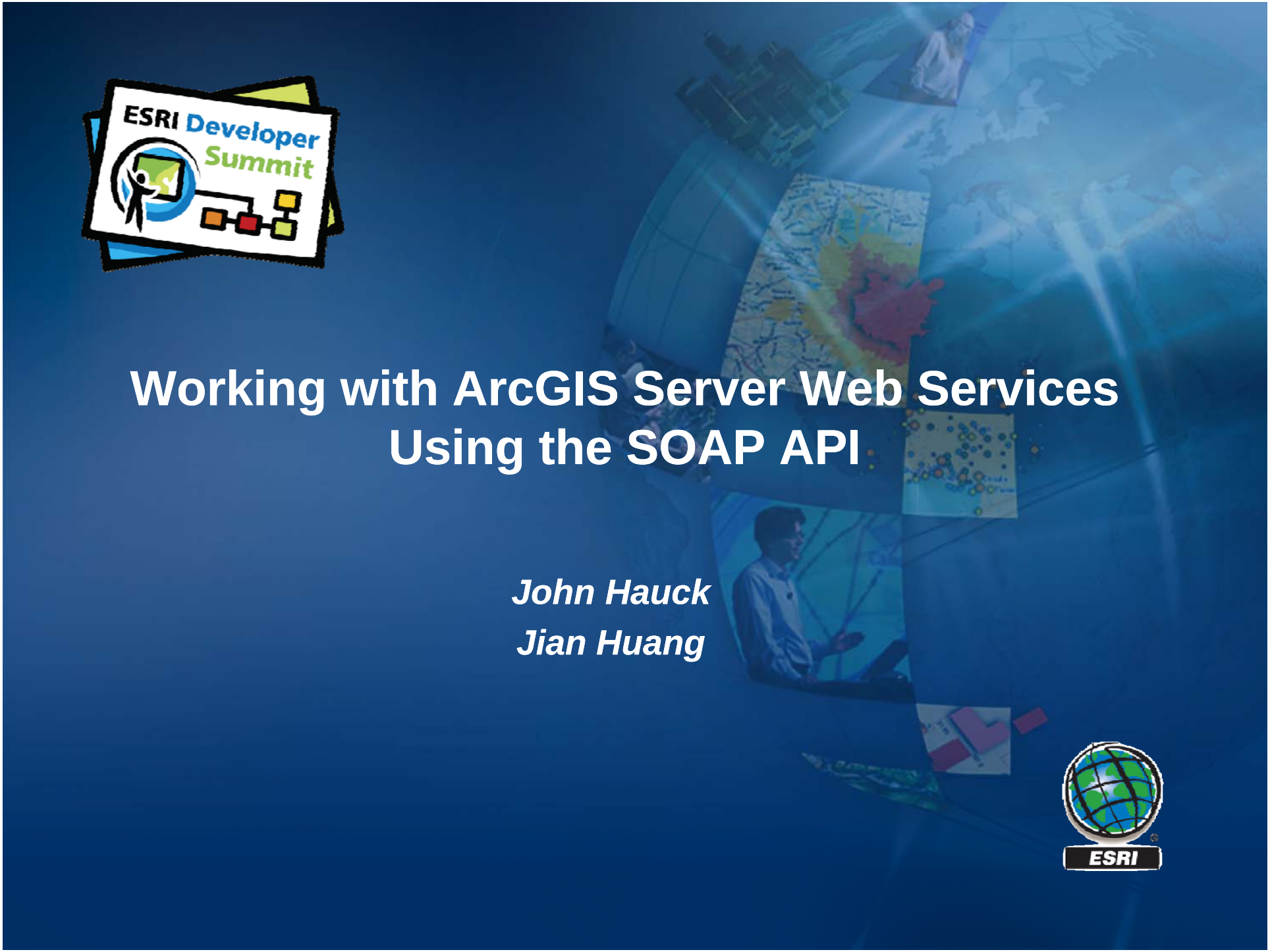


Working with ArcGIS Server Web Services Using the SOAP API

John Hauck

Jian Huang

ESRI

Introductions

Please!
Turn OFF cell phones and paging devices

- **Who are we?**
  - **Jian Huang**
  - **John Hauck**
- **Who are you?**
- **We will answer questions at the end**

Please complete the session survey!

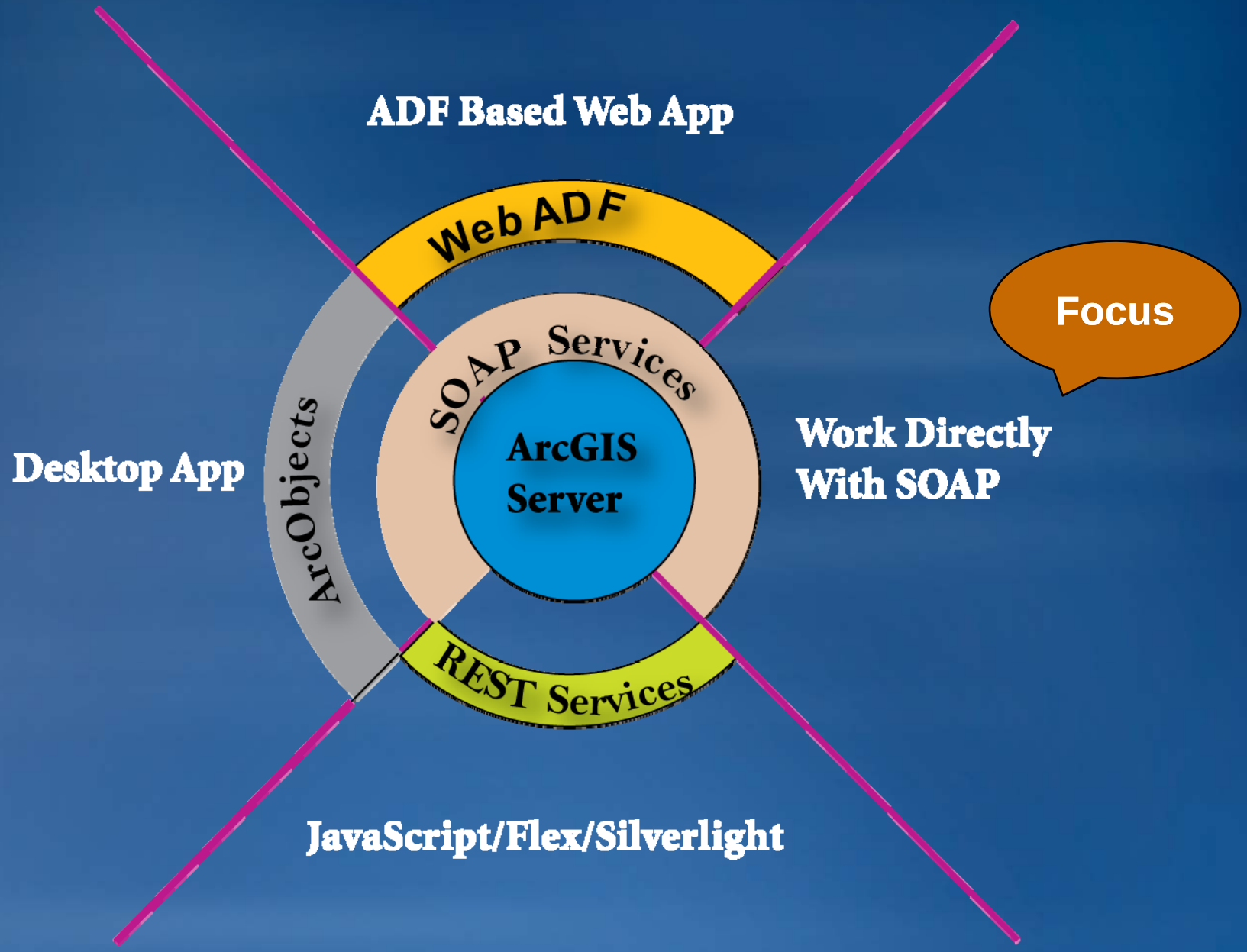
Agenda

- Brief overview of ArcGIS Server Web Services
  - What
  - Why
- SOAP API Walkthrough :
  - Functional capabilities of each GIS web service
  - The SOAP API for the service
  - Sample applications that consume the services
- Patterns, tips and tricks
  - Asynch SOAP request
  - Security
  - Implementation

ArcGIS Server Web Services - Overview

- ArcGIS Server has a rich set of GIS Web Services
- You can work with Web Services using the following api's / interfaces :
  - SOAP
  - REST
  - OGC

Clients for ArcGIS Server Web Services



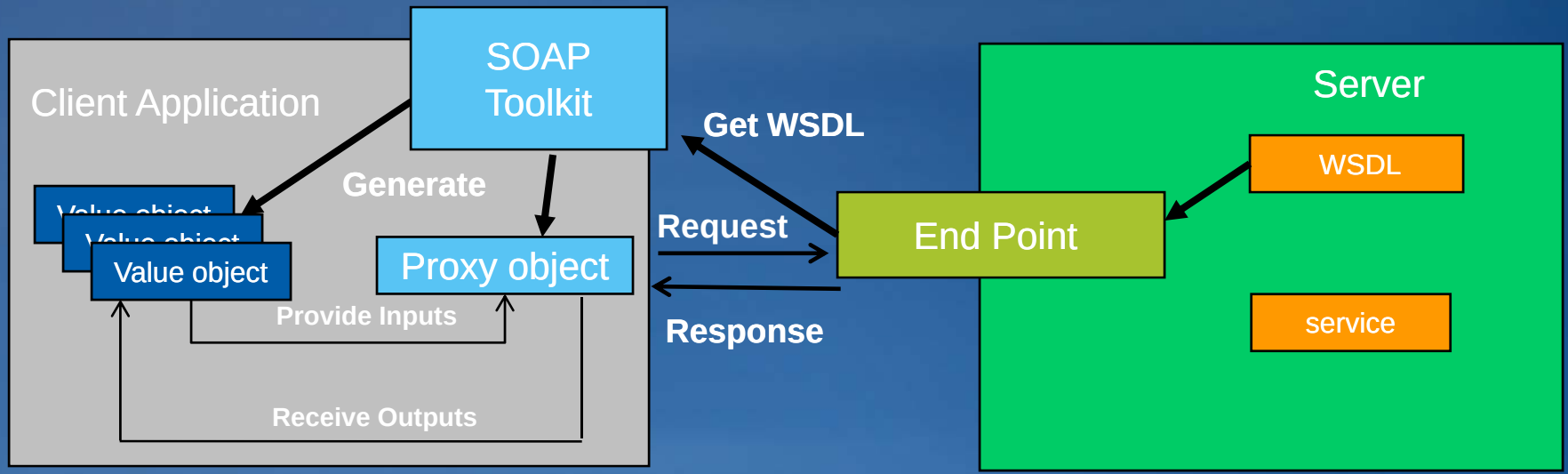
SOAP Web Services - Advantages

- easily accessible from .Net, Java, C++, Python, et al
- cross-platform support, Windows, Linux, Solaris
- lends itself to standard OO programming
- lets you take advantage of compile time type checking
- fully integrated into IDE's
  - Class documentation, Full intellisense

Working with a SOAP service

What

- Generated on the client using a SOAP Toolkit
- Proxy Object
  - Communicate with server end points
  - Call methods on the proxy to execute server-side logic
- Value objects
  - Native types designed to support input and output from proxy

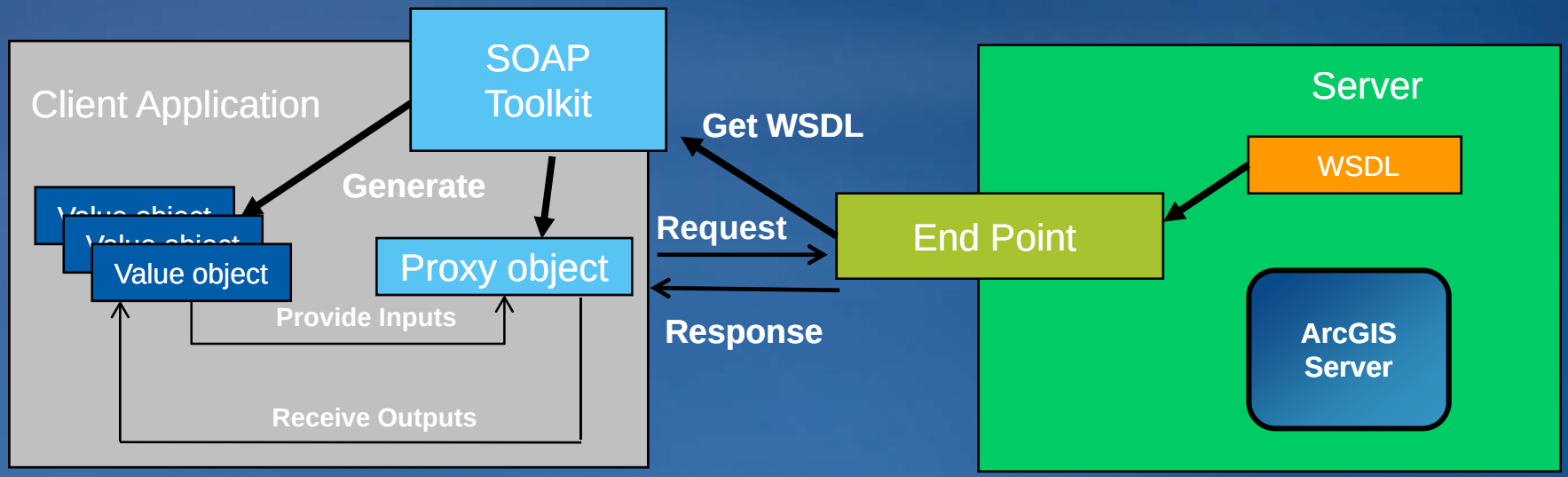


SOAP Web Services

- Proxy objects and Value objects should be XML serializable
- SOAP Toolkit
- Synchronous and Asynchronous calls
- Security option

ArcGIS Server : SOAP Web Service URLs

- A standard scheme for all SOAP web service URLS :
- `http://<hostname>/<arcgis_instance>/services/<folder>/<servicename>/<servicetype>`
- **To get the wsdl :**
- `http://gis.mybiz.com/arcgis/services/usa/mapserver?wsdl`



The ArcGIS Server SOAP API

- Coarse Grained
- Stateless
- Value Objects are based on existing well known ArcObjects types
  - Eg Color, Symbol, Graphic Element, Geometries, DataElements
- Application you can build
  - Desktop app
  - Web app
  - Web service

SOAP Web Services

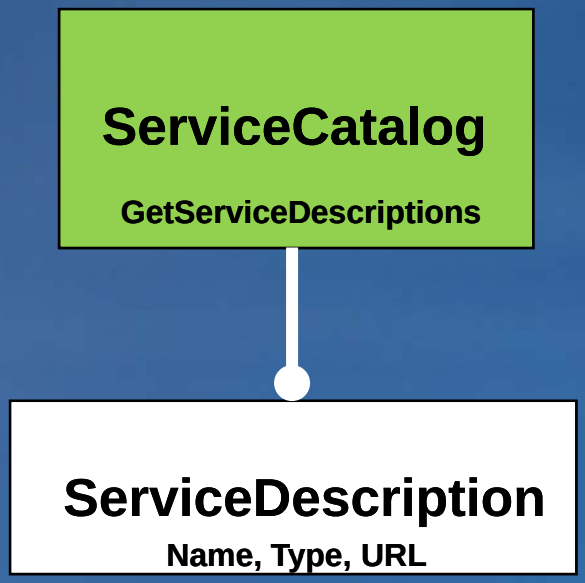
- **Service Catalog Service**
- **Map Service**
- **Geocoding Service**
- **Geometry Service**
- **Network Analysis Service**
- **Image Service**
- **Geoprocessing Service**
- **Geodata Service**

- Mobile Service (accessed using the Mobile ADF client)
- Globe Service (accessed using the ArcGIS Engine client)

Service Catalog Service

- **Every ArcGIS Server has a Service Catalog Web Service**
  - **`http://<web server hostname>/<arcgis instance>/services?wsdl`**

- **`What Services do you have?`**



WSDL

Method

```
<xs:element name="GetServiceDescriptions">
  <xs:complexType/>
</xs:element>
```

Response

```
<xs:element name="GetServiceDescriptionsResponse">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="ServiceDescriptions"
                  type="ArrayOfServiceDescription"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
```

Value Object

```
<xs:complexType name="ArrayOfServiceDescription">
  <xs:sequence>
    <xs:element name="ServiceDescription"
                type="ServiceDescription"
                maxOccurs="unbounded"/>
  </xs:sequence>
</xs:complexType>
```

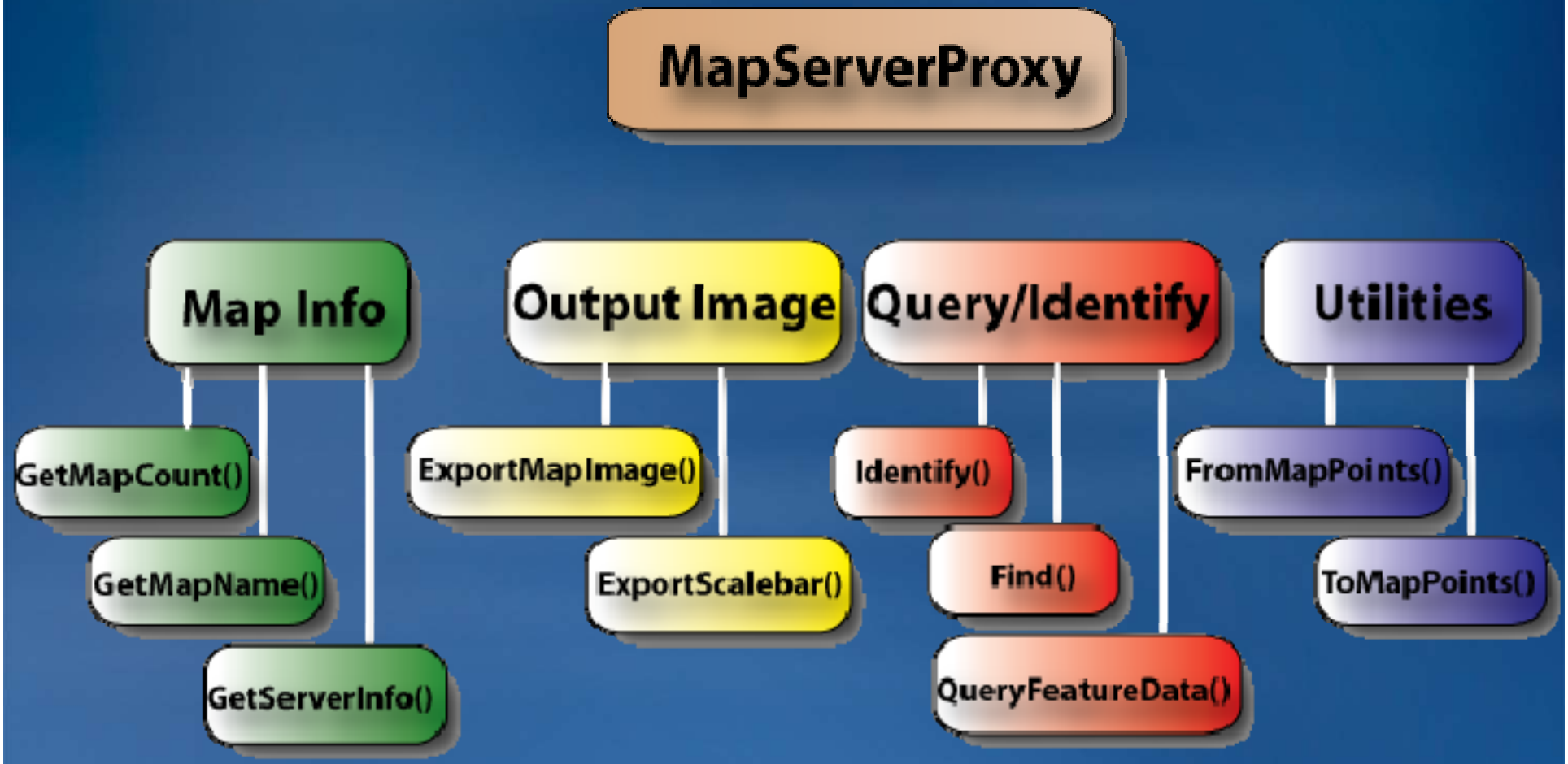
Value Object

```
<xs:complexType name="ServiceDescription">
  <xs:sequence>
    <xs:element name="Name" type="xs:string"/>
    <xs:element name="Type"  type="xs:string"/>
    <xs:element name="Url"   type="xs:string"/>
  </xs:sequence>
</xs:complexType>
```

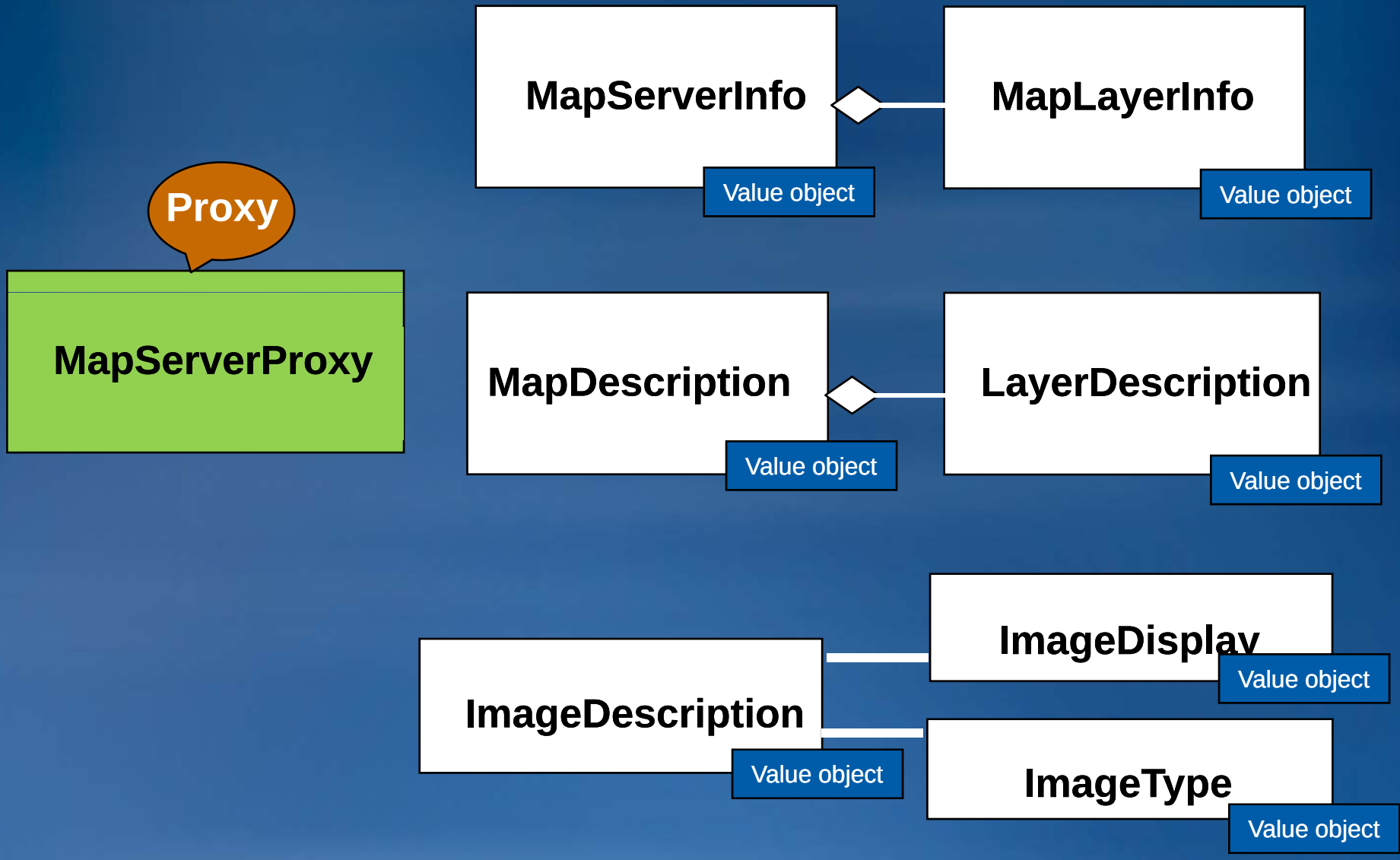
Map Service

- Retrieve information about the map
- Dynamically generate map images in a variety of image formats; also can be used to get tile info, or retrieve tiles of cached map service
- Query and identify features
  - Results returned as record sets
  - Can return densified and generalized geometries (new at 9.3)
  - Can return geometries as KML (new at 9.3)
- Overlay additional information on top of the map

Map Server – Key Methods

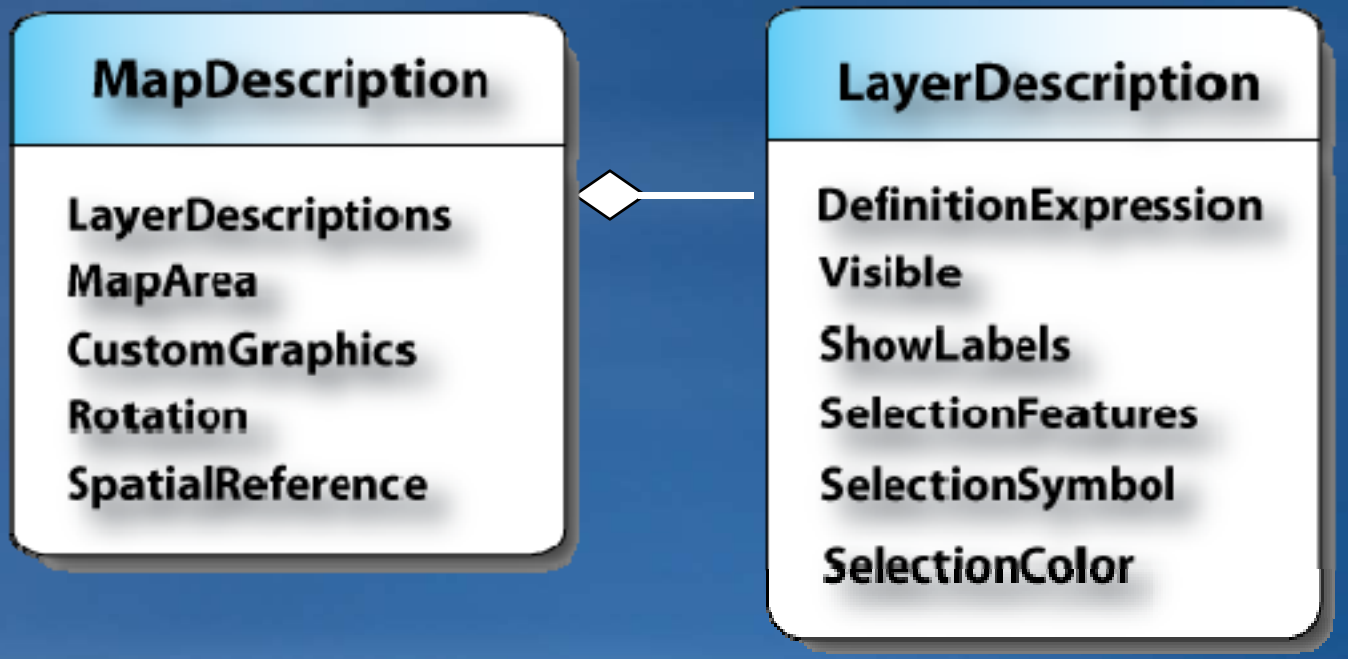


Map Service Object Model – Output Map Image

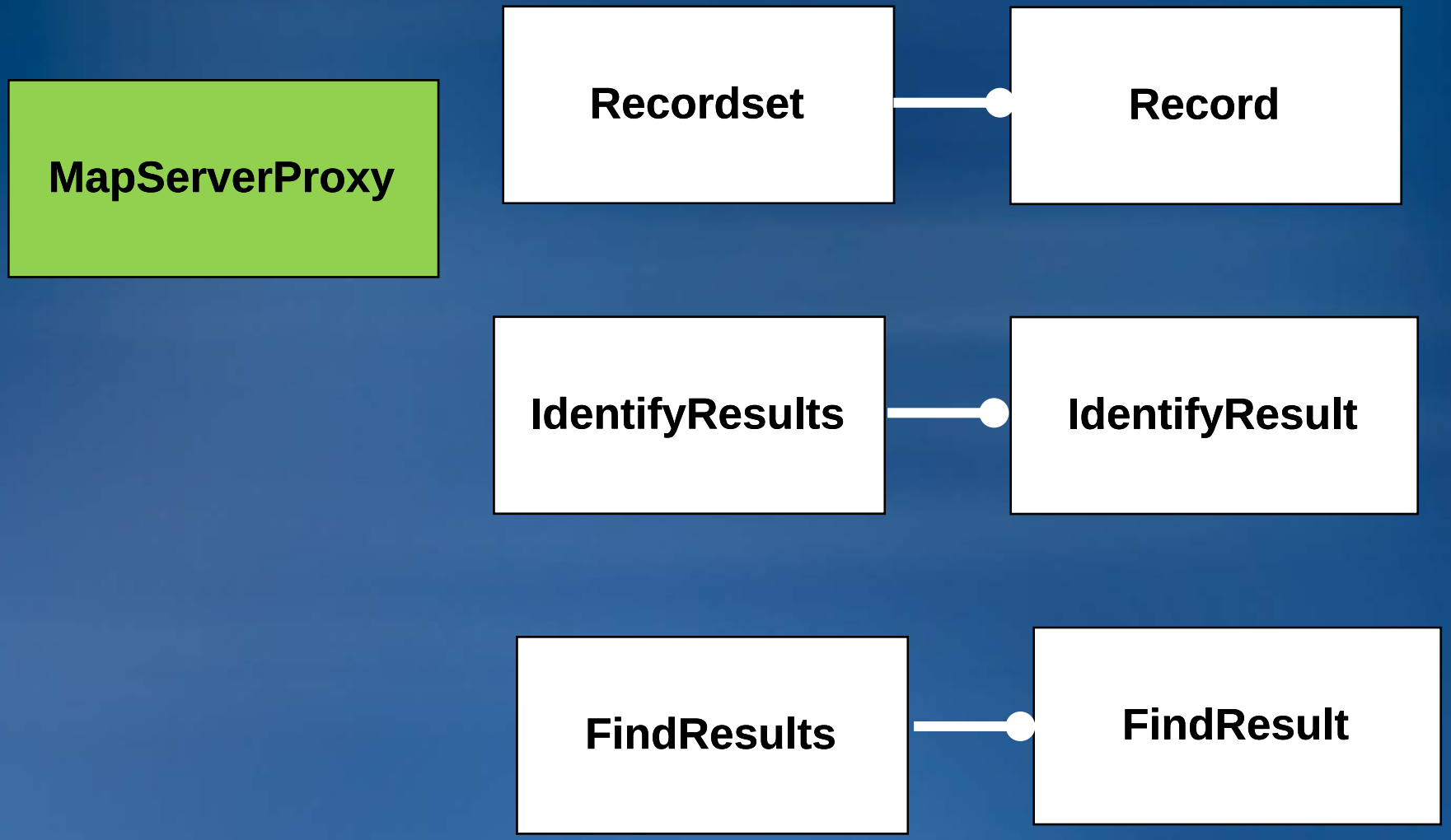


MapDescription and LayerDescription

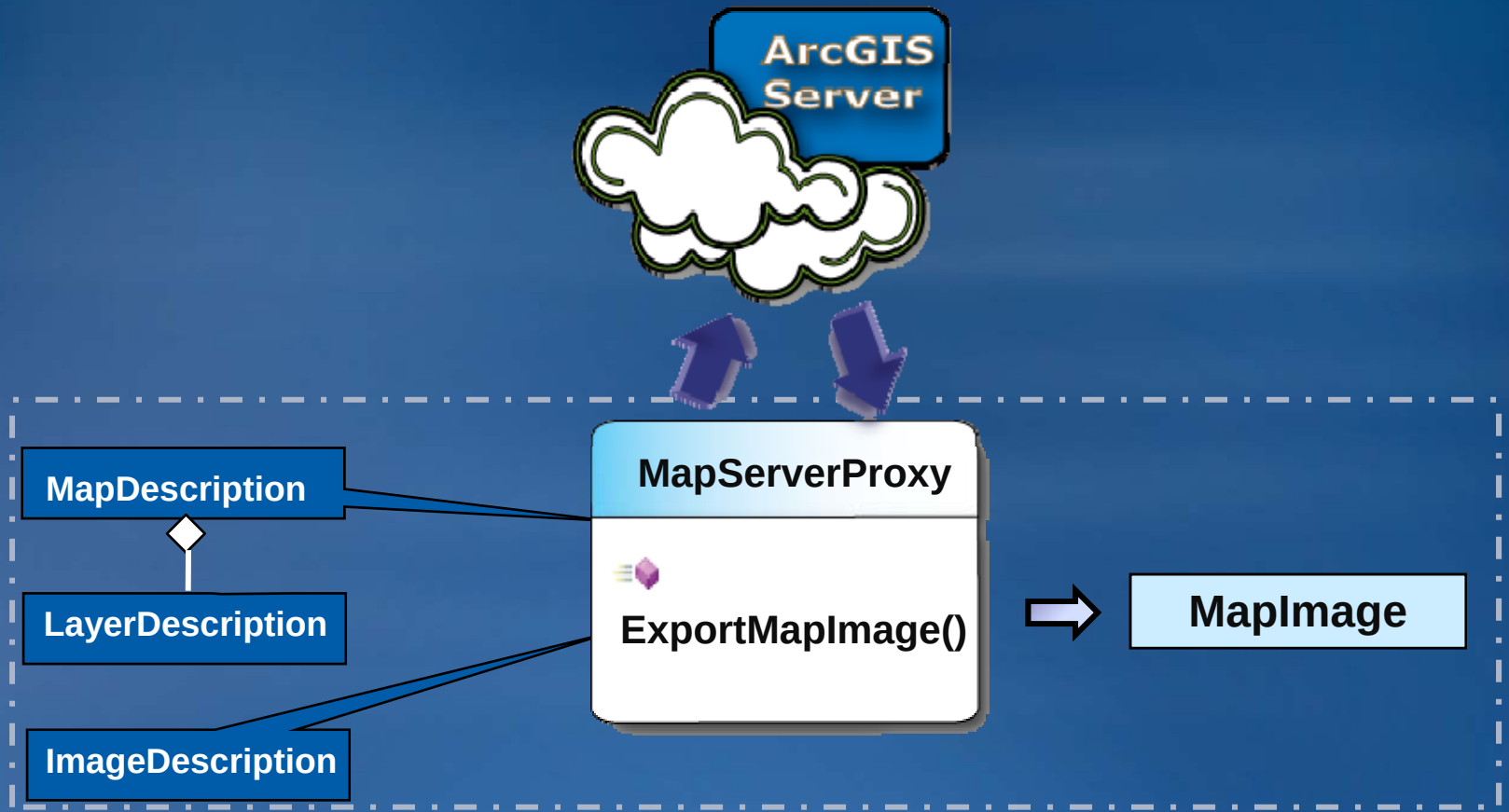
- MapDescription value object
  - Properties to control the drawing of the map
- LayerDescription value object
  - Properties to control the drawing of a layer



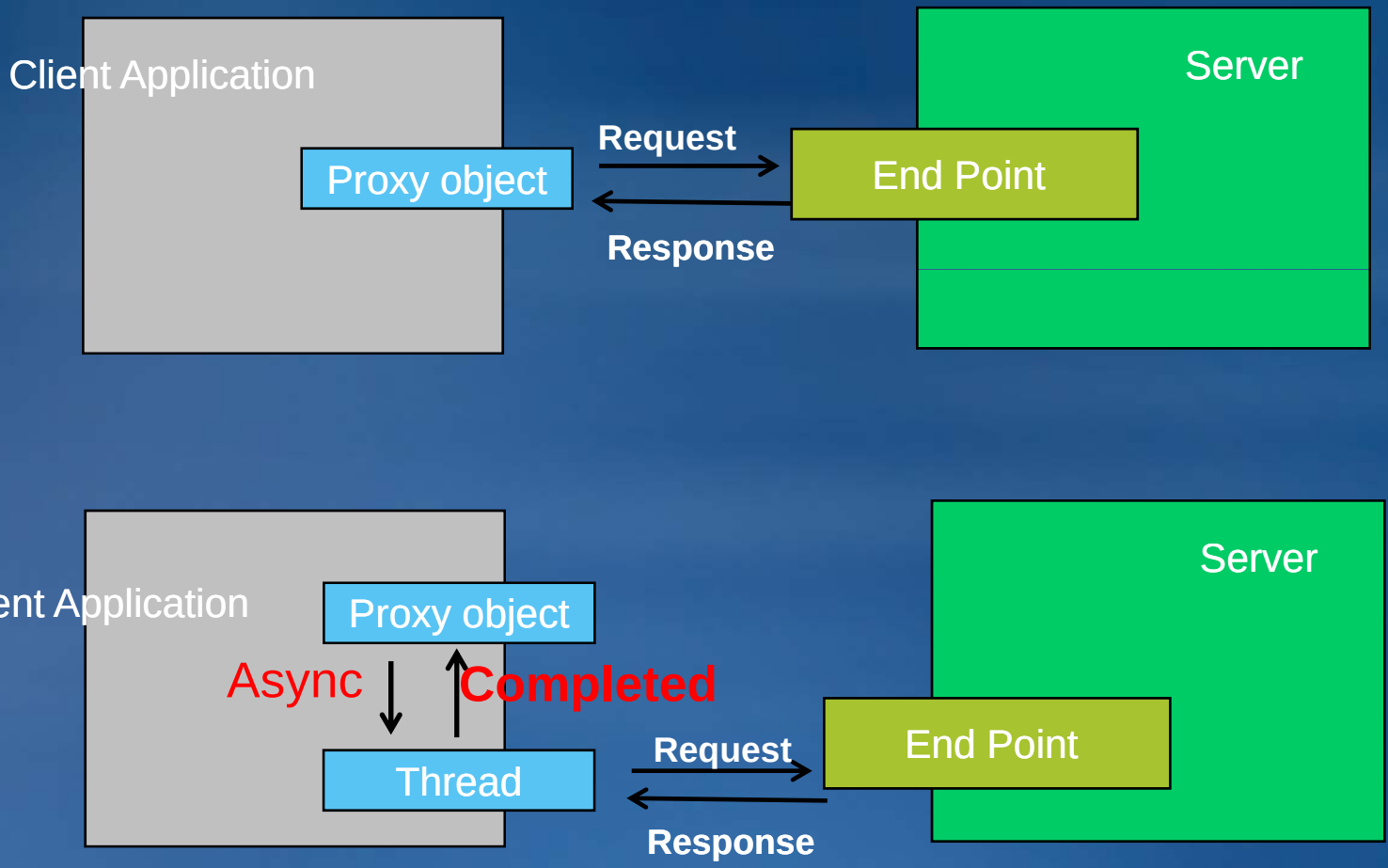
Map Service Object Model – Querying Features



Map Service Demo



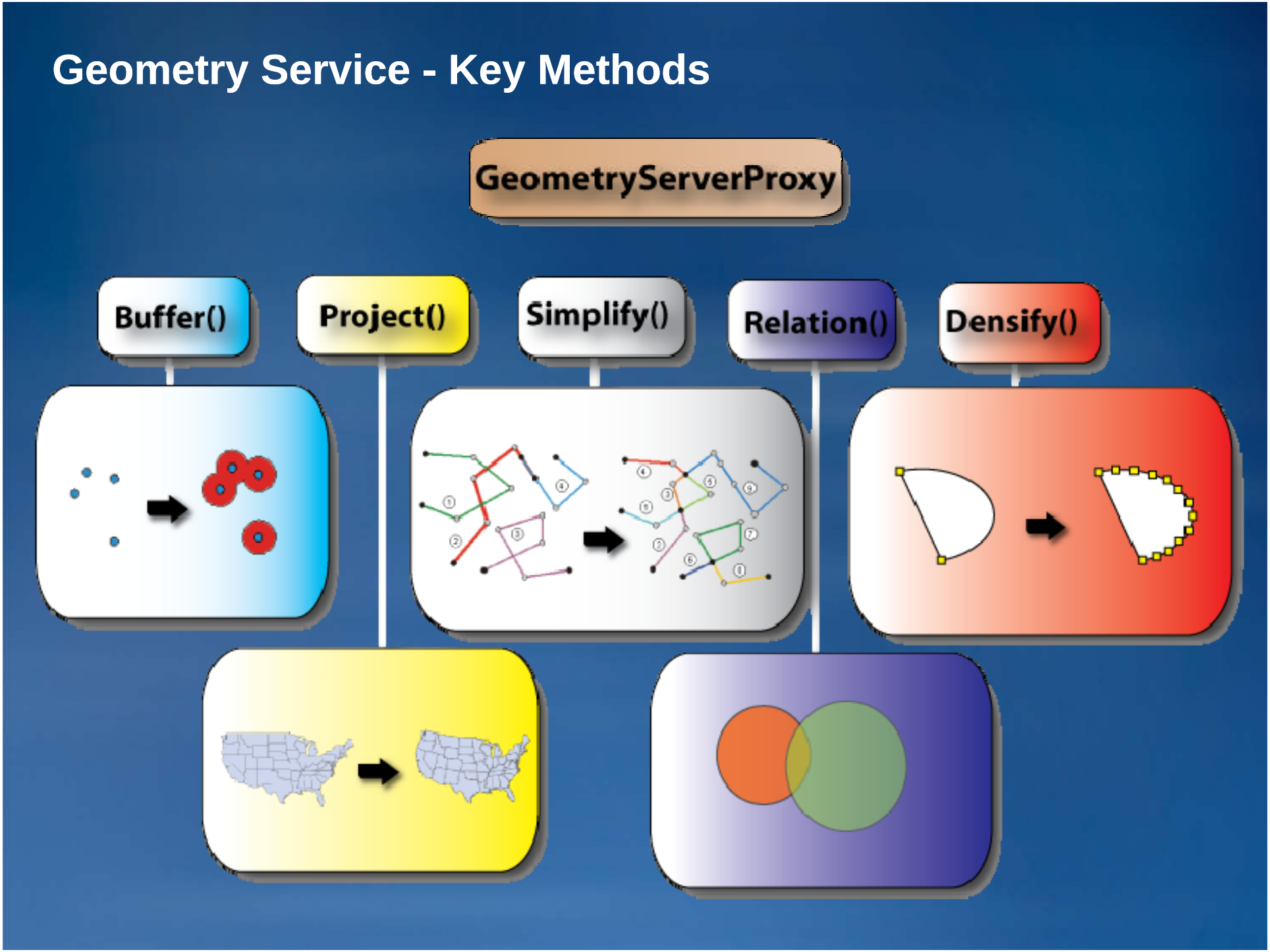
Async Calls for SOAP Web Service



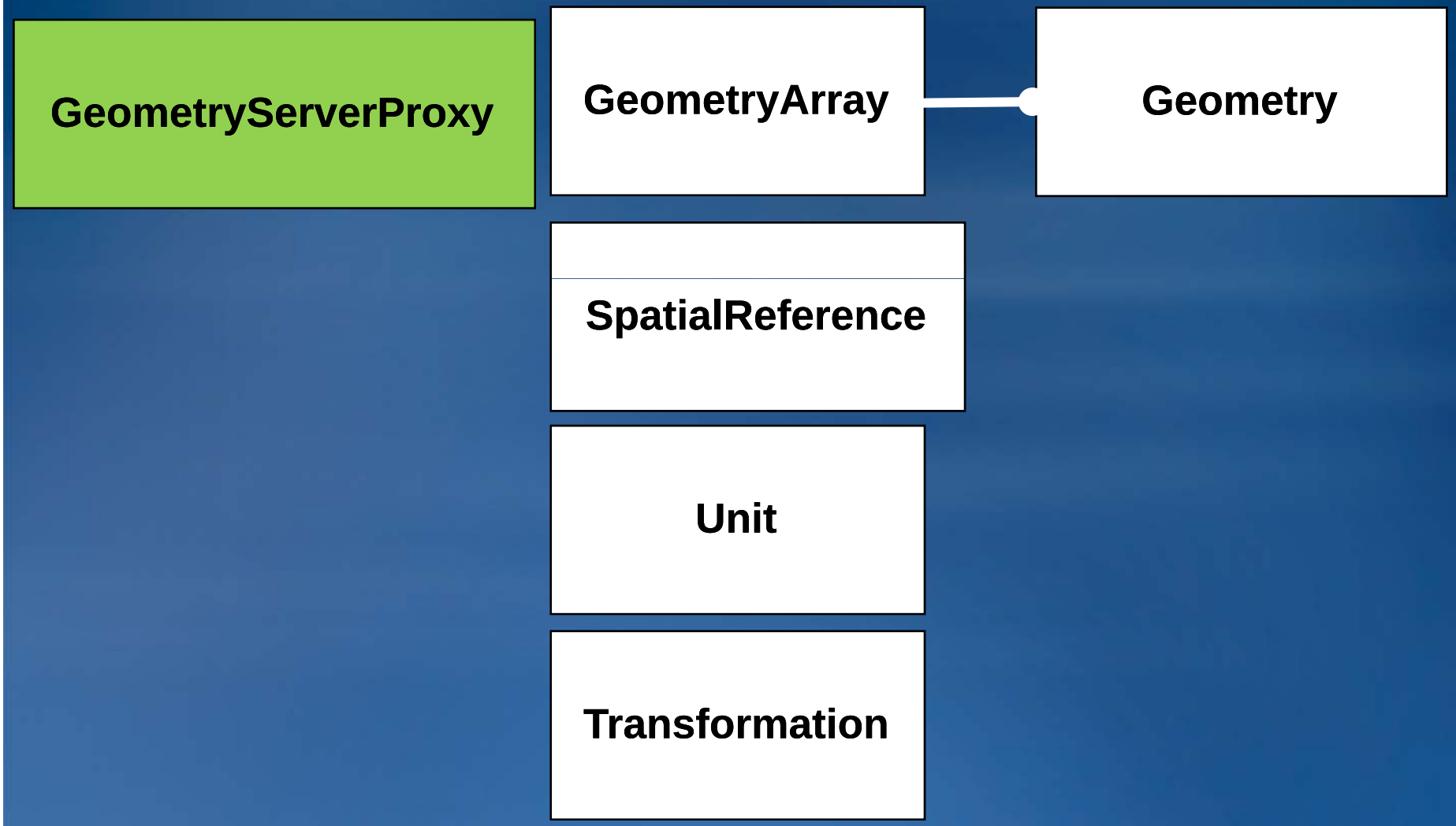
Geometry Service

- A computational service, not bound to any data on the server
- Cannot change the name
- An ArcGIS Server can host one Geometry Service
  - Number of instances can be increased as needed
- Provides basic geometric operations for use by web service clients
  - Get area and length
  - Simplify geometry

Geometry Service - Key Methods



Geometry Service – Object Model



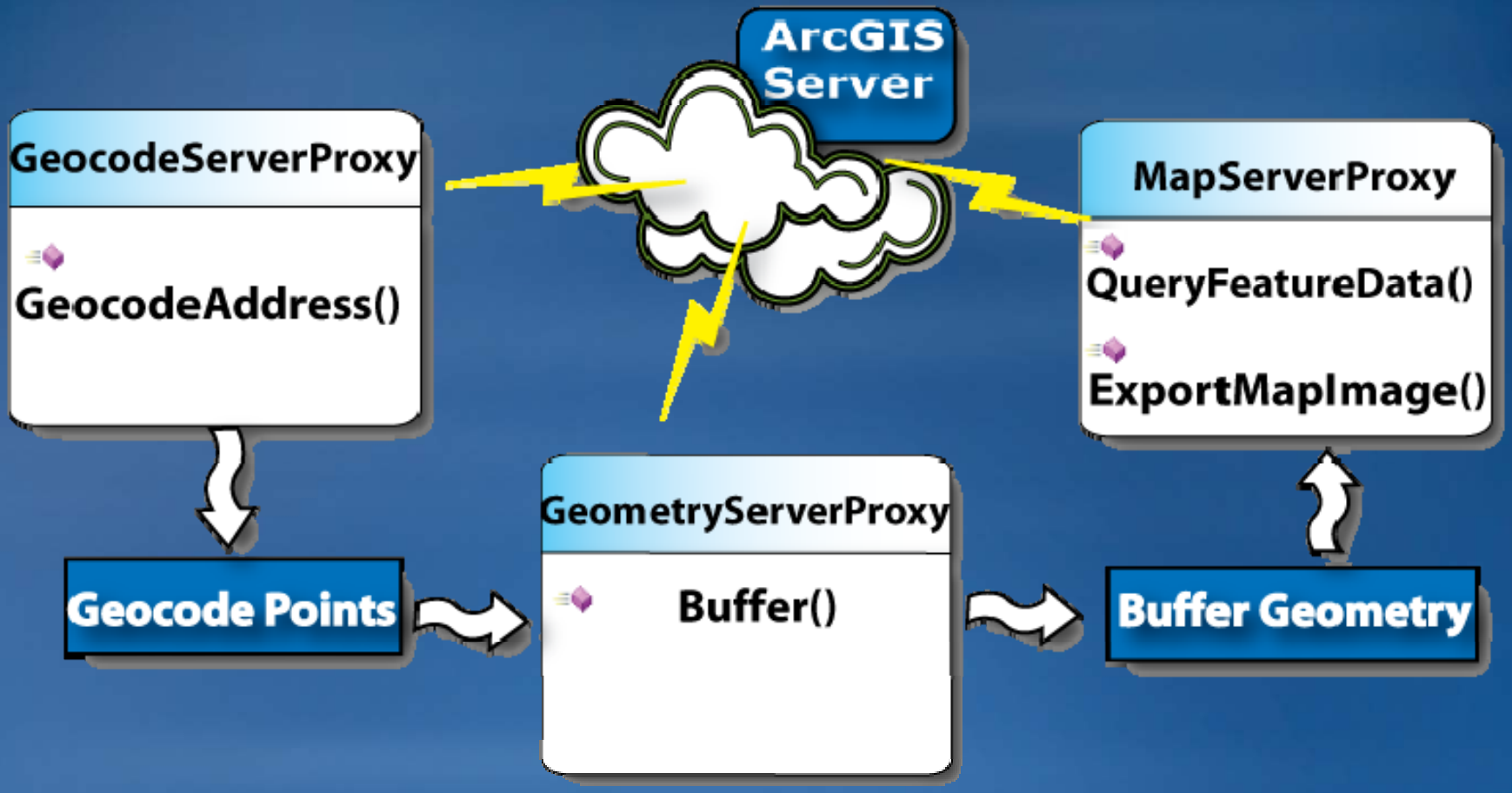
Geocode Service

- Based on a Locator stored in the file system or in a Geodatabase
- Key Methods to perform

GeocodeAddress	Geocode single address
GeocodeAddresses	Batch geocoding
ReverseGeocode	Generates an address for a point

Demo

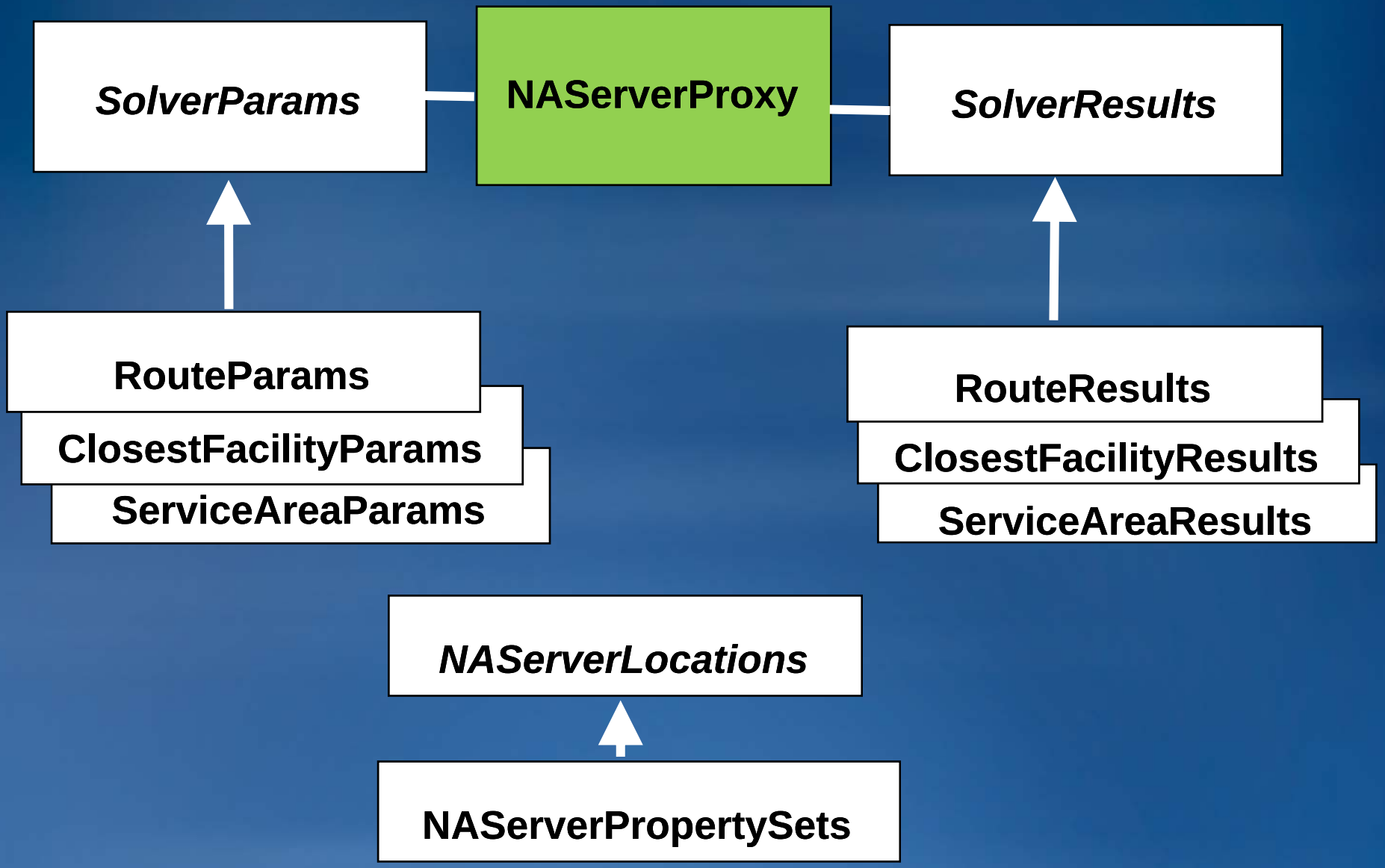
- Integrated application using Map, Geocode and Geometry Services
- Shared value objects crossing difference services



Network Analysis Service

- Based on publishing a map containing network analysis layers
- A network analysis layer represents a specific analysis (Routing, Service Area, Closest Facility) to be performed against a specific network dataset (for eg. LA Streets)
- Methods to :
  - Discover the parameters of the analysis solver
  - Solve
  - Get Results (paths, directions etc)
- Callers supply input parameters (for eg stops, barriers) using basic web service types such as PropertySets and RecordSets.

Network Analysis Service – Object Model



NetworkAnalysis Server – Key Methods

GetNALayerNames	Array of Network Analysis Layers of a particular type
GetNetworkDescription	Returns the Network Dataset Data Element for the specified layer
GetSolverParameters	Default Solver Parameters for the specified Network Analysis Layer
Solve	Perform Network Analysis based on the specified solver parameters

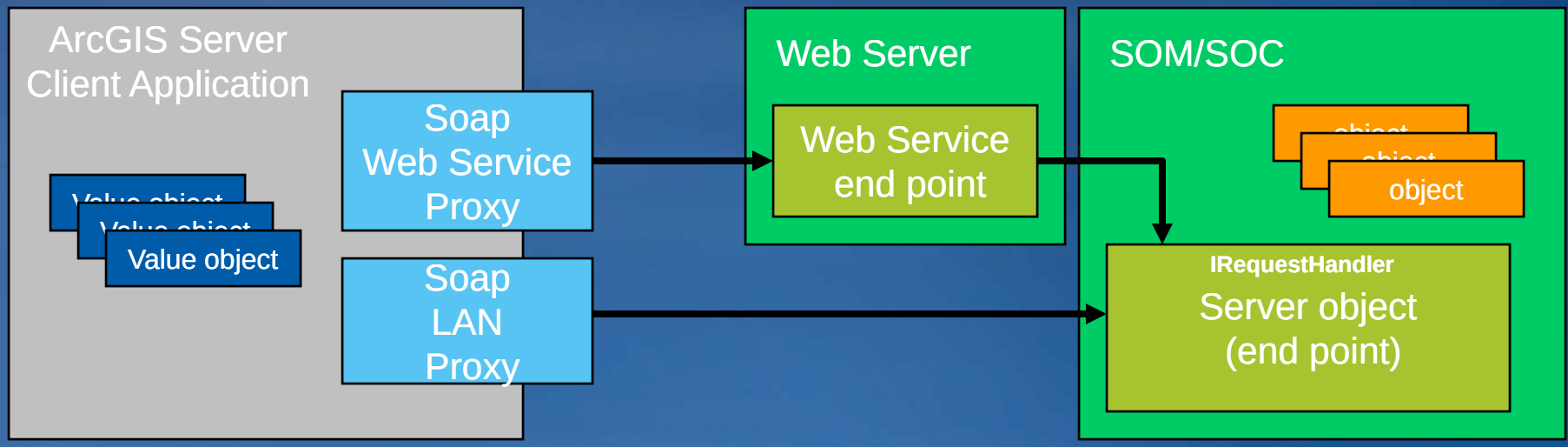
- Finding a Route :
  - Get Route Network Analysis Layer
  - Get Default Route Solver Parameters
  - Specify Desired Route Solver Parameters
    - Barriers, Stops, FindBestSequence, UseTimeWindows, …
  - Solve
  - Parse Results

Pre-generated ADF Proxy/Value objects

- Proxy/Value objects generated by a SOAP Toolkit
  - Cross platforms, languages
  - No ESRI components required
  - Rely on toolkit
  - Shared namespace using wsdl.exe tool
  - No utilities
- Pre-generated Web ADF Proxy/Value Objects
  - .NET and Java
  - All value objects are in the same namespace
  - Support DCOM connection
  - Easy to convert value objects to
    - Web ADF
    - ArcObjects
  - Works with Web ADF Controls
  - ADF install required

Working with SOAP requests over the LAN

- Web ADF includes both a Web proxy as well as a LAN proxy
- Web service proxy generated from WSDL - MapServerProxy
  - Used for SOAP / HTTP
- LAN proxy is also included - MapServerDCOMProxy
  - Used for SOAP / LAN
  - Uses the IRequestHandler interface to submit SOAP requests directly to the server object



Geocoding and Network Analysis Service demo - routing

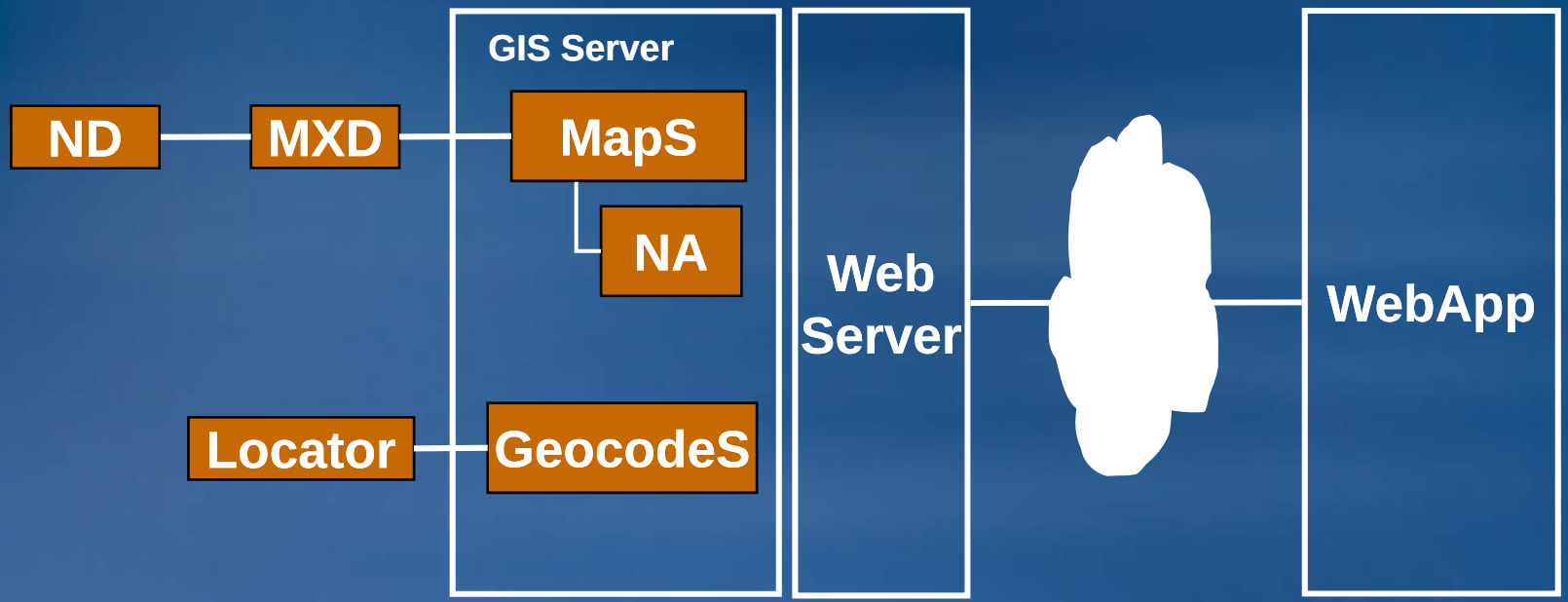


Image Service

- Allows you to serve imagery and raster data :
  - Raster Datasets
    - eg large mosaics in SDE
  - Raster Layers
    - With rendering set up on the server
  - Image Service Definitions
    - Catalogs of file based imagery that can be mosaiced and processed on the fly
    - Uses a back end ArcGIS Image Server
- Clients can control
  - Returned image format, mime or url
  - band selection, compression, projection, interpolation

Image Server - Key Methods

ExportImage	**Returns the requested image using a well known image format**
GetImage	**Returns the requested image as a byte stream**
GetServiceInfo	**Returns the properties of the image service** **- numBands, pixelType, statistics etc**

Image Service – Object Model

Image Service demo

Geodata Services

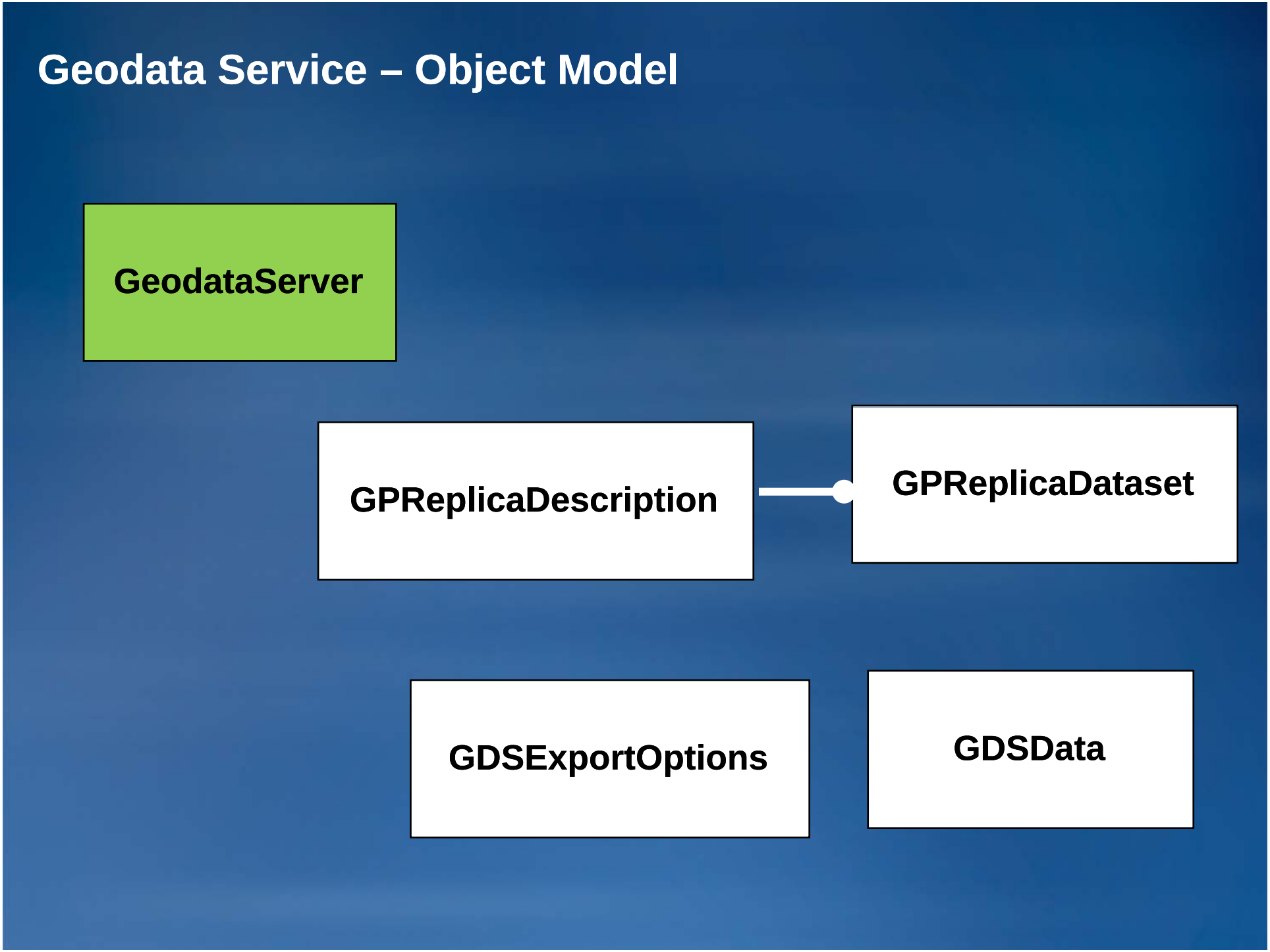
- Geodata Services allow you to publish a geodatabase so that it can be accessed remotely over the Web
- Query dataset
- ArcGIS Desktop can be used as a client with both local and remote geodatabases in order to
  - Extract data
  - Create replicas
  - Synchronize replicas

Geodata Service

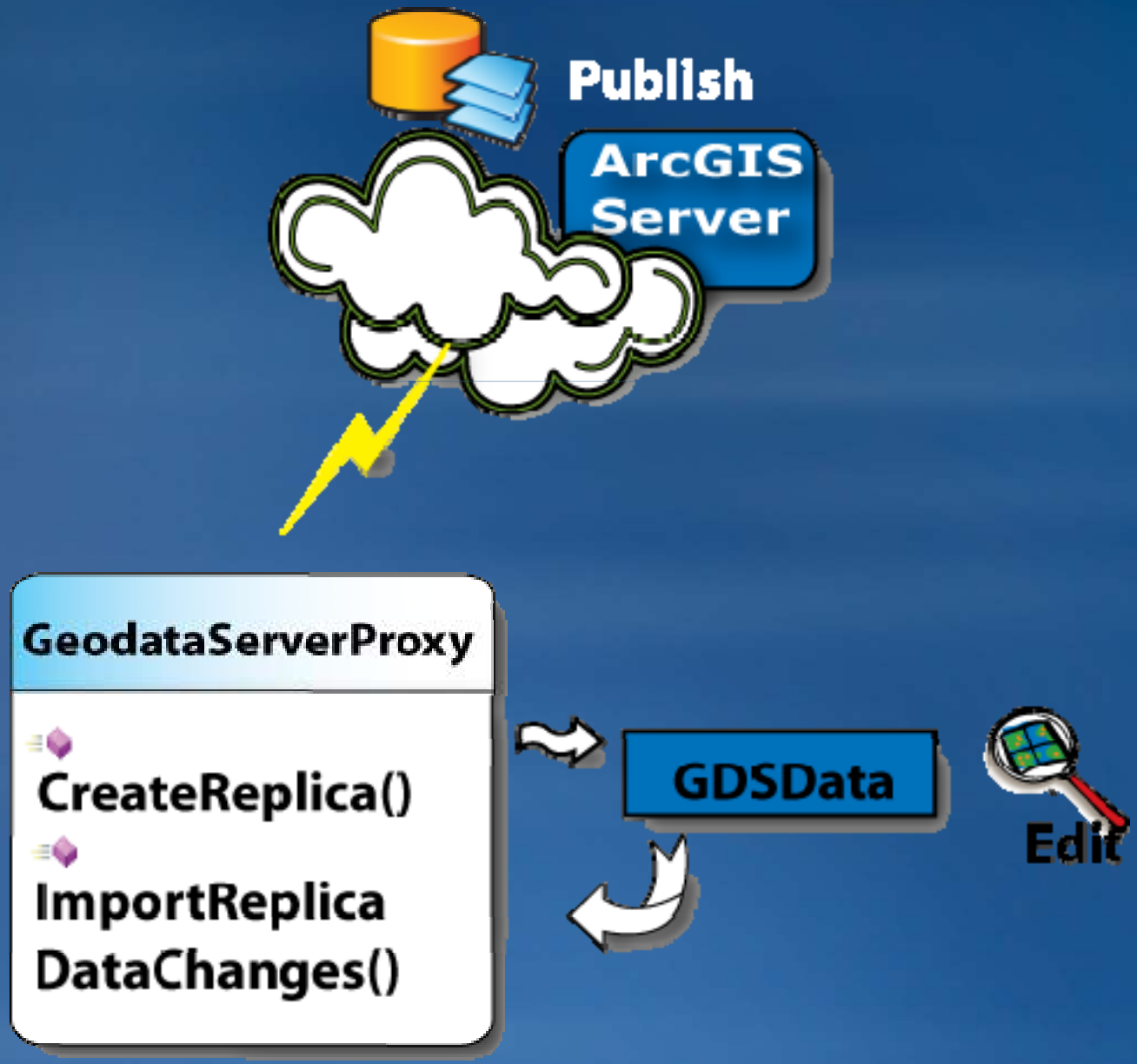
- Methods to perform

TableSearch	Returns the records satisfying the specified query
ExtractData	Extract Data
CreateReplica	Creating check-out replicas that can be down loaded and edited
ImportReplicaDataChanges	Import the data changes for a replica

Geodata Service – Object Model



Geodata Service Use Case – Disconnected Edit



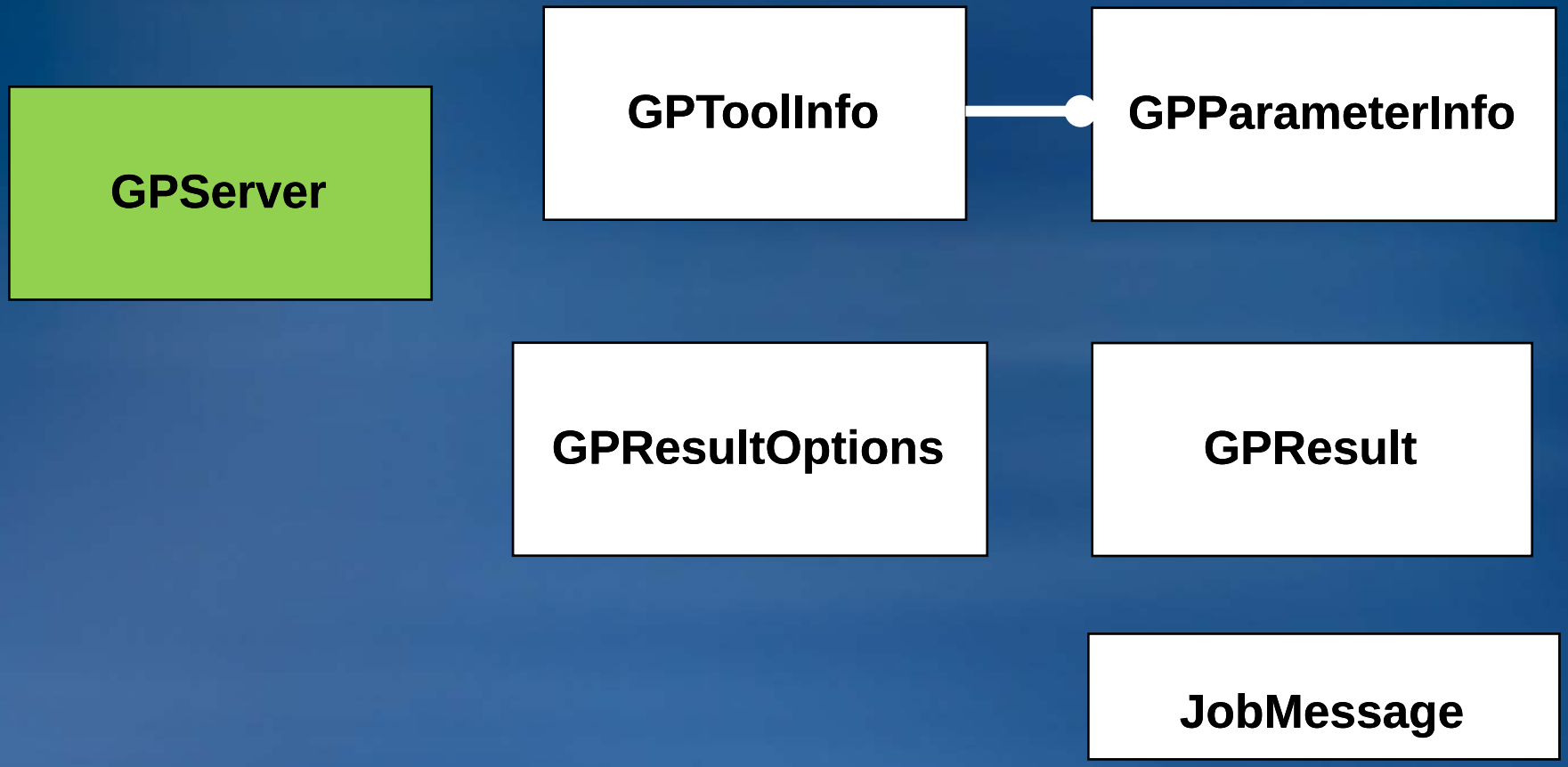
Geoprocessing Service

- Allows organizations to centralize both data and processing on the server
- Allows organizations with spatial data to expose spatial analysis functionality against that data as easy to use tasks that can be invoked by less experienced users
- Allows GIS Analysts to easily author and publish geoprocessing models

Geoprocessing Service

- You publish either a geoprocessing Toolbox
- Or a Map containing GP Tool Layers, meaning a GP Service may be associated with a map service
  - that can be used to render results created on the server
  - Useful for large datasets as the model results stay on the server
  - Provides access to results that are not supported by a client, for example rasters and TINs
  - Can use layers in the map document as input to the model

Geoprocessing Service – Object Model



Geoprocessing Service - Parameters

- Supported parameter types
  - String
  - Long
  - Double
  - Boolean
  - Date
  - Linear unit
  - Feature Set
  - Record Set
  - Raster

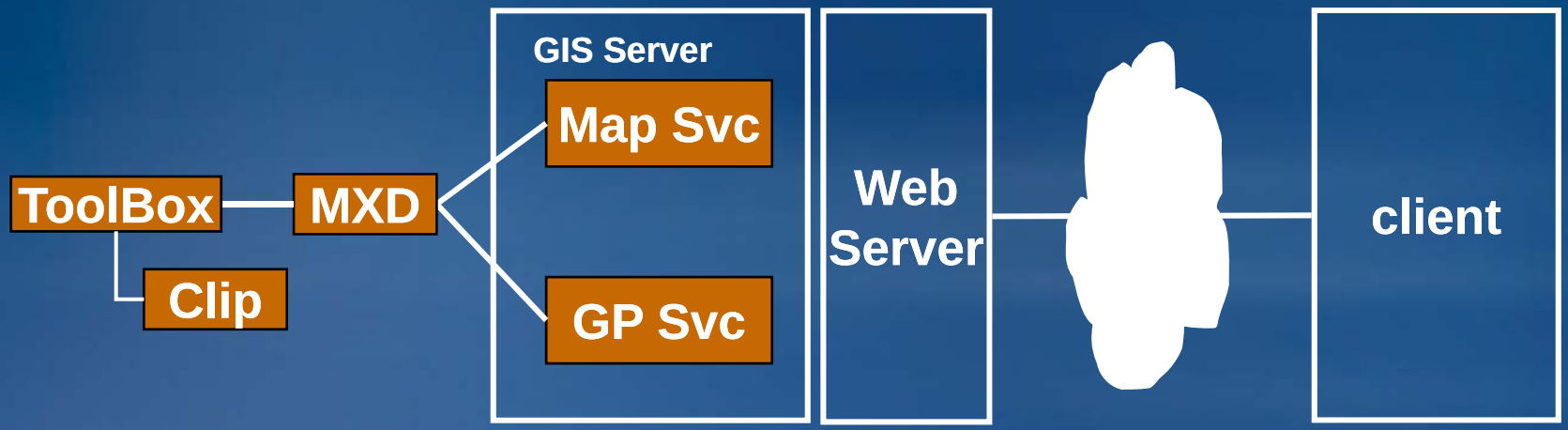
Geoprocessing Service Properties

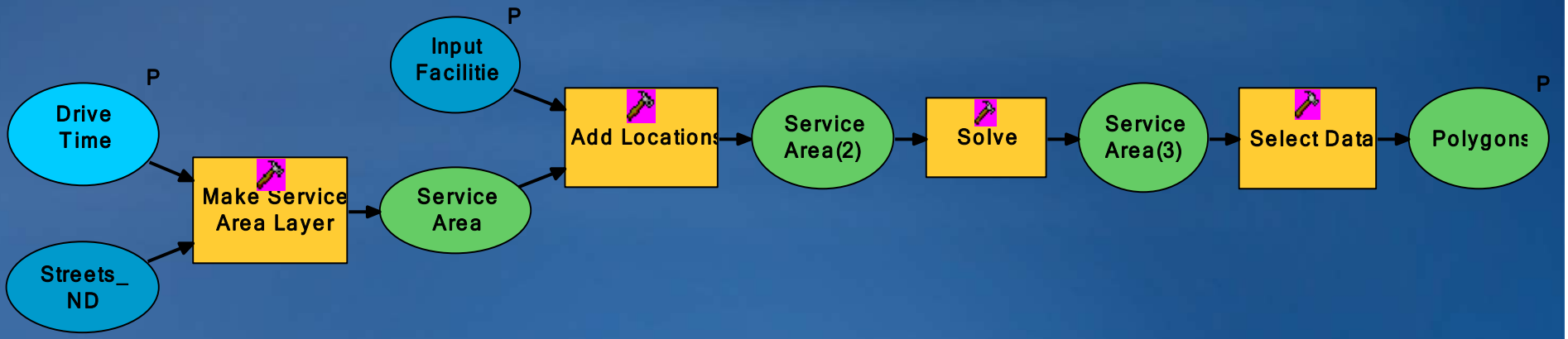
- **Execution Mode :**
  - **Synchronous**
    - **Results calculated and returned immediately by value**
    - **Appropriate for fast tools with small results**
  - **Asynchronous**
    - **Allows client to submit a job and come back later to fetch or draw results**
    - **Results are saved on the server**
    - **large results are best left on the server**
    - **Job message is used to track the status**

Geoprocessing Service – Key Methods

GetToolInfo	Returns the signature and default parameter values for a tool
GetExecutionType	Return the type of execution: synchronous or asynchronous
Execute	Execute a synchronous geoprocessing tool
SubmitJob	Execute an asynchronous geoprocessing tool
GetJobStatus	Return the current status of a geoprocessing job
GetJobResults	Return the results of a geoprocessing job that has completed successfully

Geoprocessing Demo





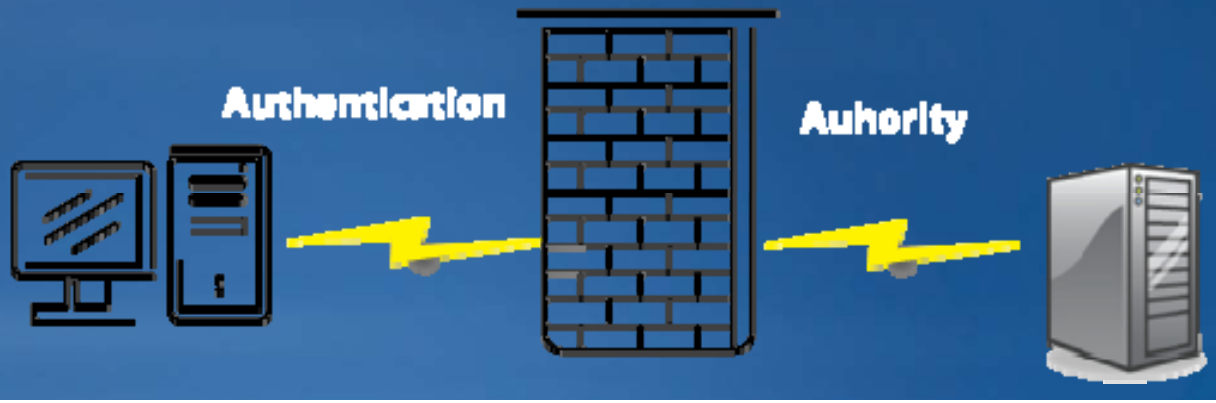
Security for GIS Services

- Supports multiple authentication methods
  - Token Based
  - HTTP/windows authentication

```
MapServerProxy msProxy = new MapServerProxy();
msProxy.Url =
"http://MyWebServer/arcgis/services/MyMapServiceName/MapServer?token=" + myToken;
```

- Supports a role based security model

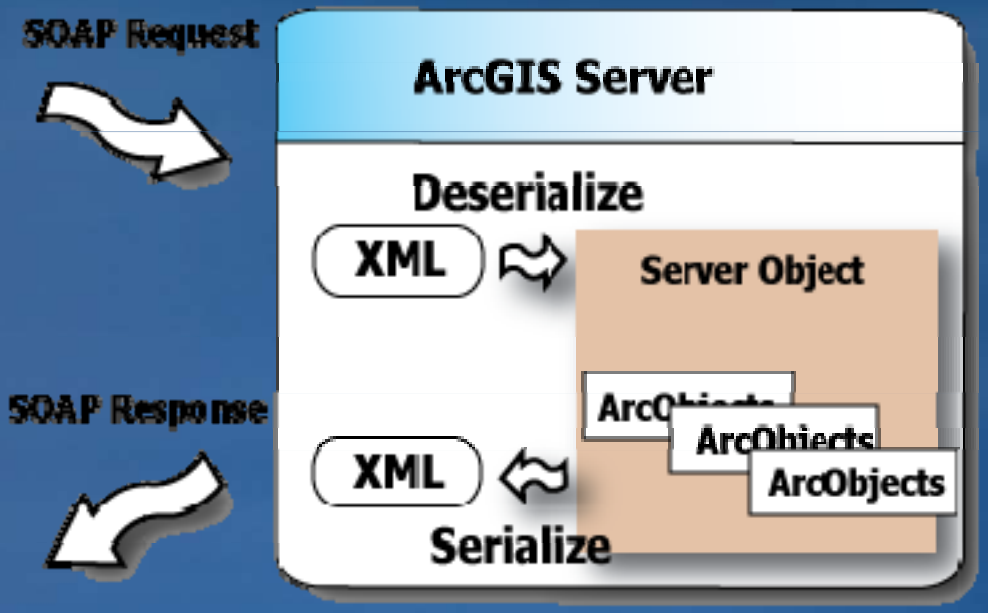
- Supports permissions on folders and individual services



ArcGIS Server Web Services – Under the Hood

- SOAP requests received by the web server are handled by a custom HTTP handler [.Net] / Servlet [Java] and forwarded to the corresponding server object in the GIS Server for processing.
- ArcGIS includes its own SOAP stack and XML serialization framework for ArcObjects
- All parameter objects implement IXMLSerialize
- SOAP requests [the SOAP body] is deserialized and processed by the server object
- Results are serialized into the corresponding SOAP response

ArcGIS Server Web Services – Under the Hood



Summary

- ArcGIS Server has a rich set of GIS Web Services
- You can work with services using the SOAP API
  - Proxies generated by SOAP Toolkit
  - Pre-generated proxies in Web ADF
- The SOAP API is
  - easily accessible from .Net, Java and other language
  - has a well described contract
  - is fully integrated into IDE's
  - lets you take advantage of compile time type checking
- Backward compatibility

Additional Resources

Questions, answers and information…

- ***Tech Talk***
  - ***Outside this room right now!***
- ***Meet the Team***
  - ***Tech Support Island***
- ***Other sessions***
  - ***Implementing Security for ArcGIS Server .NET Solutions(1:00PM)***
  - ***Distributed Geodatabase Development(2:45PM)***
  - ***Using the ArcGIS Server REST API***
- ***ESRI Resource Centers***
  - **PPTs, code and video**

resources.esri.com

- ***Social Networking***

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Want to Learn More?

ESRI Training and Education Resources

- **Instructor-Led Training**
  - **Introduction to ArcGIS Server**
- **Free Web Training Seminars**
  - **Authoring and Publishing Optimized Map Services**
  - **Authoring and Publishing Geoprocessing Services**
  - **Using ArcGIS Server Geoprocessing Services**

http://www.esri.com/training