



Location-Based Services with WFS

Alan J. Caldera
IBM Software Group

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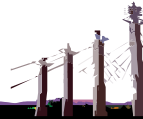
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Location based Services/RFID using WFS

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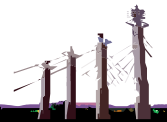
IBM Software Group

acaldera@us.ibm.com



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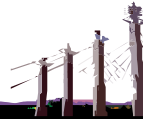
- The increasing importance of location information
- IDS capabilities for location services
- The IDS Web Services interface for location information
- Demonstrating how IDS can leverage location information



Why Location Services?

To identify and add context for:

- User location (current or anticipated)
- Time (now, future)
- User preferences
- What relevant services are available in user's proximity

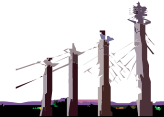


Examples of Location Services

- Directory Service (eg: Spatial Yellow Pages)
- Gateway Service
- Location Utility Service
- Presentation Service
- Route Service

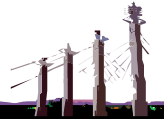


Source: Open Geospatial
Consortium 2005



Databases and geographic data

- You have geographic data in your databases
 - If you think you don't, think again
- The challenge: unlocking that information
 - Enhance business processes
 - Share information, serve the public and other constituencies
 - Visualize, analyze, find patterns



Geographic data

- Addresses

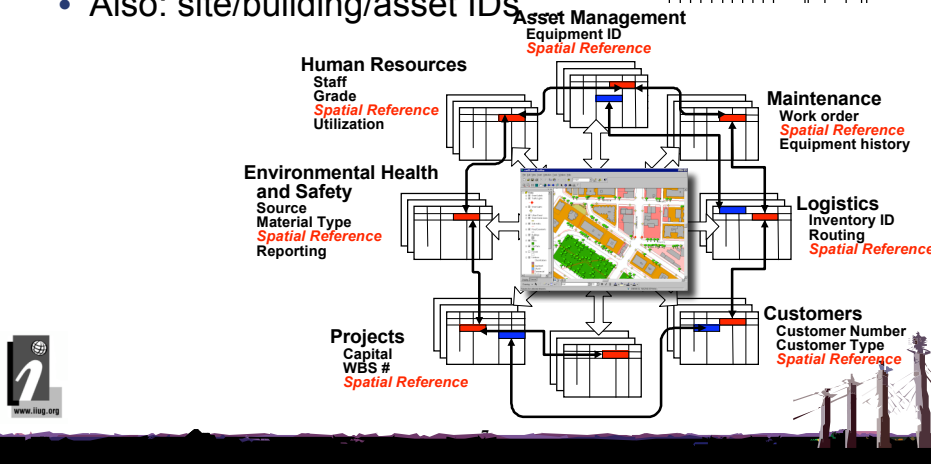
rows

LOCATION	OBJECTID	CAS
145 S CHURCH ST	33	S
1711 N ORANGE ST	36	S
1702 N ORANGE ST	38	S
1144 OCCIDENTAL DR	53	9903022

geocoding



- Also: site/building/asset IDs



Perhaps the best geographic data you'll find is in your own organization! If you look around, you'll see that as much as 80% of your corporate data has a geographic component! What about addresses? Facility ids? Warehouse locations? If you have an ERP, CRM, or other system, it's a good bet that you'll have special spatial reference fields for your asset, work, and project management systems. These references can be linked directly to features in your spatial database! When that is done, you have a whole new way to access, use, and visualize your corporate data – spatially!

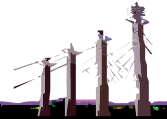
Real World Applications Now

- **Government**
 - Bureau of Land Management, Morocco
 - Environment sites - Australia & New Zealand
 - City of San Francisco
 - Parcel maps, crime statistics & mapping – hot spot highlight
- **Utilities, Water, and Power**
 - IBM's biggest non-military customers, some in Latin America
 - Sector that is willing to spend money, lucrative ROI
 - Asset management, power grid/network monitoring, gas line leaks
- **Telco**
 - Orange (1) signal strength map throughout UK, based on field report and coverage map
 - (2) customer support, mapping customer complaints about signal strength
 - Sprint local service
 - Enables distribution of mapping info so departments can cooperate with each other
 - IBM's largest commercial account
 - WFM work force management with MapInfo
 - Sprint's family locator cell phones
 - Sprint/Verizon package tracking via cell phones
 - 911 location mapping for VOIP
 - ESRI & Italian phone company
 - determine where the call came in, where service is available



Location Services Real World Applications Now

- Retail, Manufacturing, Distribution, & Shipping
 - Walmart RFID mandate with suppliers
 - Inventory management, control, optimization
 - Shipping and tracking, real time information anywhere, anytime



Future Location Services Applications

Mobile communications - automatic location services

- Using GPS enabled cell phones
 - Declare interest in certain things, nearest store/shop/restaurants
 - Look for nearest service center, retail outlet
 - Send all kinds of things, map, coupons, addresses
 - Museums while traveling
 - Automatically know where you are
 - Get info on request like on a computer
 - Nearby business can send promo's

- Health services

- Doctor's can monitor patients remote
 - Hospitals can track patients, drugs

Car insurance

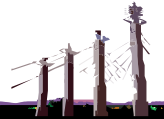
- Determine risks based on locations visited



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IBM Informix Spatial DataBlade

- OpenGIS standard spatial types and functions
 - Certified compliant with OpenGIS Simple Features Specification
 - Geometric data types: Vector Features
 - ST_Point, ST_Linestring, ST_Polygon, ST_Geometry, etc.
 - Spatial functions
 - ST_Distance, ST_Intersects, ST_Within, etc.
 - Standard Data representations
 - Well-Known Binary, Well-Known Text, ESRI Shape, OGC GML
- Tailored to ESRI's ArcGIS 9.x (spatial database gateway)
- Additional functions, support for annotation, SDE format, etc.

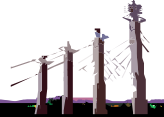


The Open GIS Consortium is the world's dominant organization that builds standards for interoperability of spatial technology at many different levels. So far, the Simple Features Specification is the only one that addresses SQL. Think of this as version one of basic functionality; it has its flaws but it's a decent start.

In addition, it is specifically tailored to ESRI's ArcSDE application server—the piece of middleware on which database access for all their client products is based. ESRI, by the way, is an IBM strategic partner and the undisputed leader in the GIS software business.

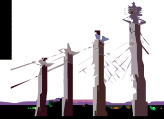
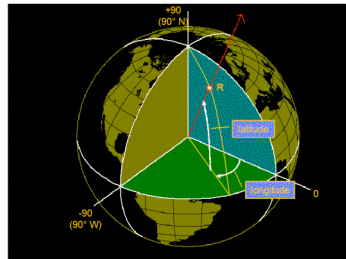
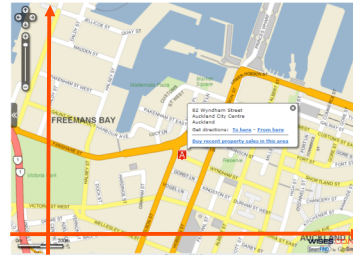
What's special about spatial?

- “Traditionally” not supported by relational databases (up to 10 years ago)
- Requires new indexing techniques
- Voluminous data
 - Individual values can get arbitrarily large:
 - Convolved lines and polygons (e.g., a coastline); raster images
 - Lots of features
- Maps can effectively represent lots of information
 - Much more than spreadsheets or reports
 - Queries often retrieve many more rows than “normal” queries
 - **Need context** (streets, political boundaries, ...)
- Individual operations may be computationally expensive
- Spatial predicates in WHERE clause



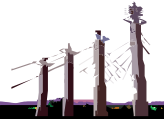
The earth: Flat or round?

- Does the earth look like a map ...
 - Flat
 - Edges
 - Straight lines
- ... or like a globe?
 - Curved
 - No edges
 - Great circles



IBM Informix Geodetic DataBlade

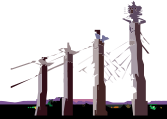
- Latitude-longitude ('geodetic') coordinates, ellipsoidal datum
- Uniform accuracy and resolution around the globe ("world to cm")
- No scale singularities and map edges
- Integrated time and floating-point dimensions for single-index searches
 - UNIQUE: true spatiotemporal data management
- Powerful index for high performance
 - R-tree in up to five dimensions
- Unique to IBM



The Informix Geodetic DataBlade, originally developed for NASA's Earth Observing System Data Information System (EOSDIS, a component of its Mission to Planet Earth) has been around for many years and successfully helps manage large repositories of satellite imagery and meteorological and oceanographic observations and models. Informix now lets you manage spatial data around the globe with uniform, high accuracy, consistent answers that do not depend on an arbitrary choice of projection, no need to manage multiple projections in the database, and high performance. This is an area where IBM leads the industry and has no competition.

Introduction

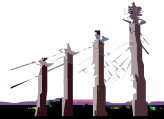
- The Web Feature Service (WFS) allows a client to retrieve and update geospatial data from multiple Web Feature Service instances.
- A WFS allows uniform access to features stored on a server:
 - query a dataset and retrieve the features
 - find the feature definition (feature's property names and types)
 - add features to dataset
 - delete feature from a dataset
 - update feature in a dataset
 - lock features to prevent modification (optional – not in this implementation)



A web feature service (WFS) handles requests for geographical features from a web server using platform-independent calls. The Web Feature Service (WFS) DataBlade Module is based on the transaction WFS specification from the Open Geospatial Consortium (OGC).

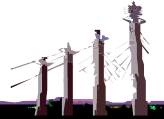
Why WFS?

- Standard is gaining acceptance
- Higher level of abstraction for geographic “Information on Demand”
 - Support all GIS/mapping tools
 - No need to port to our particular flavor of SQL
- Makes Geodetic DataBlade accessible
 - No commercial tools support its SQL directly
 - Making SQL more standard would negate its uniqueness
 - Round-earth treatment
 - Integrated time dimension
- Even organizations that own GIS software want to set up additional, simple map data sharing and services without high license costs
 - Often looking for open-source solutions
 - WFS is a database-like mechanism: no maps, just features



Why Use A WFS?

- Provides a generic way to access raw geographic data over the web.
- While a Web Mapping Service (WMS) returns map images a client, a WFS returns features related to a location. Eg.
 - Which lakes are within a particular district?
 - Which rare species sightings occur outside of protected areas?
 - Which hospitals are located in Tokyo and are less than 97% full?
 - Which intersection/street is closest to my GPS location?
- Greater transparency and openness in mapping applications.
- Interoperability with WFS from different vendors.



IBM Web Feature Service (WFS) Datablade Module

- Supports web-based geographical programs using data stored in IDS using the Spatial or Geodetic Datablade modules
- Encodes geographical features in Geographical Markup Language (GML) 3.1.1 or 2.1.2 specification
- Based on the Transactional WFS 1.1 (WFS-T) specification from the Open Geospatial Consortium (OGC)
- Uses HTTP GET or POST methods encoded as key-value-pairs (KVP) or XML for requests and responses.
- Requires Spatial or Geodetic Datablade modules to be installed and registered in the same database as WFS Datablade module



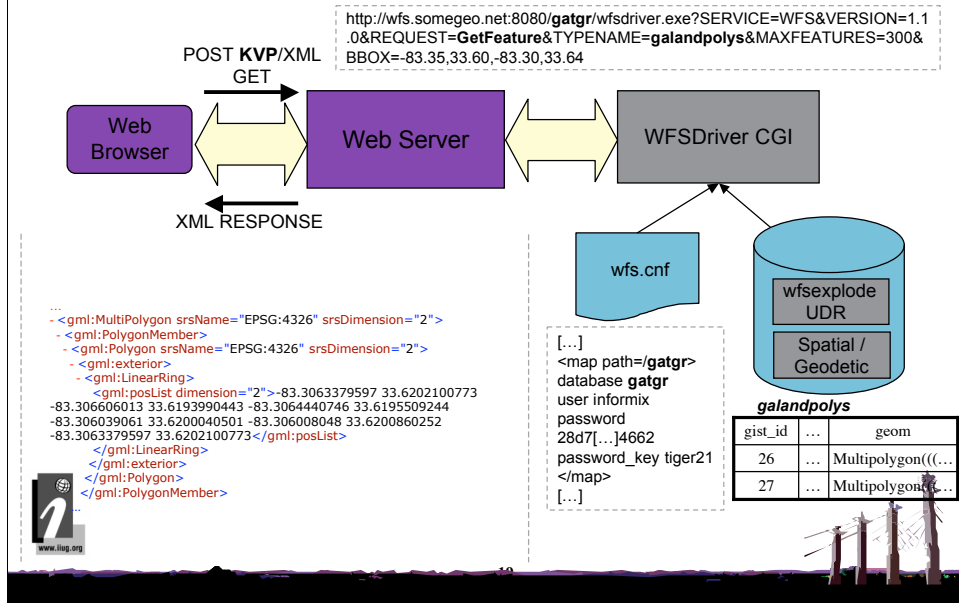
The WFS lets you support web-based geographical programs using data that you have stored in Dynamic Server using the Spatial or Geodetic DataBlade modules. You can insert, update, and delete geographical features.

The XML-based Geography Markup Language (GML) encodes the geographic features. The detailed specification is available at

<http://www.opengeospatial.org/standards/wfs>.

This DataBlade module encodes geographic features in the Geography Markup Language (GML) 3.1.1 specification. GML 2.1.1 is also supported for compatibility.

Implementation

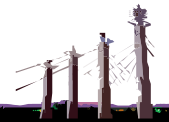


The WFSDriver CGI program processes all requests using either the HTTP methods GET or POST encoded as key-value-pairs (KVP) or XML. The program uses its corresponding wfs.cnf file to determine which Informix database to connect to, how to connect to it, and the user ID to use to connect to the database.

The WFSDriver CGI program determines whether it is passing KVP or XML data. KVP data goes through preliminary validation, while XML is passed directly to the wfsexplode UDR on the data server. The WFSDriver CGI program finally returns the results from the WFSExplode UDR and returns them to the web server.

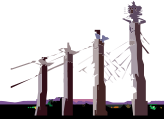
Some Terminology

- Namespace -> Database
- Feature Type -> Table
- Feature -> Row
- Feature ID -> Primary key



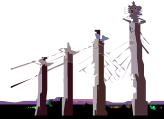
Feature Identifiers

- All features must be uniquely identified.
- Features usually take the form *Feature.ObjectID* where *Feature* is a feature class or table, and *ObjectID* is a unique identifier (usually a primary key) for that class or table.
- Eg. Customer number 101 in the *customer* table is referenced with the feature ID of *customer.101*.
- This must be a single column primary key. Composite keys are not supported.



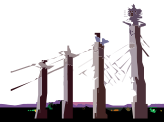
Transactional WFS (WFS-T)

- Basic WFS (Read-only WFS)
 - GetCapabilities
 - Retrieve description of capabilities of WFS
 - DescribeFeatureType
 - Request descriptions of features types from WFS
 - GetFeature
 - Retrieve features from WFS
- WFS-T
 - Transaction
 - Insert, Delete, Update
 - Native (not supported in this release)



WFS-T Transactions

- Transaction operations include insert, update and delete operations on web-accessible feature instances.
- A transaction operation can contain multiple insert, update and delete elements.
- Upon transaction completion, WFS generates an XML response document which indicates the completion status.

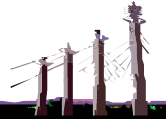


The transaction operation includes insert, update, and delete operations on web-accessible feature instances. After a transaction completes, the WFS DataBlade Module generates an XML response document that indicates the completion status of the transaction. A transaction operation can contain multiple insert, update, and delete elements. These elements are processed in the order in which they are contained in the transaction request.

GetCapabilities Request

- Used to request a capabilities document from a WFS
- Commonly used by WFS clients to discover a list of datasets available (FeatureTypeList), types supported (SupportsGMLObjectTypeList) and filter capabilities
- Request can be encoded in XML or KVP
- Example using HTTP GET method:

```
http://ajcsystem.homeunix.net/geoevents/wfsdriver?SERVICE=WFS&V  
ERSION=1.1.0&REQUEST=GetCapabilities
```



The web feature service (WFS) can describe its capabilities by returning service metadata in response to a GetCapabilities request. A GetCapabilities request uses key-value pair (KVP) encoded form over an HTTP GET request.

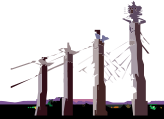
The Response Document contains the following:

1. Service identification
2. Service provider
3. Operational metadata
4. FeatureType list
5. ServesGMLObjectType list
6. SupportsGMLObjectType list
7. Filter capabilities

GetCapabilities Request

- Sample response document:

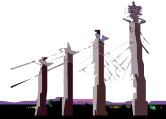
```
- <wfs:WFS_Capabilities xsi:schemaLocation="http://www.opengis.net/wfs ../wfs/1.1.0/wfs.xsd" version="1.1.0" updateSequence="0">
-   <ows:ServiceIdentification>
-       <ows:ServiceType>WFS</ows:ServiceType>
-       <ows:ServiceTypeVersion>1.1.0</ows:ServiceTypeVersion>
-       <ows:Title>IBM Informix Web Feature Service</ows:Title>
-   <ows:Abstract>
-       This is a test abstract value for the IBM Informix WFS Database
-   </ows:Abstract>
-   <ows:Fees>None</ows:Fees>
-   <ows:AccessConstraints>None</ows:AccessConstraints>
-   <ows:ServiceIdentification>
+   <ows:OperationsMetadata></ows:OperationsMetadata>
+   <wfs:SupportsGMLObjectTypeList></wfs:SupportsGMLObjectTypeList>
+   <ogc:Filter_Capabilities></ogc:Filter_Capabilities>
</wfs:WFS_Capabilities>
```



DescribeFeatureType Request

- Commonly used by WFS clients to request a schema description (xsd) of feature types presented
- Can contain zero or more TypeName elements that correspond to the names of the feature types to be described
- Request can be encoded in XML or KVP
- Example using HTTP GET:

```
http://ajcsystem.homeunix.net/geoevents/wfsdriver?SERVICE=WFS  
&VERSION=1.1.0&REQUEST=DescribeFeatureType
```



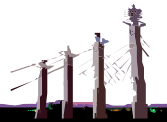
A DescribeFeatureType request contains zero or more TypeName elements that encode the names of feature types that are to be described. This request is the same as issuing the following query in dbaccess:

INFO COLUMNS FOR TABLE *tableName*

If no TypeName element is specified, all of the feature types (ie. tables) that are registered to the WFS are returned.

GetFeature Request

- Used to retrieve features from WFS
- Contains one or more Query elements
- Filter clauses use “CQL” query language to form the “predicate” of the query
- Can limit the number of features returned with maxFeatures element
- Request can be encoded in XML or KVP



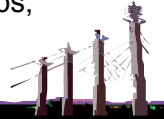
The GetFeature operation lets you retrieve features from a WFS. The information that is retrieved can be features or a number that indicates how many features match your query.

You can use the MaxFeatures element to limit the number of features that are returned.

The GetFeature operation contains one or more Query elements, each of which contains the description of the query. The results of all queries in a GetFeature request are concatenated into a result set. The typeName attribute in the schema indicates the name of one or more feature type instances or class instances to be queried. The value of this attribute is a list of valid feature types that are registered in the database.

GetFeature Request

- Supported OGC CQL Filter clauses:
 - PropertyIsLessThan, PropertyIsGreaterThan, PropertyIsLessThanOrEqualTo, PropertyIsGreaterThanOrEqualTo, PropertyIsEqualTo, PropertyIsNotEqualTo, PropertyIsLike, PropertyIsBetween, PropertyIsNull
- Supported OGC CQL operations for Spatial:
 - BBOX, Equals, Disjoint, Intersects, Touches, Crosses, Within, Overlaps, Beyond, DWithin
- Supported OGC CQL operations for Geodetic:
 - BBOX, Equals, Disjoint, Intersects, Within, Overlaps, Beyond, DWithin

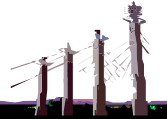


This slide lists the operations that can be used in a GetFeature request to the IBM WFS database. CQL stands for Common Query Language, which is used by the OGC web services (WMS, WCS, WFS). This predicate query language is used to constrain GetFeature and Transaction (Update, Delete) requests. The syntax for using these operations can be found in the OGC Filter Specification on the OGC website.

GetFeature Request

- XML Example:

```
<?xml version="1.0" ?>
<wfs:GetFeature
  version="1.1.0"
  service="WFS"
  xmlns:geoevents="http://ajcsystem.homeunix.net/geoevents"
  xmlns:wfs="http://www.opengis.net/wfs"
  xmlns:ogc="http://www.opengis.net/ogc"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://www.opengis.net/wfs ../wfs/1.1.0/WFS.xsd">
  <wfs:Query typeName="quakes">
    <ogc:Filter>
      <ogc:FeatureId fid="quakes.1275490"/>
    </ogc:Filter>
  </wfs:Query>
</wfs:GetFeature>
```



The following query returns all properties of all instances of type InWaterA_1M:

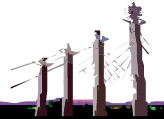
http://www.ibm.com/wfsdriver.cgi&SERVICE=WFS&VERSION=1.1.0&REQUEST=GetFeature&TypeName=InWaterA_1M

The query is passed to the WFSExplode UDR, which creates the following SQL query:

```
SELECT id, ST_AsGML(geom) FROM InWaterA_1M WHERE id=1234;
```

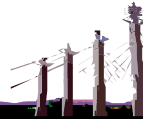
Geodetic Datablade and WFS

- Spatiotemporal types represented as flat XML for easier querying and display
 - e.g. GeoPoint ((33.245, -82.1567), (0,1000),(2007-09-30T11:15:45.12343, 2007-10-15T23:45:15.43556))
 - Represented as 7 fields in the XML output
 - `<columnname><gml:Point><gml:posList>-82.1567 33.245</gml:posList><gml:Point></columnname>`
 - `<columnname_valt_any>False</columnname_valt_any>`
 - `<columnname_valt_bottom>0</columnname_valt_bottom>`
 - `<columnname_valt_top>1000</columnname_valt_top>`
 - `<columnname_vtime_any>False</columnname_vtime_any>`
 - `<columnname_vtime_begin>2007-09-30T11:15:45.12343</columnname_vtime_begin>`
 - `<columnname_vtime_end>2007-10-15T23:45:15.43556</columnname_vtime_end>`



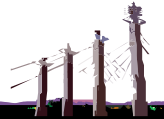
Sample Distance query in WFS (Spatial)

```
http://ajcssystem.homeunix.net/gatgr/wfsdriver.exe?SERVICE=WFS&
VERSION=1.1.0&REQUEST=GetFeature&TYPENAME=airports&
FILTER=(<Filter xmlns="http://www.opengis.net/ogc"
xmlns:ogc="http://www.opengis.net/ogc"
xmlns:gml="http://www.opengis.net/gml"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.opengis.net/ogc
../filter/1.1.0/filter.xsd http://www.opengis.net/gml
../gml/3.1.1/base/gml.xsd"><DWithin><PropertyName>airports/loc
n</PropertyName><gml:Point><gml:pos>-84.407
33.764</gml:pos></gml:Point><Distance
units=%27km%27>50</Distance></DWithin></Filter>)
```



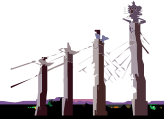
Equivalent Spatial SQL Query

- `SELECT airports.faa_id,airports.city AS city,airports.state
AS state,airports.name AS name,ST_AsGML(airports.locn)
AS locn,airports.elev AS elev,airports.mag_var AS
mag_var,airports.runways AS runways,airports.length AS
length FROM airports WHERE ST_Intersects
(airports.locn,ST_Buffer(ST_GeomFromGML('<gml:Point
xmlns:gml="http://www.opengis.net/gml"><gml:pos>-84.407
33.764</gml:pos></gml:Point>',4) ,0.539838))`



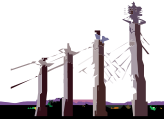
Setting Up WFS

1. Install IDS, Version 11 or higher.
2. Install Informix Client SDK version 3 or higher.
3. Install the companion blade, which works with WFS,
i.e. Spatial Datablade 8.21.xC1 or Geodetic 3.12.xC1
4. Create a database with logging enabled.
5. Create an sbspace with a size of at least 50 megabytes.
6. Register the WFS DataBlade module in your database.
7. Register the companion blade in the same database as the WFS Datablade.
8. Run wfssetup
`$INFORMIXDIR/extend/wfs.1.00.xC1/wfsdriver/wfssetup`
9. Configure the web server to include a mapping to the CGI path.
Eg. Apache web server
`ScriptAlias /mydb "/local0/webserver/mydb/`



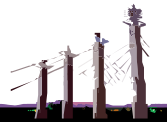
Setting up WFS (cont'd)

-  Declare your table in `sde.geometry_columns`
-  Register your table (feature) via `WFSRegister()`.
-  Verify connectivity by using a `GetCapabilities` request from your web browser.



WFS Datablade Module Security

- Web server handles secure access to the WFSDriver CGI program.
- User ID and password stored in wfs.cnf file.
- Use WFSpwcrypt to generate encrypted passwords for users.



The web server handles secure access to the CGI program. The password to access the database is stored in the wfs.cnf file, which is in the same directory as the WFSDriver CGI program. The user ID should have permission to select, insert, update, and delete features. You can use the WFSpwcrypt program to generate encrypted passwords for the user IDs.

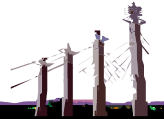
Unlocking spatial intelligence: Mashups and WFS

- Confluence of trends
 - Open standards (like WFS)
 - Easy, powerful scripting (javascript, php, AJAX)
 - Popular mapping applications with open APIs (Google Maps)
 - Open-source and commercial web mapping tools
 - Web services
- Maps and geography as common framework
 - Maps are the most powerful visualization medium
 - Geographic location is the common reference to everything

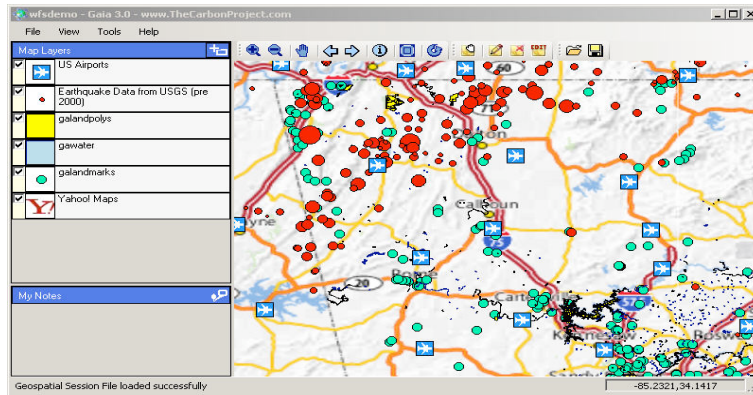


Using a GIS Map Client with WFS

- Add a new WFS “layer” by specifying the URL for the GetCapabilities request
- Select the typename that is associated with that layer
- Add any additional attributes
 - Maximum features
 - Spatial bounding box



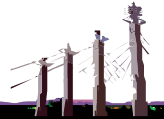
A WFS Client example



The demo: OpenLayers

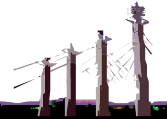
- Open-source javascript library
- Supports WMS, WFS, Google, Yahoo!, etc.
- Base layers and overlays
- Simple programming

```
<script src="http://www.openlayers.org/api/OpenLayers.js"></script>
...
<script defer="defer" type="text/javascript">
...
  map = new OpenLayers.Map( 'map' );
...
  var landmarks = new OpenLayers.Layer.WFS
  (
    "Georgia Landmarks WFS",
    "http://ajcssystem.homeunix.net:8080/gatgr/wfsdriver?",
    { typename: 'galandmarks', maxfeatures: 200 },
    { extractAttributes: true, visibility: false }
  );
...
  map.addLayer(landmarks);
...
</script>
```



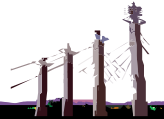
Three Example WFS Applications

- Traditional GIS
 - Gaia, ESRI ArcGIS Viewer
- Location based service
 - Mobile Restaurant Rater
- RFID
 - Fencing application



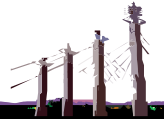
Mobile Restaurant Rater

- Use a GetFeature request to locate the type of restaurant based on current location and desired search radius
- GetFeature returns name, address ordered by rating
- After your meal, use a Transaction operation to upload your rating and comments



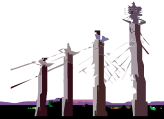
MobileRater GetFeature Request

```
<xml version="1.0">
<GetFeature
  xmlns=http://mobilerate.com/restaurants
  service="WFS"
  version="1.1.0" >
  <Query typeName="nationrest">
    <ogc:PropertyName>nationrest.name</ogc:PropertyName>
    <ogc:PropertyName>nationrest.address</ogc:PropertyName>
    <ogc:PropertyName>nationrest.rating</ogc:PropertyName>
    <ogc:Filter>
      <And>
        <DWithin>
          <ogc:PropertyName>nationrest.location</ogc:PropertyName>
          <gml:Point>-84.35 31.5467</gml:Point>
          <Distance units="mi">1</Distance>
        </DWithin>
        <PropertyIsEqualTo>
          <PropertyName>nationrest.resttype</PropertyName>
          <Literal>Italian</Literal>
        </PropertyIsEqualTo>
      </And>
    </ogc:Filter>
    <ogc:SortBy>
      <ogc:SortProperty>
        <ogc:PropertyName>nationrest.rating</ogc:PropertyName>
        <ogc:SortOrder>DESC</ogc:SortOrder>
      </ogc:SortProperty>
      <ogc:SortBy>
        <ogc:SortProperty>
          <ogc:PropertyName>nationrest.name</ogc:PropertyName>
          <ogc:SortOrder>ASC</ogc:SortOrder>
        </ogc:SortProperty>
      </ogc:SortBy>
    </ogc:SortBy>
  </Query>
```



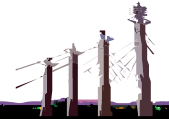
MobileRater Insert Transaction

```
<?xml version='1.0' ?>
<wfs:Transaction
  version="1.1.0"
  service="WFS"
  xmlns=http://mobilerate.com/restaurants
  <wfs:Insert idgen="GenerateNew"
    <ratings>
      <id/>
      <restaurant_id>43546</restaurant_id>
      <foodquality>3</foodquality>
      <servicequality>3</servicequality>
      <comments>Lasagna is great</comments>
      <visit_time>2007-09-07T19:35:00</visit_time>
    </ratings>
  </wfs:Insert>
</wfs:Transaction>
```



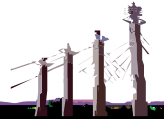
RFID Fencing Application

- Scenario:
 - Containers equipped with GPS RFID tags
 - Want to know if containers are removed during shipping (piracy)
 - Want to know if containers leave port area



Possible RFID Fencing Solution with WFS

- Use GetFeature request with Beyond operator to check track against proposed course by shipper or outside the ports boundaries
 - Can return either a simple count or the actual location of the tags that are out of the specified area



Additional Information on WFS

- Open Geospatial Consortium (OGC)
<http://www.opengeospatial.org/>
- OGC Web Feature Service Specification
<http://www.opengeospatial.org/standards/wfs>
- Geographical Markup Language (GML) Encoding Specification
<http://www.opengeospatial.org/standards/gml>
- Redbook: Customizing IDS for your environment (SG24-7522)

