's own protocol for its Internet products. By having its own protocol, ESRI® software is able to communicate quickly and efficiently. However, this means that it cannot communicate with other products without a translator. Many individual ArcWeb Services use the ArcXML protocol for easy integration with ArcGIS and ArcExplorer™ Web services.

To give you a better idea of what ArcXML looks like, the figure below is a sample request that your computer might send to ESRI.

SAMPLE ArcXML REQUEST

```
<?xml version="1.0" encoding="UTF-8" ?>
<ARCXML version="1.1">
  <REQUEST>
    <GET_IMAGE>
      <PROPERTIES>
        <ENVELOPE minx="-125" miny="25" maxx="-67" maxy="50" />
      </PROPERTIES>
    </GET_IMAGE>
  </REQUEST>
</ARCXML>
```

The first line of XML tells ESRI which version of XML you are using. The rest of the code is composed of nested tags. These tags are called wrappers because they describe the information they are surrounding; each outer layer tells you what the inner layers contain. The second line and the bottom line tell ESRI that you are using ArcXML. The rest of the tags indicate that the information is a request of an image with certain properties. These properties are described by an envelope with set bounding coordinates.

The following is a sample response that ESRI might send back to you.

SAMPLE ArcXML RESPONSE

```
<?xml version="1.0"?>
<ARCXML version="1.1">
  <RESPONSE>
    <IMAGE>
      <ENVELOPE minx="-125" miny="25" maxx="-67" maxy="50" />
      <OUTPUT file="C:\ArcIMS\output\
usa_image_MYCOMPUTER2953026.jpg"
url="http://mycomputer.domain.com/output/
usa_image_MYCOMPUTER2953026.jpg"/>
    </IMAGE>
  </RESPONSE>
</ARCXML>
```

Although similar to the request, this code has response tags that contain the location of where it put the requested image. Had this been a real request/response (also known as a transaction), you could go to this location on your computer and find the delivered image. Some ArcWeb Services use ArcXML as their protocol, while other services utilize Simple Object Access Protocol (SOAP).

SOAP SOAP is an international standard protocol. ArcWeb Services that adhere to SOAP can be easily integrated into any Web page or custom-built Internet application. All SOAP-based ArcWeb Services are compatible with the majority of Web services frameworks available today such as Microsoft's .NET or The Mind Electric's GLUE.

SOAP is lengthier than ArcXML but is basically the same at the core. Below is a sample request that your computer might send to ESRI.

SAMPLE SOAP REQUEST

```
<?xml version="1.0" encoding="UTF-8"?>
<soap:Envelope xmlns:xsi='http://www.w3.org/2001/XMLSchema-instance'
xmlns:xsd='http://www.w3.org/2001/XMLSchema'
xmlns:soap='http://schemas.xmlsoap.org/soap/envelope/'
xmlns:soapenc='http://schemas.xmlsoap.org/soap/encoding/'
soap:encodingStyle='http://schemas.xmlsoap.org/soap/encoding/'>
  <soap:Body>
    <n:findPlace xmlns:n='http://arcweb.esri.com/PlaceFinderSample'>
      <placeName xsi:type='xsd:string'>olympia, washington</placeName>
    </n:findPlace>
  </soap:Body>
</soap:Envelope>
```

This code starts off similarly to ArcXML, telling you that it is written in XML, but this time using SOAP. The long list of Web pages are references similar to a bibliography, telling the computer where to look if it does not understand something. The list of references includes SOAP, the protocol used; arcweb.esri.com, where PlaceFinderSample is housed; and XML, the language used. The real information begins at the findPlace tag.

This SOAP request is asking ESRI to find the geographic coordinates of a place named Olympia, Washington.

Below is a sample response that ESRI might send back to you.

SAMPLE SOAP RESPONSE

```
<?xml version='1.0' encoding='UTF-8'?>
<soap:Envelope xmlns:xsi='http://www.w3.org/2001/XMLSchema-instance'
xmlns:xsd='http://www.w3.org/2001/XMLSchema'
xmlns:soap='http://schemas.xmlsoap.org/soap/envelope/'
xmlns:soapenc='http://schemas.xmlsoap.org/soap/encoding/'
soap:encodingStyle='http://schemas.xmlsoap.org/soap/encoding/'
xmlns:ns5='http://www.themindelectric.com/package/
com.esri.is.services.common/' xmlns:ns6='http://www.themindelectric.com/
package/com.esri.is.services.common.v1.geom/'>
  <soap:Body>
    <n:findPlaceResponse
xmlns:n='http://arcweb.esri.com/PlaceFinderSample'>
      <Result href='#id0'></Result>
    </n:findPlaceResponse>
    <id0 id='id0' soapenc:root='0' xsi:type='ns5:LocationInfo'>
      <matchType xsi:type='xsd:string'>EXACT</matchType>
      <candidates href='#id1'></candidates>
    </id0>
    <id1 id='id1' soapenc:root='0' xsi:type='soapenc:Array'
soapenc:arrayType='ns5:Location[1]'>
      <i href='#id2'></i>
    </id1>
    <id2 id='id2' soapenc:root='0' xsi:type='ns5:Location'>
      <x xsi:type='xsd:double'>-122.899444</x>
      <y xsi:type='xsd:double'>47.038056</y>
      <description1 xsi:type='xsd:string'>Olympia, Washington, United
States</description1>
      <description2 xsi:type='xsd:string'>Olympia</description2>
      <score xsi:type='xsd:double'>7.0</score>
      <type xsi:type='xsd:string'>G</type>
      <locationExtent href='#id3'></locationExtent>
    </id2>
    <id3 id='id3' soapenc:root='0' xsi:type='ns6:Envelope'>
      <minx xsi:type='xsd:double'>-122.974444</minx>
      <miny xsi:type='xsd:double'>46.963056</miny>
      <maxx xsi:type='xsd:double'>-122.824444</maxx>
      <maxy xsi:type='xsd:double'>47.113056</maxy>
    </id3>
  </soap:Body>
</soap:Envelope>
```

This response begins with a similar list of references. The inside tags label this as a response of an exact match. The longitude/latitude pair for this location is (–122.899444, 47.038056). It gives it a score of 7.0 and a type of G, meaning it is a fairly good match with a small U.S. city. It also includes a bounding envelope of the extent of this location.

Although the code shown above may look intimidating, it does not have to be difficult to create. Web service toolkits allow you to create code without having to type it by hand.

Web Service Toolkits

Web service toolkits make it easier to use SOAP-based ArcWeb Services by creating most of the code needed to make a request. Many toolkits already exist and many more are being written. ESRI uses GLUE and .NET to test ArcWeb Services, so these two toolkits are fully supported. Web service toolkits are helpful but not required. Without a toolkit, the developer needs to more fully understand the exchange between the server and client. With a toolkit, all you have to do is point the toolkit to the Web Service Description Language (WSDL).

WSDL Each of the SOAP-based ArcWeb Services has its own WSDL document. WSDL defines ArcWeb Services so the client knows what the service does. WSDL defines such things as which methods are available, their parameters, and the parameters' types. WSDL documents are most useful if used with a toolkit. Together, WSDL and SOAP allow any application connected to the Web to communicate with ArcWeb Services. These Web services can be initially found using the Universal Description, Discovery, and Integration (UDDI) project.

UDDI The UDDI project provides a searchable list of Web services. This "metaservice" allows businesses to describe and register their Web services. Users can then search for all types of Web services including GIS Web services. The UDDI can be found at <http://www.uddi.org>.



For more than 30 years ESRI has been helping people manage and analyze geographic information. ESRI offers a framework for implementing GIS technology in any organization with a seamless link from personal GIS on the desktop to enterprisewide GIS client/server and data management systems. ESRI GIS solutions are flexible and can be customized to meet the needs of our users. ESRI is a full-service GIS company, ready to help you begin, grow, and build success with GIS.

Corporate

ESRI
380 New York Street
Redlands, California
92373-8100, USA
Telephone: 909-793-2853
Fax: 909-793-5953

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on ESRI, call

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(1-800-GIS-XPRT)

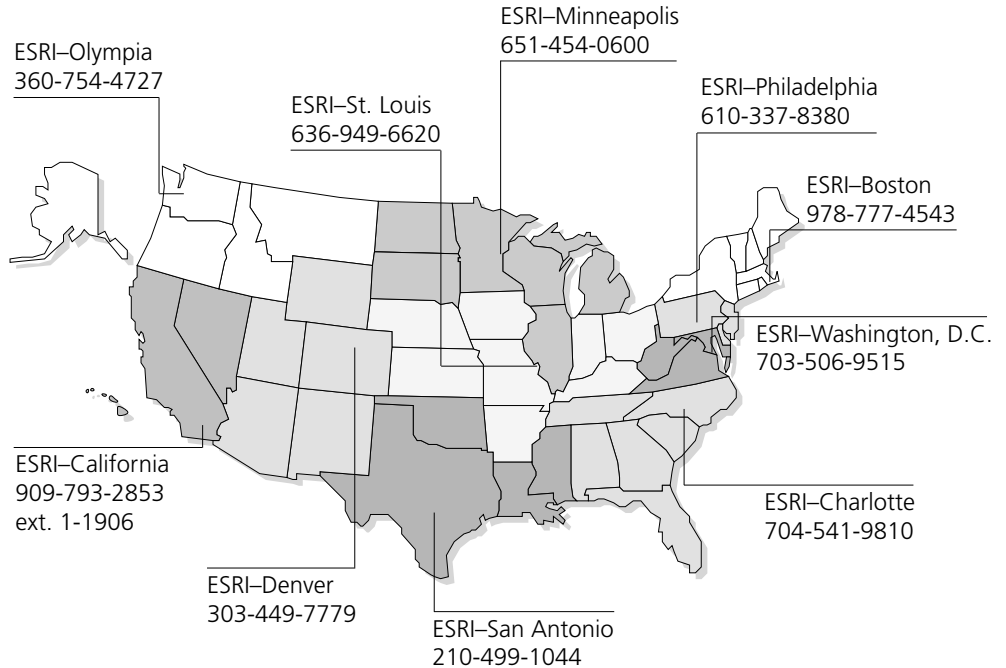
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