



MetroGIS Internet- Enabled Data Distribution Mechanism

Functional Requirements Document
v2.1 (FINAL)
11 December 2001

by Adam B. Hocherman and Raj Singh

1 Contents

1	Contents	2
2	Governing Contract	3
2.1	Contract Number	3
2.2	Contractor Information	3
2.3	Contract Details	3
3	Vitals	4
3.1	Personnel	4
3.2	Milestones	4
3.3	Resources	4
3.4	Functional Overview	5
3.5	System Dependencies	5
3.6	Client Dependencies	5
3.7	Errata	5
4	Functional Overview	6
4.1	Launching the Client	6
4.2	Security Requirements	6
4.3	Basic Mapping Functionality	9
4.4	Data Extract Functionality	12
4.5	Use Case	13
5	Additional Nice-to-Have Functionality	14
5.1	Basic Mapping Functionality	14
5.2	Data Extract Functionality	14
5.3	Security Requirements	14
6	Addendum A – R&D Pertaining to Server-side eCommerce Proposal	15
6.1	Scope	15
6.2	Fee Structure	15
7	Detailed Timetable	16
8	Payment Schedule	17
9	Approval of Scope	18

2 Governing Contract

2.1 Contract Number

Contract #: 01P068

Project Name: MetroGIS Internet-Enabled Data Distribution Mechanism

2.2 Contractor Information

Syncline, Inc., a Chapter C Corporation, is located at 373 Washington Avenue, Boston, MA 02108. The official point of contact is:

Matthew M. Gentile, President & CEO
Syncline, Inc.
373 Washington Street, 5th Floor
Boston, MA 02108

p. (617) 986-1000

x. (617) 986-1001

Syncline, Inc. acknowledges Matthew M. Gentile as the authorized representative as seen above and on Contractor Authorized Signature Verification Form.

2.3 Contract Details

TBD

3 Vitals

3.1 Personnel

3.1.a Syncline Principal

Raj Singh, Chief Technology Officer

3.1.b Project Manager

Adam B. Hocherman, V.P. Engineering

3.1.c Technical Architects

Josh Lieberman, V.P. Information Architecture

Michael Schenck, Sr. Technical Architect

3.1.d Development Team

Jian Huang, Sr. Java Application Engineer

Libing Liao, Java Application Engineer

Rick Clift, Sr. User Interface Engineer

Chris Akin, GIS Analyst

3.2 Milestones

For a detailed breakdown, please see section 7, 'Detailed Timetable'.

- Functional Reqs. Doc. (FINAL) 11 December 2001
- Design Spec. Doc. (FINAL) 1 February 2002
- BETA release 29 March 2002
- Preliminary Design Feedback Forum W1 June 2002
- Production code completion 12 July 2002
- On-site deployment, final pres. And wrap-up 30 Aug 2002 (latest)

3.3 Resources

This document is based on:

- *Attachment to the Proposal Instructions: 1. Scope of Work*
- *Proposal to Provide Professional Services to develop the "MetroGIS Internet-Enabled Data Distribution Mechanism" submitted by Syncline, Inc. to MetroGIS.*
- *MetroGIS Internet Enabled Data Distribution Mechanism Interview Questions and Answers, October 2, 2001*

- Review of the MetroGIS DataFinder Website (<http://www.datafinder.org>) and homepage (<http://www.metrogis.org>).
- Take-aways derived from the design clarification meeting of 15 November 2001.

3.4 Functional Overview

The MetroGIS Internet-Enabled Data Distribution Mechanism (IEDDM) will be designed as an Internet-based, data delivery tool that satisfies the following criteria:

- Securely automates the distribution of geospatial data to the MetroGIS data user community and provides a security mechanism which is able to distinguish data requests that require licensing or fees from those that do not and handle these requests appropriately.
- Provide a self-service mechanism by which the user has the ability to define (via custom extent and theme selection) and subsequently download vector- and raster-based geospatial data of interest.
- Provide the user with a choice of geospatial data formats.
- Leverage the Web Services that are being designed and built via the MetroGIS NSDI Grant Project (OGC-Compliant Map Internet Services).

3.5 System Dependencies

The functionality and scope described in this document relate almost entirely to a Java web client application. Successful use of this client in a web application depends on access to the corresponding server functionality and geospatial content. These components will not be provided by Syncline. Rather, Syncline is expected to ensure that the client described in this document is able to interact with web services that are being designed and built via the MetroGIS NSDI Grant Project (OGC-Compliant Map Internet Services). MetroGIS will provide all data required for this application.

It is assumed that the MetroGIS Internet-Enabled Data Distribution Mechanism will be launched from an appropriate location on the MetroGIS DataFinder Website and that MetroGIS will be responsible for implementing the link and creating any ancillary “marketing” content required.

3.6 Client Dependencies

MetroGIS requires that the IEDDM be launchable from major web browsers and usable across both Windows and UNIX environments. In addition, a small portion of the user base may access this application over a 56k modem connection.

3.7 Errata

3.7.a Provisions for the Americans with Disabilities Act (ADA)

The MetroGIS IEDDM application will provide capabilities for assistance technologies where possible and appropriate. Specifically Syncline will leverage the Java Accessibility API and general best practices to a reasonable extent.

4 Functional Overview

4.1 Launching the Client

Syncline and MetroGIS have come to an agreement regarding the underlying technology platform that this product will be built on. Based on the application and user requirements Sun's Java Web Start technology has been selected as the ideal platform for development. This platform provides the ability to:

- Launch the client via either a desktop icon or a URL link from a web browser.
- Overcome the problems associated with downloading a large Java applet via web browser each and every time the application is accessed.
- Provide the rich GUI capabilities mandated by the functional requirements of this application.
- Provide the option of initially installing the application via CD-ROM, rather than via web download – attractive to modem users.
- Meet all of the browser and cross-platform requirements for this application.

4.1.a URL Parameter Details

The following parameters will be specifiable via the URL to provide flexibility in what the initial map displayed looks like:

4.1.a.1 *Initial Map Service*

The map service from which the map images are derived.

4.1.a.2 *Initial Visible Layer List*

A list of layers that will be initially visible.

4.1.a.3 *Initial Map Extent*

A set of coordinate pairs which will specify the geographic extent of the initial map image.

4.2 Security Requirements

4.2.a Background

It is important to note that MetroGIS' expectation is that the authentication mechanism derived for the purposes of this application are to restrict access to the back-end WMS by other, non-sanctioned mapping clients. As such it should not be possible for anyone to request a map image or data extract without first being authenticated by this mechanism.

In addition the security module developed will be designed with consideration for future integration with an eCommerce mechanism used to sell the data distributed by the tool outlined in this specification. Details of said "eCommerce mechanism" will be the product of the work performed as outlined in Addendum A, found at the end of this document.

4.2.b Authentication

4.2.b.1 Anonymous browsing

A non-named user is able to utilize all features of the tool without a named login. If the tool is accessed in this fashion only data sets assigned to the “Anonymous Access” group (see below) are made available to the user.

4.2.b.2 Accounts (Organizations), Groups and Users

A user’s security clearance dictates what data sets appear for browsing and using.

To see non-publicly accessible data sets, the IEDDM will require user-level authentication via a login / password mechanism. Organizations are assigned to a group (see table below) which dictates license requirements for that organization. However, a further access restriction that checks for the presence of a valid licensing arrangement (in other words, has this organization’s license expired?) is defined at the more granular, organization level.

The initial release of this product assumes that authentication will occur at an account (or organization) level. As such, any one organization will have a single username and password that can be distributed to various members of that organization at the discretion of the account owner.

Future releases of this product will allow for individual usernames and passwords to be created for individual members of a particular organization.¹ It should be noted that when this does occur, all users will assume the same license restrictions defined for their organization. **That is to say that licensing restrictions are defined at the organization level, not the user level.**

4.2.c Group-Level Restrictions

When a user logs into the system they are identified as being a part of a group. A user is associated with one and only one group. Different groups have different license restriction privileges on a per-data set basis. Some example privileges can be found in the table below however this security model provides for any number of groups and data sets to be defined and organized under this structure.

A “Y” indicates that a particular data set is available to a particular group, for view or download. An “L” indicates that a particular data set is available to a particular group but that a (non-expired) license is required. An “N” indicates that the defined action is not permissible to a particular group for a particular data set.

	Organization Type (Group)			
	Government / Academic (named login)		Non-profit / For-profit / General Public / Other (anonymous access)	
Data Set	<i>View</i>	<i>Download</i>	<i>View</i>	<i>Download</i>
Street Centerlines	Y	L	Y	N

¹ Tech note: Syncline will design a data model that provides for a 1-to-many relationship between accounts and users, however initially there will be only one user record per account.

(TLG)				
Census Geography (1990)	Y	Y	Y	Y
Municipal Boundaries	Y	Y	Y	Y
Land Cover	Y	Y	Y	Y
Orthoimagery 2000	Y	L	Y	N
Parcels	L	L	N	N

Data sets are assigned to groups that are allowed access to that data set and can be downloaded by users of those groups subject to the data delivery restrictions outlined.

4.2.d Organization-Level Restrictions

An additional level of security granularity provides checks for the presence of a non-expired license – a flag which is defined at the organization level. Obviously anonymous users cannot view or download data sets that require a license check and will need to contact MetroGIS for a user id and password.

4.2.e Administration of Data Sets, Organization-Level Privileges and User Accounts

A very simple HTML-based administrative interface will be provided that will allow for the creation, removal and assignment (to a pre-existing group) of new Organization accounts:

- Name of organization
- Primary username / password
- Group assignment

All other administrative functions will need to be performed manually in the backend. This includes such functions as:

- Creation of new groups
- Creation of new map services and associated data browsing hierarchies
- Assignment of new data sets to groups

4.2.f Security Use Case

The Bloomington public school system has a named account with the system and is associated with the “Government / Academic” group. Upon login under the Bloomington account the user is shown a list of data sets (via the hierarchical browsing panel) which are accessible to organizations assigned to the “Government / Academic” group.

This user is able to freely view and download data sets such as municipal boundaries and land cover. However, to take an example, should this user request to view or download

parcel information the system checks to ensure that the Bloomington public school system has a non-expired license to do.

4.3 Basic Mapping Functionality

The MetroGIS Data Viewer provides for the following basic mapping capabilities.

4.3.a Access to the Spatial Data Catalog (Choosing a Data Set and Extent)

4.3.a.1 Select a Data Set For Viewing

A hierarchical data set browsing pane allows the user to browse through the data sets that MetroGIS chooses to make available to the user base and are accessible to that user based on their access privileges. These data sets will be organized hierarchically according to ISO Category name and will be flexible such that the hierarchy may be amended².

For example:

```
+ - ISO Category Name 1
    +- Data Set 1
    +- Data Set 2
    +- Data Set 3
+ - ISO Category Name 2
    +- Data Set 4
    +- Data Set 5
    +- Data Set 6
```

This setup also provides MetroGIS with the ability to designate officially endorsed MetroGIS datasets either in the name of the data set and/or by creating a completely separate top-level category grouping alongside the ISO Category names.

It is also of note that this setup provides for data sets to be pulled from disparate back-end web mapping services in a manner that is transparent to the user.

Once a theme has been selected, it will be added to the map viewer component as a non-visible map layer until a distinct map view extent has been chosen which is within both the layer's extent and its view scale range.

4.3.a.2 Gazetteer (Quick Zoom)

A second component is also dynamic and hierarchical in nature and is populated with categorical and/or textual descriptions of places of interest within the extent of the MetroGIS data warehouse. This allows the user to select a view extent to zoom to within the map

² It is understood that MetroGIS will be responsible for maintaining the available data and creating (and/or manually updating) the data set hierarchy such that it is in sync with the available map services.

viewer component by selecting a meaningful placename instead of a set of coordinates. The user may browse the placename hierarchically by either:

- location (e.g. by county, city)
- type (e.g. public resource locations, parks, schools).

Once a placename has been selected the map display will zoom to the extent of the selected feature.

4.3.b Map Tools

Other navigation tools provided with a map viewer component will allow the user to:

4.3.b.1 Pan

Pan the extent of the map by clicking on the map image and dragging the mouse.

4.3.b.2 Zoom In (single click or bound)

Zoom in the extent of the map by either:

- Clicking to zoom a preset amount (i.e. 2x)
- Clicking and dragging a box on the current map extent in order to select the new extent.

4.3.b.3 Zoom Out

Zoom out the extent of the map out by clicking a point on the map in order to zoom the map out a preset amount (i.e. 2x).

4.3.b.4 Measure Distance

This tool enables the user to perform a rough distance measure (in some default unit of measure) by clicking two points on the map.

4.3.b.5 Overview Map

This feature will present a small full-extent image of the currently selected data set and indicate with a bounding box the geographic extent that is currently being viewed in the main map window.

4.3.b.6 Scale Bar

An active scale bar always indicates the current map scale as a ratio of 1:x and visually as a standard length (e.g. kilometer).

4.3.b.7 North Arrow

A north arrow icon is always displayed somewhere on the map or interface.

4.3.b.8 Simple Identify Tool

A simple single-click ID tool will enable the user to visually select a geographic feature from the map in order to ascertain a listing of attribute data affiliated with that geographic feature. The purpose of the tool is to enable the user to quickly and easily orient themselves by performing a simple spot-check on the geographic data. Multiple records would only be

retrieved by this selection in the event that multiple features are stacked on top of one another in an indiscernible fashion³.

4.3.c Map Layer Tools (Legend)

A live legend component will enable a user to perform various functions pertaining to the manipulation of map data layers.

4.3.c.1 Toggle

The user will have the ability to selectively toggle the visibility of any map layer “on” or “off”.

4.3.c.2 Order

The user will have the ability to order the map layers in any way they choose.

4.3.c.3 Activate

The user will have the ability to select a single map layer to become the “active” data layer – the layer on which identify queries are performed.

4.3.d Other Tools

4.3.d.1 Browse Meta Data

The user will have the ability to display HTML-based metadata (currently available at datafinder.org) for any data set.

4.3.d.2 Print

The user is able to print the currently displayed map extent and layers. Output format is pre-defined in layout and will consist of the following elements:

- Map Image
- Legend
- Scale Bar
- North Arrow
- Title

The print operation spawns a browser window and lays out the above components in a one-page HTML display, designed to be printed using the browser’s print feature.

4.3.d.3 On-line Help

This feature will open a browser window containing detailed help information about the operation of the IEDDM.

³ This tool is not meant to be used to perform extensive analysis or attribute data manipulation in the client – it is assumed that this type of analysis will take place with the extracted data in an external GIS.

4.4 Data Extract Functionality

The MetroGIS IEDDM provides a mechanism by which the user may “extract” the currently displayed map data for subsequent analysis in their own desktop GIS package.

4.4.a The Data Extraction Wizard

The user may step forward and backwards through this wizard until they press the “extract” button in the final step.

4.4.a.1 Step 1: Select Data for Extract

Here the user is presented with two options:

- Use the current geographic extent displayed in the map window.
- Use a set of feature selection tools to define an irregular area for extraction. The tools available to perform this step include:
 - rectangular selection tool
 - irregular polygon selection tool
 - buffer tool - allows the user to select a distance over which to perform a buffer from the currently selected features
 - clear selection tool - clears all highlighted features

4.4.a.2 Step 2: Confirm Layers for Extract

Here the user is presented with a list of all layers that are present in the currently displayed map composition. Layers that are “on” in the map window have a checked checkbox in front of them. Layers that are “off” in the map window have an unchecked checkbox in front of them. The user has the ability to check or uncheck layers here that will or will not be included in the extraction.

4.4.a.3 Step 3: Filter Columns for Extraction

Here the user is prompted to step through n filter dialogs where n is the number of layers that were selected for extraction. In each dialog the user is presented with:

- A list of all of the attribute columns present in the layer in a manner similar to the “Confirm Layers for Extract” dialog.
- A data sample (i.e. the first attribute record in the data set) alongside the column name.

By default every attribute column is checked. The user may selectively uncheck attribute columns in each dialog in order to limit the amount of extracted data. A “skip this step” button on this step allows the user to avoid having to step through each dialog if they are not interested in using the filter *for any layer*.

4.4.a.4 Step 4: Select Output Format

The user is presented with a drop-down list containing the following format types: ESRI .shp, MapInfo .tab, Intergraph .dgn, and FME Transfer Format .ffs.

4.4.a.5 Step 5: Perform Extraction

In the final step of the wizard the user is asked to confirm if they are ready to perform the extraction. The user clicks the “extract” button when they are ready. The system checks a pre-defined threshold value for maximum data extraction size and if the requested data is larger than the threshold a message is displayed and the download is denied. Otherwise the extraction is performed and a .zip archive is delivered containing the requested files.

4.5 Use Case

4.5.a Using the Data Browser

Bob wants to extract census geography information for all of the parcels in, or within a half-mile from, the Bloomington municipal boundary. Bob uses the data browser to locate the data he is interested in and adds the following layers to his map:

- municipal boundaries
- parcels
- census geography

4.5.b Using the Gazetteer

Using the gazetteer Bob selects “Bloomington”, which is in quick zoom the list, and the map extent jumps to this location.

4.5.c Extracting Data

Bob clicks the “extract data wizard” button.

In step 1 Bob opts to define an irregular area for extraction. Bob uses the feature selection tools presented to select the Bloomington municipal boundary and perform a half-mile buffer.

In step 2 Bob is presented with a list of three layers: municipal boundaries, parcels and census geography. Because Bob isn’t interested in the municipal boundary data, he unchecks this layer and is left with the parcel and census geography layers for extraction.

In step 3 Bob steps through the two filter column dialogs and decides that he wants all of the column data for the census geography layer (the default) but only selects 5 of a total 24 column attributes for the parcel layer.

In step 4 Bob selects ESRI .shp from the drop-down list.

Finally, in step 5 Bob hits “extract” and receives his requested data.

5 Additional Nice-to-Have Functionality

Functionality outlined in this section has been deemed out of scope for the initial release of this product. At the discretion of the contractor this functionality will be included, if at all possible.

5.1 Basic Mapping Functionality

5.1.a Map Tools

5.1.a.1 *Save Map Image to Local Disk*

The user will have the ability to save the current map view that is displayed as an image file to their local workstation.

5.1.a.2 *Copy Map Image to the Windows Clipboard*

The user will have the ability to copy the current map view to the Windows clipboard for later use in another compliant application.

5.1.a.3 *Enhanced Zoom Out*

An enhanced zoom out function will provide the user with the ability to drag a box and have the current visible extent reduced to the size of that box, thus revealing a broader viewable area overall.

5.1.a.4 *Advanced Tabular Attribute Analysis*

The user will have the ability to retrieve attribute records in a pliable, tabular format that permits for data sorting.

5.2 Data Extract Functionality

5.2.a The Data Extraction Wizard

5.2.a.1 *Feature Filter Tool*

This feature allows the user to filter features selected for extract by filtering on an attribute (is greater than, less than, equal to or not equal to).

5.3 Security Requirements

5.3.a Administration of Data Sets, Organization-Level Privileges and User Accounts

5.3.a.1 *Advanced Web-based "Command Center"*

This would entail further web-based administration features not covered in the initial release of the product.

6 Addendum A – R&D Pertaining to Server-side eCommerce Proposal

The following addendum covers the creation of a document outlining the results of a study performed by the contractor to assess and propose an applicable server-side eCommerce solution that will meet the needs of MetroGIS and integrate with the client already being developed.

6.1 Scope

6.1.a Needs Assessment

Conversations, correspondence, interviews and/or visits⁴ required to fully understand MetroGIS' eCommerce needs now and in the foreseeable future.

6.1.b Product Analysis

An inclusive study of available products, technologies and/or services available that may or may not meet the needs of MetroGIS

6.1.c Deliverable

A written report composed by Syncline, Inc. detailing the results of the needs assessment and product analysis as well as a detailed proposal indicating product options, technical considerations, effort levels and proposed costs (should Syncline be selected to implement the findings of this study).

One (1) bound paper copy, prepared using Microsoft Word word-processing software, will be submitted.

6.2 Fee Structure

Personnel	Time	Rate (per hour)	Total
Product Specialist	30 hours	\$190	\$5700
Sr. Tech Arch	12 hours	\$170	\$2040
			\$7740

⁴ Travel and expenses incurred as a result of meetings surrounding this addendum will be paid by MetroGIS.

7 Detailed Timetable

Milestone	Proposed Date	RFP Date
Design Clarification Meeting	15 November 2001	Functional Reqs. Doc. complete by 14 December 2001
Functional Reqs. Doc. (DRAFT)	19 November 2001	
MetroGIS Feedback	26 November 2001	
Functional Reqs. Doc. (FINAL)	11 December 2001	
Design Spec. Doc. (DRAFT)	11 January 2002	Design Spec. Doc. complete by 1 March 2002
Design Spec. Agreement Meeting	17 January 2002	
E-commerce On-site Needs Assessment	18 January 2002	
Design Spec. Doc. (FINAL)	1 February 2002	
BETA release	29 March 2002	Beta complete by 29 March 2002
E-commerce Deliverable	29 March 2002	N/A
MetroGIS feedback to Syncline on Beta	26 April 2002	26 April 2002
Preliminary Design Feedback Forum (meeting in MN – Note that Syncline does not attend this forum, but the RFP provisions for a meeting in Minnesota if necessary as follow-up)	First week in June 2002	First week in June 2002
MetroGIS feedback to Syncline based on forum	Forum + 1 week	Forum + 1 week
Production code completion	12 July 2002	12 July 2002
On-site deployment (Install Deliverable & Draft Technical Report submitted)	30 August 2002 (latest)	2 August 2002
Final Presentation		16 August 2002
Wrap Up Meeting (Final Project Summary & Technical Report submitted)		30 August 2002

8 Payment Schedule

* Note that the following schedule **does** include the \$7740.00 for Addendum A and **does not** include the agreed upon \$1200.00 retainer for T&E.

Month of Invoice	Amount
November	\$ 8,882.50
December	\$ 9,730.38
January	\$ 9,730.38 + \$ 1,200.00 T&E = \$ 10,930.38
February	\$ 9,730.38
March	\$ 9,730.38
Upon On-site Deployment	\$ 8,436.00
Total:	\$ 57,440.02

9 Approval of Scope

MetroGIS (“the client”) has read and reviewed the *MetroGIS Internet-Enabled Data Distribution Mechanism* document and hereby authorizes Syncline, Inc. to proceed with the design and development of the application described in this document.

The client acknowledges that any requests for the addition of features not outlined in this document will be considered beyond the scope of work authorized and may affect the timeline and/or cost of the project.

The client confirms that they have reviewed the milestone deadlines outlined in section 3.2 of this document and acknowledges that these are preliminary dates, estimated based on the business requirements of the application. Syncline, Inc. reserves the right to amend the timeline as demands discovered in the ‘Design and Architecture’ phase of the project dictate. Furthermore the client acknowledges that successful, on-time completion of this application is dependent upon their ability to provide deliverables for which they are responsible, in a timely fashion.

Randy Johnson, MetroGIS

Alison Slaats, MetroGIS

Raj Singh, Syncline, Inc.

Adam B. Hocherman, Syncline, Inc.