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CityMap SDK: Assembling Web Services into a Batch Geocoding Application

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City of Philadelphia

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Objectives

1. Why web services?
2. Which services were useful?
3. How can we demonstrate their utility?
4. What has gone wrong?

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Presentation

1. Introduction and Overview of CityMaps
2. Toward a CityMaps SDK
3. Web Services
4. Batch Geocoding Application
5. Lessons Learned

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CityMaps: Address Entry

CityMaps main page - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address http://citymaps.phila.gov/citymaps/moisAddressRequest.asp Go

Google Search Web Search Site News PageRank Page Info Up Highlight

phila.gov | citymaps

CityMaps: Philadelphia Address Lookup HELP

define address | special featu | aerial photo | zoning map | service areas | nearest facilities

View Orthophotography, Zoning and Service Areas:

Address/Street Name: 1911 BRANDYWINE ST NEXT

Select a result type: Aerial Photo

By entering an address, you are agreeing to the **Terms of Use Document**

Tips:
* Do *not* enter apartment numbers.
* Fully qualified addresses are better than partial addresses. In other words '400 N BROAD ST' is much better than '400 BROAD'.
* Please use single letters (N,S,E,W) for street directions.

If you don't know the full street name or don't know how to spell it, just type the part that you know into the space below and click on 'Find Street Name'.

Street Name: Find Street Name

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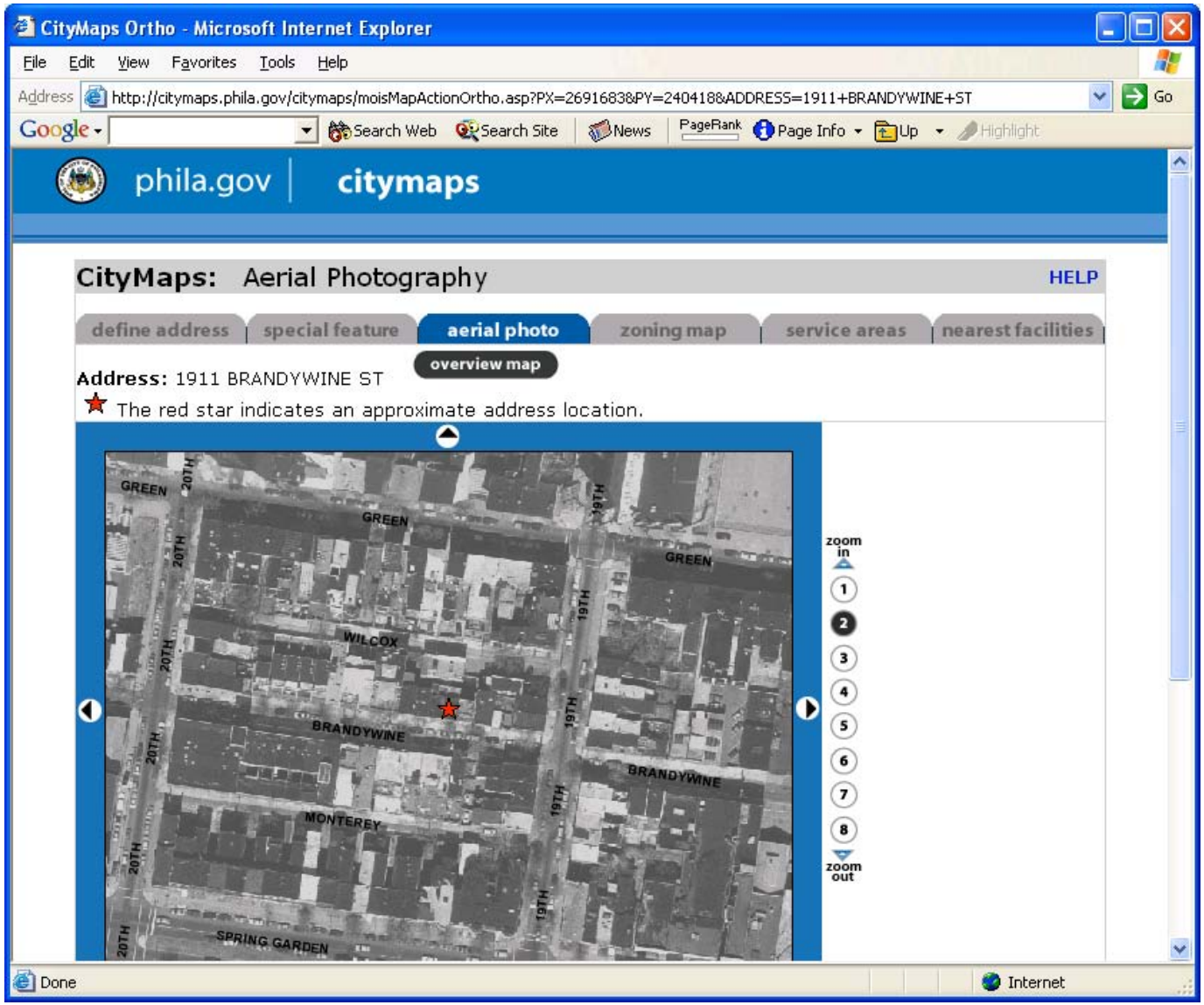
CityMaps: Aerial Photo



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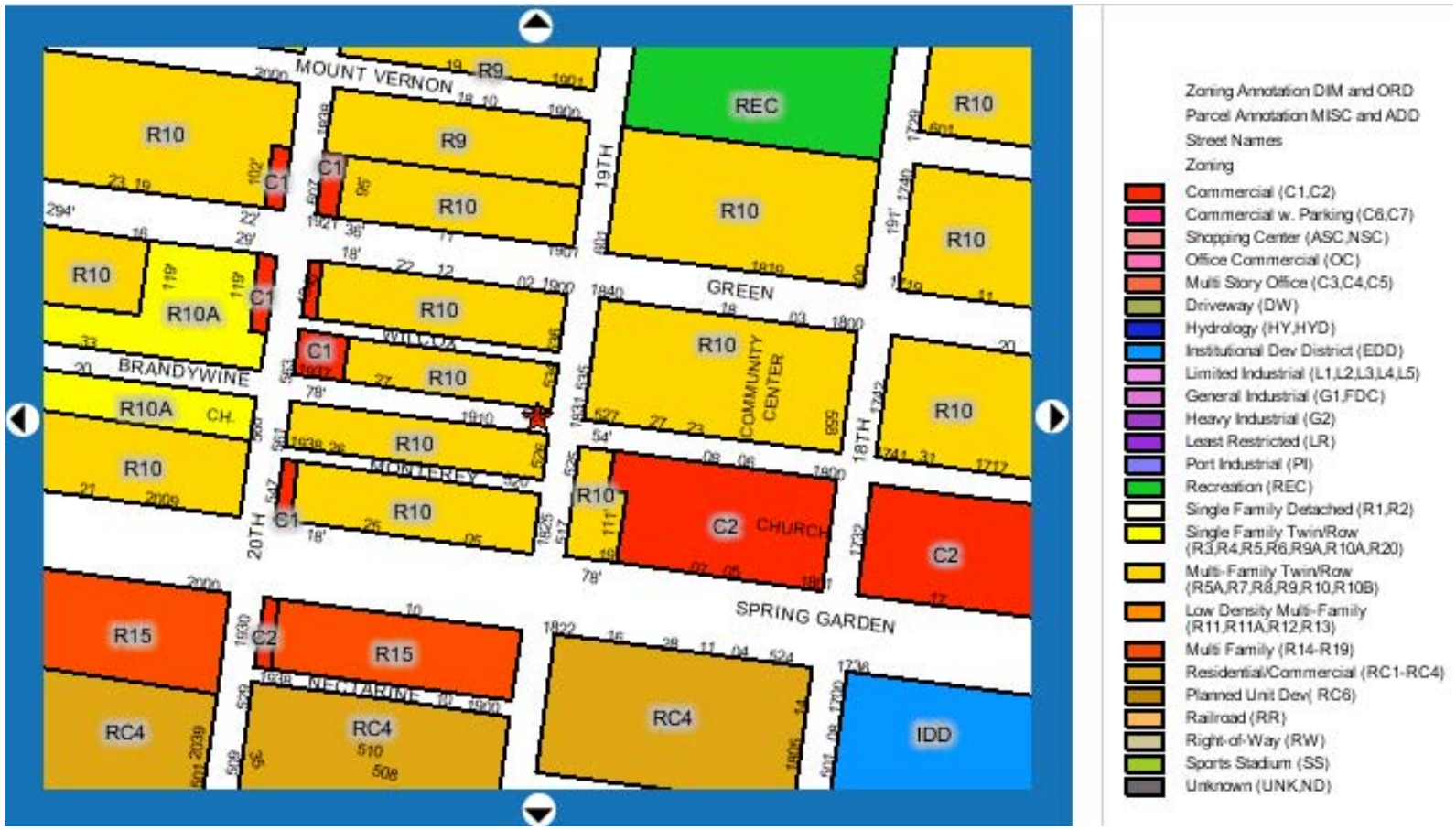
CityMaps: Zoning



- Developed for a business purpose
- Custom symbology

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CityMaps: Service Areas

CityMaps Service Areas - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address http://citymaps.phila.gov/citymaps/moisServiceAreaRequest.asp?ADDRESS=1911+BRANDYWINE+ST&PX=2691683&PY=240418&ZM=2

phila.gov | citymaps

CityMaps: Service Areas HELP

define address | special feature | aerial photo | zoning map | service areas | nearest facilities

overview map

Address: 1911 BRANDYWINE ST

Select one or more service areas from the list below:

- [ ] 1990 Census Tract
- [x] 2000 Census Tract
- [ ] 1990 Councilmanic District
- [x] 2000 Councilmanic District
- [x] Ward
- [ ] Ward Divisions
- [ ] Planning Analysis Section
- [ ] Police Sector
- [ ] Police District
- [ ] Police Division
- [ ] Fire District
- [ ] Health District
- [x] Zipcode
- [ ] Recycling Day
- [x] Rubbish Day
- [ ] Elementary School Catchment
- [ ] Middle School Catchment
- [ ] High School Catchment
- [ ] Recreation District

Select All | Clear All | FIND CITY SERVICE AREAS

For detailed information on the data used in this application, please see the **HELP**

If you are having problems with this application, please contact the Mayor's Office of Information

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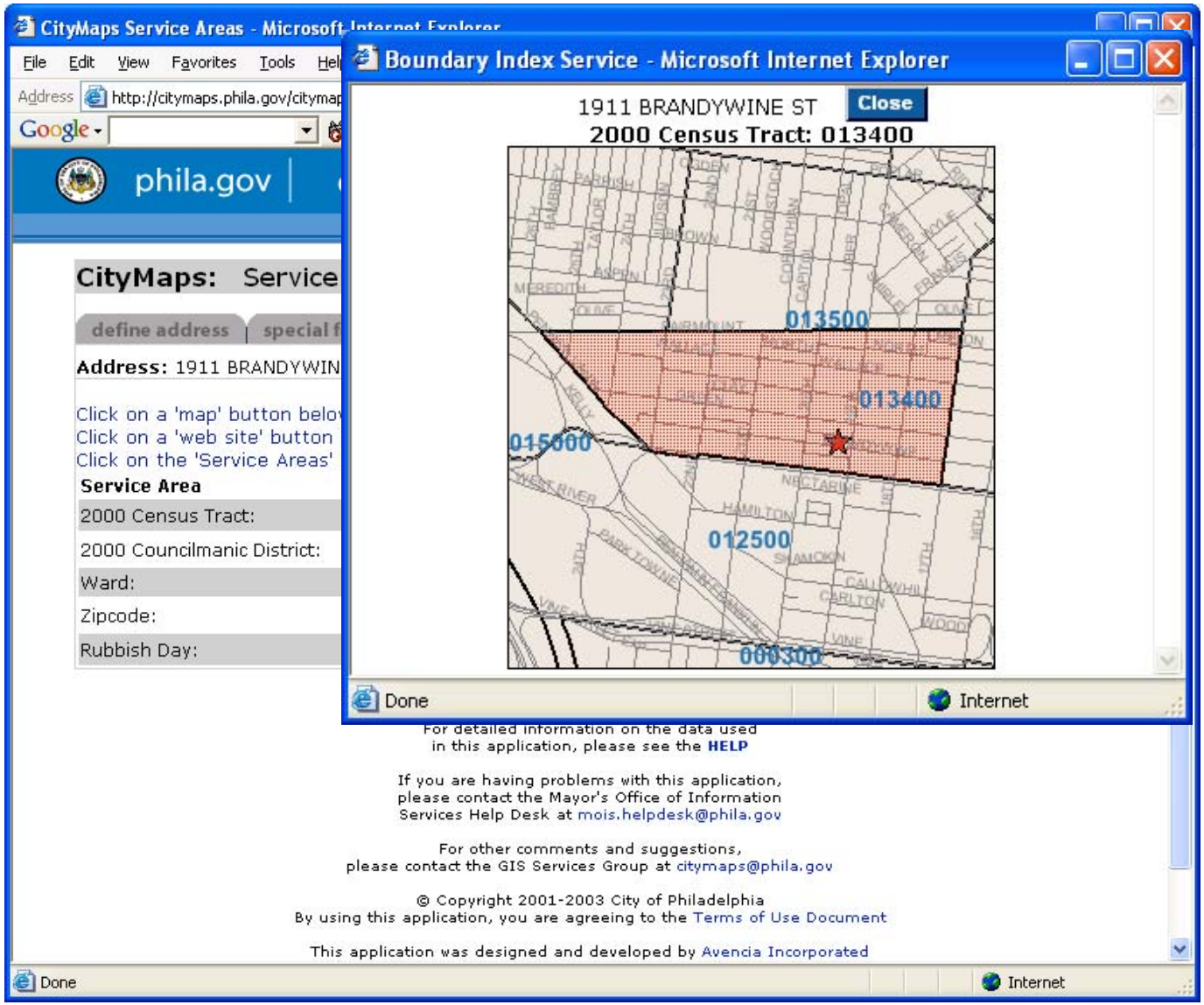
CityMaps: Service Areas



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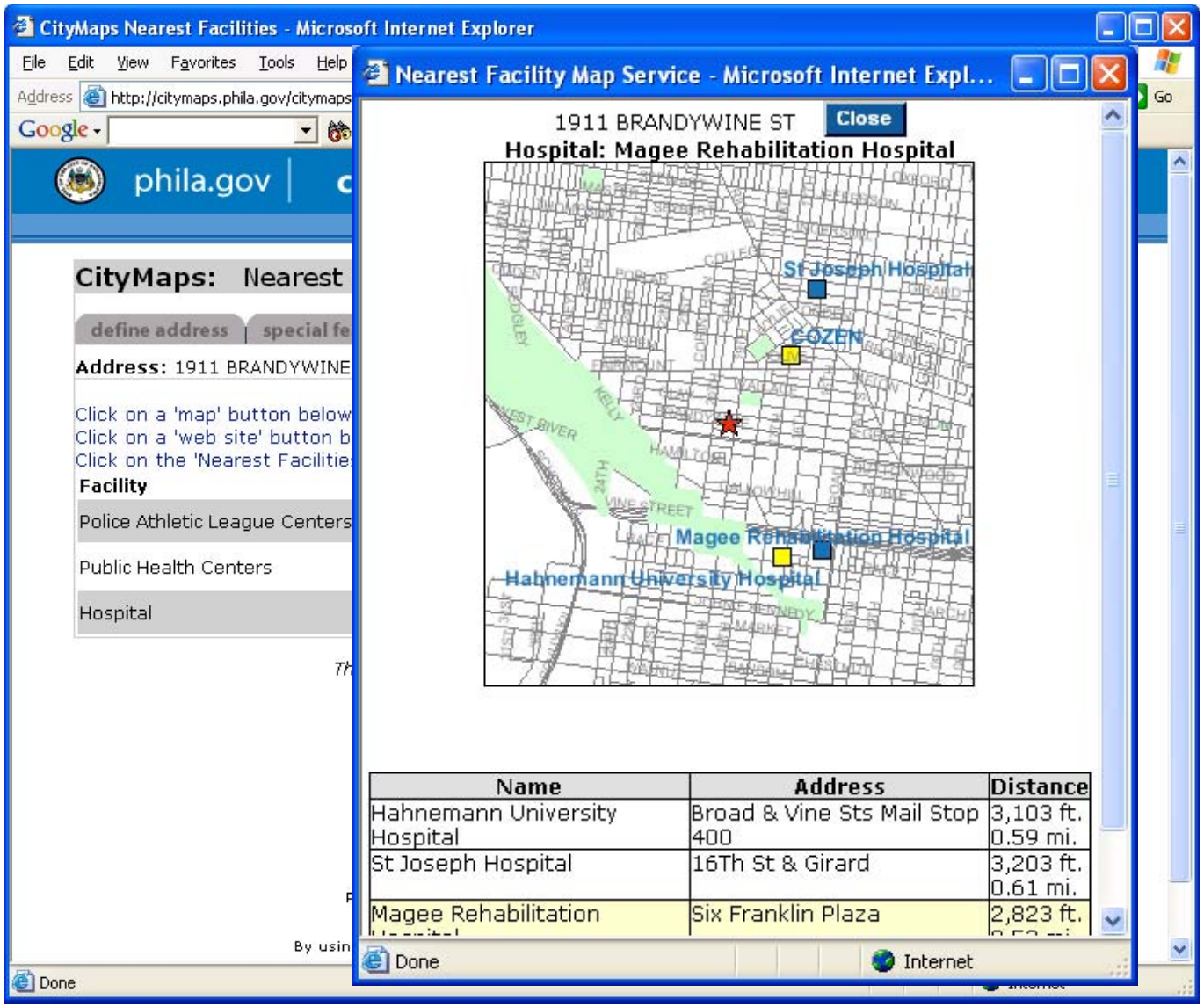
CityMaps: Nearest Facilities



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CityMaps

- TODAY:
  - Applications that use the City's spatial data
  - Uses ArcIMS and Windows 2000 to serve maps and spatial services to public
- TOMORROW
  - Tools for incorporating spatial intelligence into City business processes

Important: CityMaps is just one window on a much larger infrastructure

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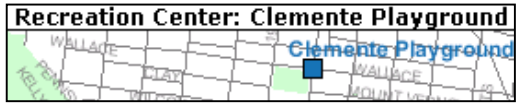
What is CityMaps?

Address Parsing and Location (Geocoding)

Mapping Services

Point-in-Polygon Service



Nearest Location Service

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Integrating GIS with City Business

- CityMaps and the Web-based GeoServices should be treated as the way in which agencies interact with spatial data and services.
- We want to minimize the amount of work required to both implement new services and maintain existing ones.

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Different ways to Integrate?

- EXTERNAL: Phila.gov agency sites
- EXTERNAL: City-affiliated sites – PPDOnline.org, CDC's, etc.
- INTERNAL: Agency web sites and applications
- INTERNAL: Agency desktop applications

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Integrating GIS with City Business

- Multiple application could obviously be developed independently, but there are obvious advantages to developing a range of techniques to plug them in:
  - Single set of current data
  - Projects costs less
  - Better services
  - Better coordination
  - Re-usable/shared building blocks encourage standardization and interoperability
  - Common user interface standard

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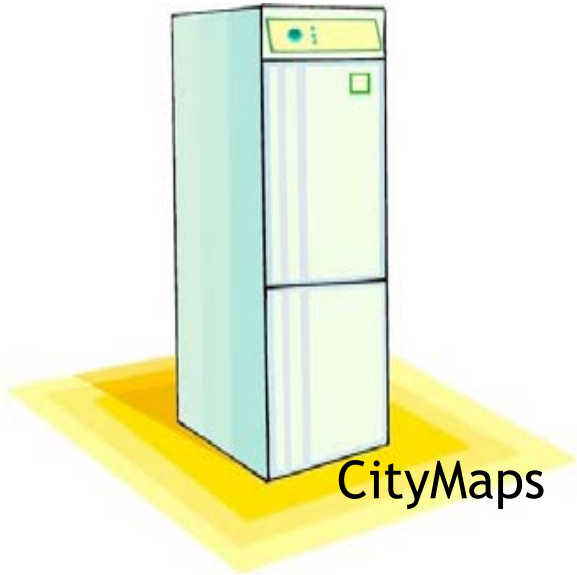
Lots of Moving Parts



- Windows 2000
- IIS
- ArcIMS
- .Net Framework
- Oracle
- ArcSDE
- Firewall/DMZ
- Networks
- CityMaps components

Q. How can we make it easier to deploy these capabilities to agencies?

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CityMaps SDK

Toolkit for Spatially Enabling Applications

What's in the toolkit?

- Customizable set of building blocks for embedding spatial intelligence in agency applications
- URL-based request capability
- Set of Templates for quickly generating map-based enterprise applications + Configuration Wizard
- Documentation
- Parameterized Configuration
- Same look and feel on any application (zoom tools don't change, for example).
- Standards-based API → Web Services

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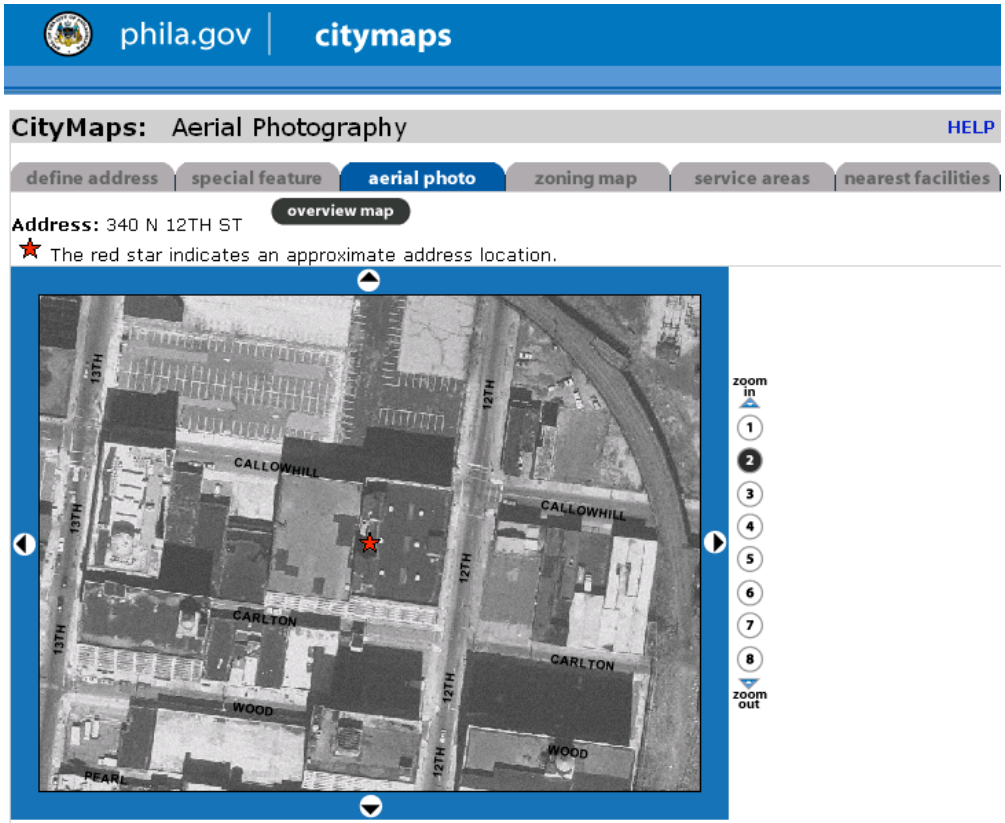
SDK: URL-based Requests

Domain name - corresponds to the numerical address of a computer

Folder containing one or more Web pages that are related

http://citymaps.phila.gov/citymaps/ moisMapActionOrtho.asp?ADDRESS=340+N+12TH+ST

Preface that says you are looking for a Web page. You don't have to type this every time.



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SDK: Map Templates

- Configuration Wizard – desktop application that interacts with ArcIMS, sets up a virtual directory, copies files to target directory, creates and edits XML configuration files.
- Further Parameterization
- Add new features
  - Email a map
  - Generate PDF of a map
  - Identify feature (for future parcel map)

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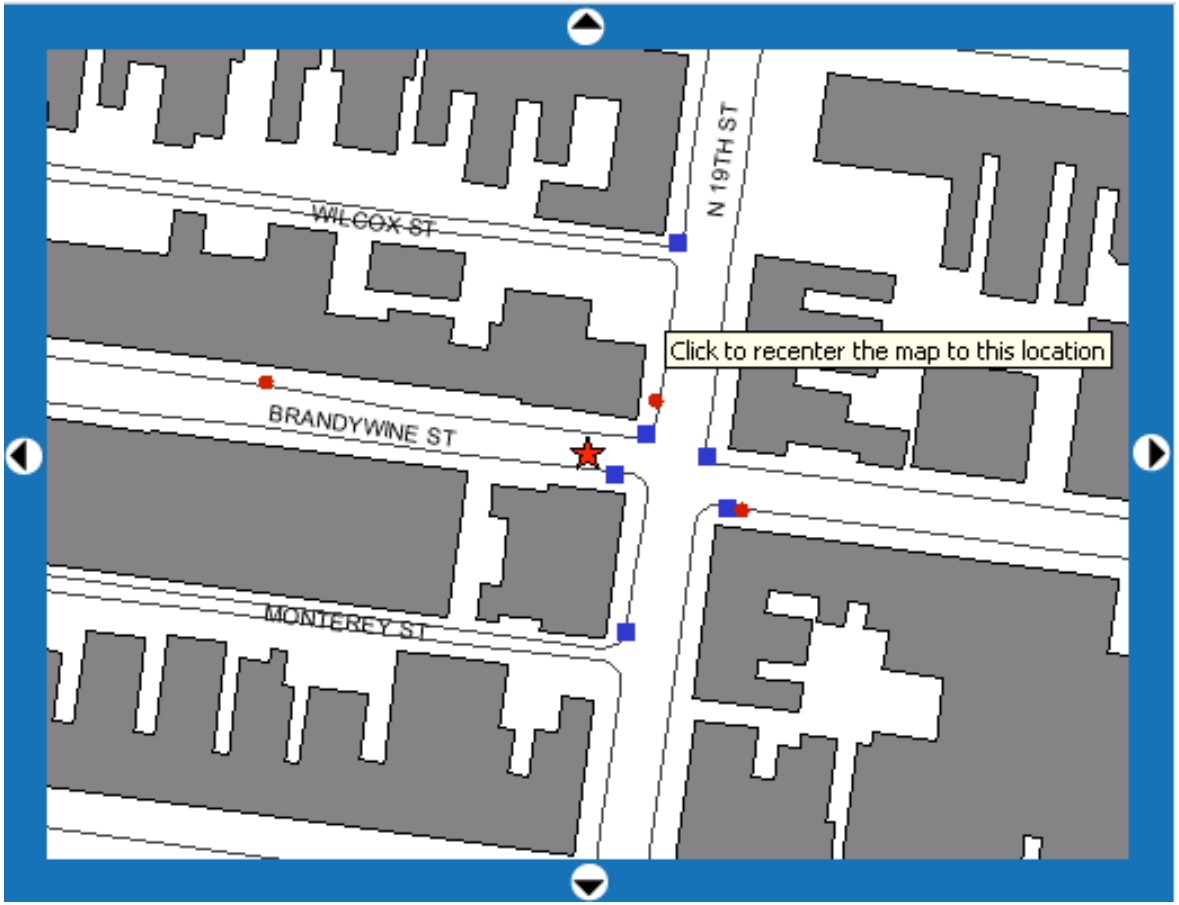
Storm Drains



- Ad Hoc
- Developed in 6 hours

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SDK: Parameterized Configuration

TextPad - [C:\projects\MOIS_CityMaps\vb\citymaps_parameters.config]

File Edit Search View Tools Macros Configure Window Help

citymaps_parameters.config

```
<?xml version="1.0" ?>
<citymaps>
<parameters type="APPLICATION">
        <parameter name="APPLICATION_NAME" value="CityMaps" />
        <parameter name="APPLICATION_VERSION" value="1.2" />
        <parameter name="APPLICATION_OWNER" value="Mayor's Office of Information Services" />
        <parameter name="APPLICATION_OWNER_LOGO" value="" />
        <parameter name="SDE_SERVER_NAME" value="" />
        <parameter name="SDE_INSTANCE_NAME" value="" />
```

```
<parameter name="SYSTEM_DATABASE_WILDCARD_SYMBOL" v
<parameter name="SYSTEM_DATABASE_CONNECTION_FILE" v
<parameter name="SYSTEM_DATABASE_CONNECTION_PASSWOR

<parameter name="AIMS_SERVER_NAME" value="ASPEN" />
<parameter name="AIMS_SERVER_PORT" value="5300" />
<parameter name="AIMS_GEOCODING_SERVICE_NAME" value
<parameter name="AIMS_ORTHOPHOTOGRAPHY_SERVICE_NAME
```

Block - Center
Block - Citation
Block - Code Extract
Block - Definition
Block - Definition List
Block - Division
Block - Horizontal Rule
Block - Ordered List
Block - Paragraph
Block - Preformatted
Block - Quotation
Block - Sample Output

```
        <parameter name="AIMS_MAP_HEIGHT" value="360" />
        <parameter name="AIMS_OVERVIEW_MAP_WIDTH" value="280" />
        <parameter name="AIMS_OVERVIEW_MAP_HEIGHT" value="300" />
        <parameter name="AIMS_EXTENT_WIDTH" value="1500" />
        <parameter name="AIMS_EXTENT_HEIGHT" value="1000" />
        <parameter name="AIMS_STREET_CENTERLINE_LAYER" value="street_centerline" />
        <parameter name="SERVICE_AREA_ARCS_SEARCH_RADIUS" value="150" />
        <parameter name="ZONING_SERVICE_LAYERS_MIN" value="7" />
        <parameter name="ZONING_SERVICE_LAYERS_MAX" value="16" />
        <parameter name="ZONING_UPDATE_SQL" value="SELECT MAX(a.SOURCE_UPDATE_DATE) as SOURCE_UP
        <parameter name="ZONING_CODE_URL" value="http://maps.phila.gov/zoning_code/" />
```

File: citymaps_parameters.config, 22497 bytes, 657 lines, PC, ANSI

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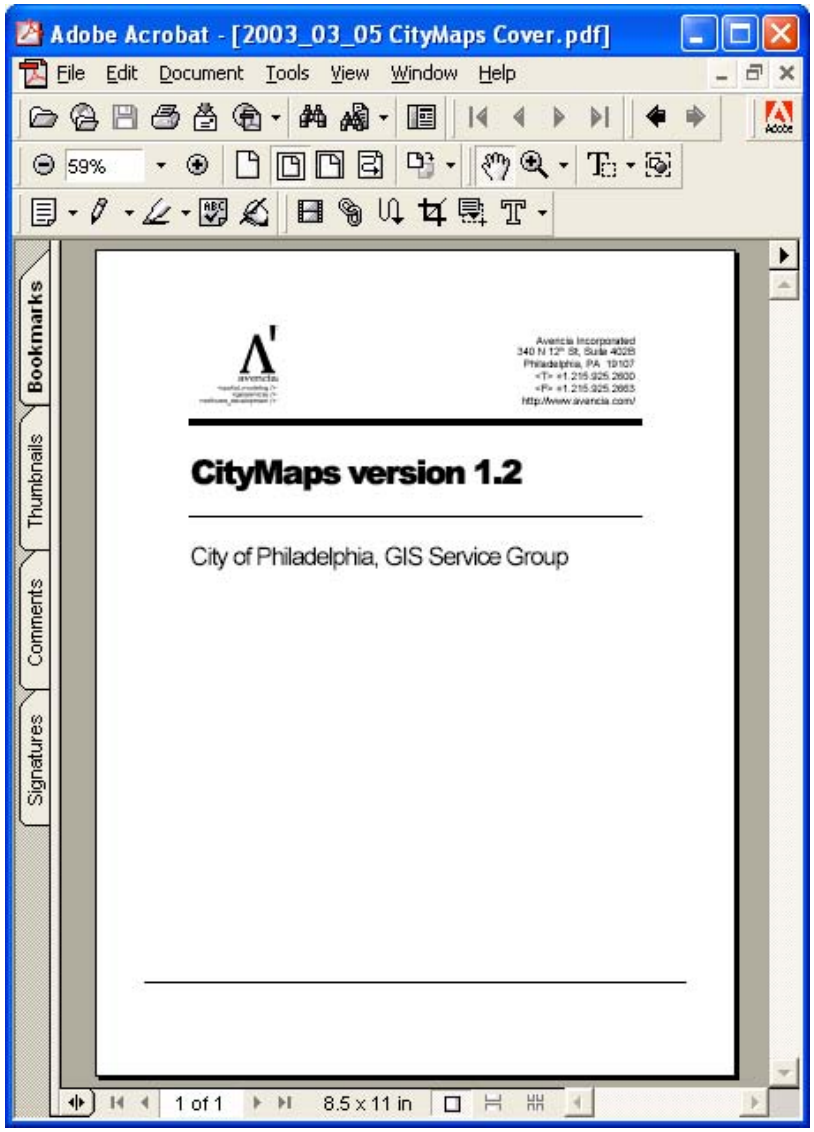
SDK: Documentation



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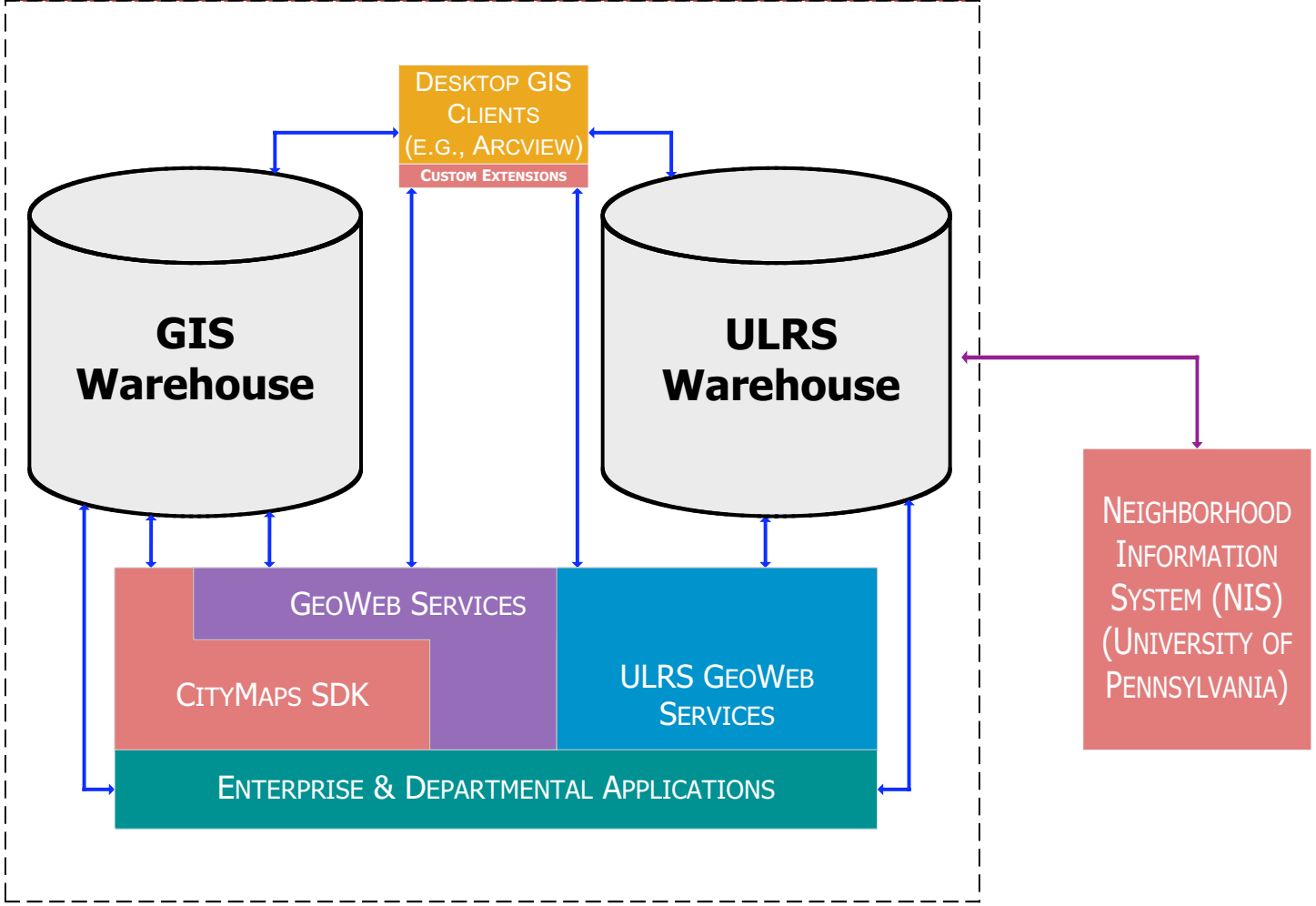
SDK: Web Services

- SOAP-based
- Intranet-use only
- Sample app for batch geocoding
- Authentication
- Address Parsing, Spell-checking, Aliasing
- Geocoding
- Point-in-Polygon
- Nearest Location
- Map/PDF Generation

Distributed GeoSpatial Services



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Service: Authentication

- Created to address potential for unauthorized use
- Developed in anticipation of future availability in the DMZ
- 2 Methods accepted:
  - IP Address
  - User Name/Password
  - Returns a token that can be passed to other services
- Not currently required as app is only for intranet use and don't want performance hit

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Service: Address Geocoding

- Custom SpellChecker
  - Place Name aliases
  - Street Name aliases (w/ ranges)
  - Street Type aliases
- Custom Geocoder
  - Uses MasterAddress and MasterIntersection tables rather than spatial data
  - Very fast
- Falls back to ArcIMS and street centerline for failed addresses
- XML configuration files

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Service: Service Areas

- Service Areas are polygon feature classes stored as shapefiles or in geodatabase
- Point-in-Polygon for most service areas
  - Uses ArcIMS Phila_ServiceAreas map service
- Find Nearest Arc necessary for some service areas
  - Streets Department has feature classes in which both sides of a street are in same service area.
  - Separate polyline feature class for these.
  - Check for proximity to such an arc for these service areas

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Service: Service Areas

- Requests submitted to ArcIMS map service as a query with spatial filter
- Responses returned as XML document string with service area id and label
- XML configuration files

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Service: Nearest Facilities

- Facilities are points stored as ArcSDE layers in City's Enterprise GIS server
- 2 Methods Provided:
  - FindNearestLocation()
  - FindLocationsWithinRadius()
- Requests submitted to ArcIMS map service as a query with spatial filter
- Responses returned as XML document string with locations, labels, x/y coordinates and distance
- XML configuration files

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Service: Map/PDF Generation

- Request for maps are defined using a ReportRequest object (XML)
- 2 Objects Provided:
  - MapImage – returns 1 or more PNG file locations
  - MapReport – returns a PDF file location
- Map Image requests submitted to ArcIMS map service
- MapReport requests generate PDF files using ABCpdf

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Service: Map/PDF Generation

- Responses returned as modified ReportRequest (XML)
- ReportRequest object has many elements to set optional parameters that include an envelope, layer visibility, user name, etc.
- XML configuration files

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Service: Activity Tracking

- Web logs are rarely sufficient
- We want to understand:
  - Which applications are being used?
  - By whom?
  - When did geocoding fail?
  - Specialized info for batch geocoding

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Service: Activity Tracking

CityMaps Activity Statistics - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Address http://citymaps.phila.gov/citymapsadmin/moisAdminSiteStatsByDates.asp?FromDate=6%2F9%2F2003&ToDate=7%2F9%2F2003 Go

Hourly Summary for *7/8/2003*

Yesterday

HOUR	TOTAL	AERIAL PHOTO	DEFINE ADDRESS	HELP	NEAREST FACILITIES	NEAREST FACILITIES MAP	OVERVIEW MAP	SERVICE AREAS	SERVICE AREAS MAP	SITE STATS	SPECIAL FEATURE MAP	STORM DRAINS MAP	ZONING MAP
00	47	32	8	0	0	0	1	2	1	0	1	0	2
02	61	31	20	0	1	0	1	1	1	0	2	0	4
04	5	3	2	0	0	0	0	0	0	0	0	0	0
05	1	0	1	0	0	0	0	0	0	0	0	0	0
06	12	0	10	0	0	0	0	1	0	0	0	0	1
07	9	1	8	0	0	0	0	0	0	0	0	0	0
08	46	17	16	0	0	0	1	1	1	0	4	0	6
09	95	6	59	1	0	0	0	0	0	0	4	0	25
10	210	50	50	1	0	0	1	4	5	0	7	0	92
11	180	26	90	2	0	0	0	0	0	0	11	0	51
12	312	195	55	0	1	0	4	1	0	0	11	0	45
13	245	71	103	0	1	0	2	1	0	0	11	0	56
14	110	2	107	0	0	0	0	0	0	0	0	0	1
15	124	6	117	0	0	0	1	0	0	0	0	0	0
16	157	0	155	2	0	0	0	0	0	0	0	0	0
17	58	0	57	1	0	0	0	0	0	0	0	0	0
18	38	11	22	0	0	0	0	2	0	0	0	0	3
19	13	0	13	0	0	0	0	0	0	0	0	0	0
20	36	0	36	0	0	0	0	0	0	0	0	0	0
21	63	0	63	0	0	0	0	0	0	0	0	0	0
22	28	0	28	0	0	0	0	0	0	0	0	0	0
23	15	0	15	0	0	0	0	0	0	0	0	0	0

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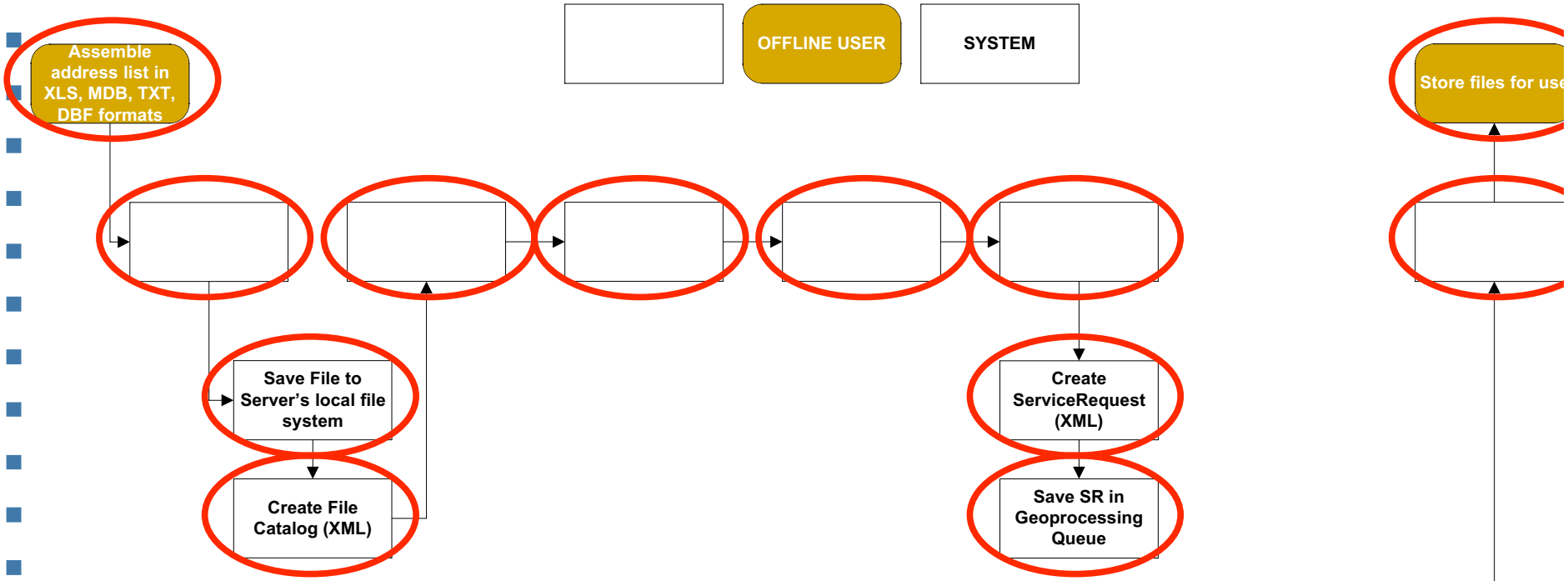
Process

CityMaps GeoServices

version 0.42 - 9 July 2003



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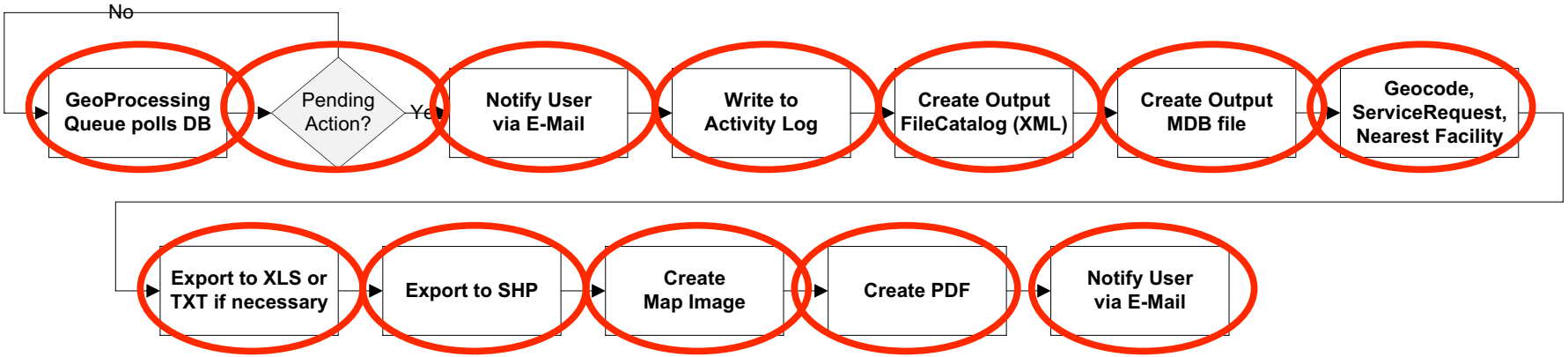
Process



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Batch Geocoding App

Batch Geocoder Options Page 4 - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Search Favorites Media

Address http://localhost/cm_batchgeocoder/cmBatchProperties4.aspx Go

Google Search Web Search Site News PageRank Page Info Up Highlight

phila.gov | citymaps

Request Parameters

Thank-you. Your request has been submitted to the CityMaps Geocoding Engine. You will receive a confirmation e-mail shortly. When the request has been processed, you will receive a second e-mail informing you how to retrieve the results.

The request ID for your geocoding job is ***1045***. Please use this id in any correspondence with the system administrators.

To check the status of your request, you may point your browser to http://localhost/CM_BatchGeocoder/cmBatchPickup.aspx?ID=1045.

EMail Address:	*cheetham@pobox.upenn.edu*
Uploaded Filename:	*cheALDCJYM.mdb*
Address Table:	*Addresses*
Address Field:	*address*
ID Field:	*name*
Output File Type:	*.mdb*
Project Title:	*Batch Geocoding Project*
Create PDF?:	*true*

Philadelphia CityMaps

CityMaps Apps

Aerial Photography
Zoning
Service Areas
Nearest Facilities

GIS Services Group

Home

Other GIS Apps

neighborhoodBase
muralBase
parcelBase
crimeBase

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For comments and suggestions,
please contact the GIS Services Group at citymaps@phila.gov

This application was designed and developed by Avencia Incorporated
and the Mayor's Office of Information Services

Local intranet

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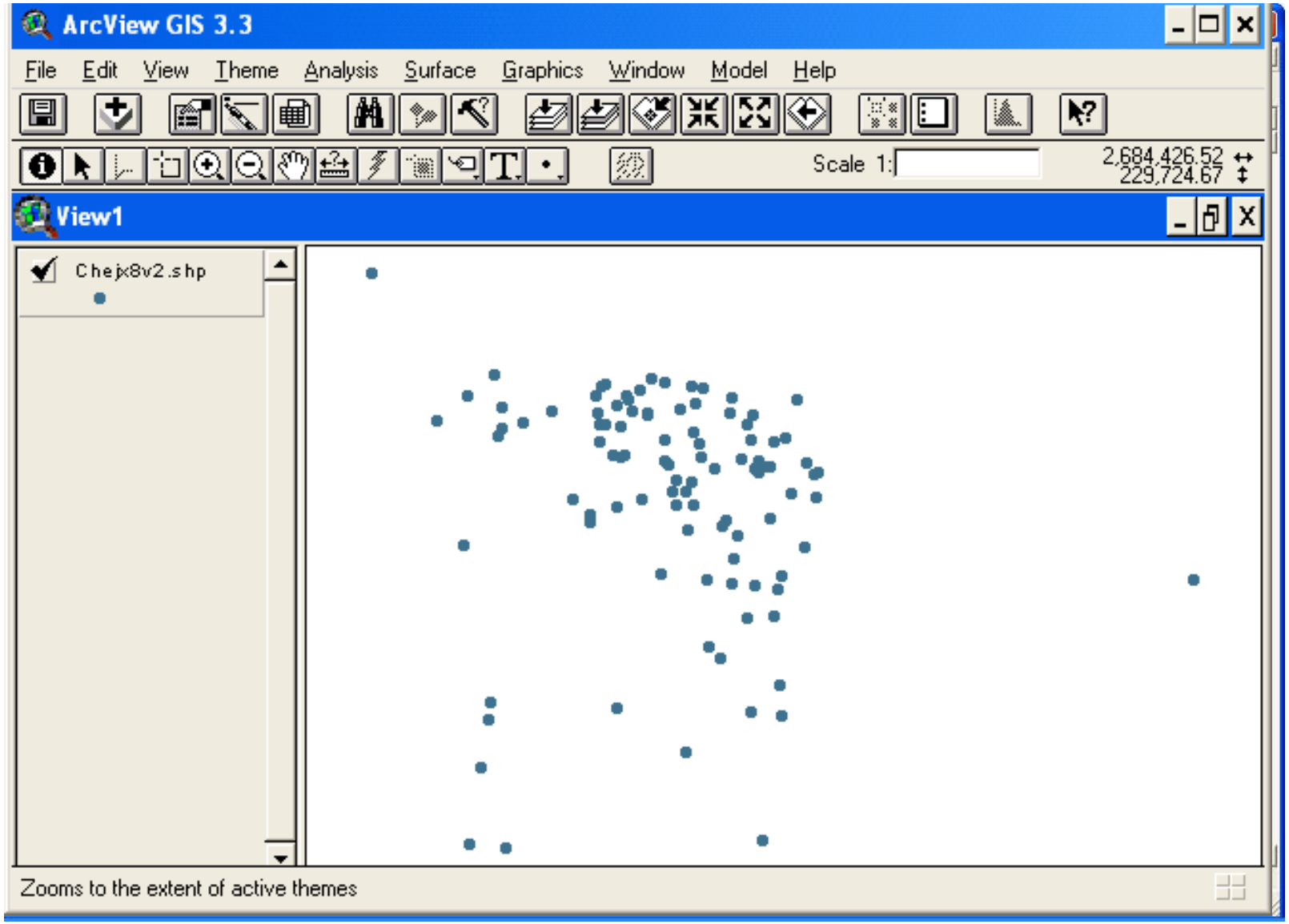
Batch Geocoding App



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Additional Services

- Server Components
  - PageClass
  - Navigation Menu
  - CheckBoxList
- Queue Manager and Queue Service
  - Windows Service
  - Queue Database
- Service Request Manager
  - GeoProcessor class
  - Mailer class
  - ServiceRequest class (XML document)
  - ServiceReponse class (XML document)

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Additional Services

- Address Request Manager
  - FileCatalog class (XML document)
  - ForeignFile class (reads and generates Access, Excel, Text, SHP, etc.)
- Shapefile Generator
  - MapObjects (would prefer ArcGIS Engine) – wrapped in RCW
  - Zip component (for assembling shapefile pieces)
- GML Generator
  - Not currently used b/c want to support DBF/Excel/TXT

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Lessons Learned

- XML is good, long live XML!!
  - XML for Configuration
  - XML for passing messages
  - AXL for ArcIMS work
- SOAP is good over the wire, but don't use it locally or for .Net apps that are nearby on the network
  - Verbose
  - Too Slow
  - Unnecessary
- Web Services are rarely sufficient for a complete application
- Create Components first, add web service as a facade
- We can't wait for ArcGIS Engine and ArcGIS Server
  - ArcIMS is not best solution for FindNearest and PointInPoly services
  - We'd prefer to use ArcObjects for PDF generation, shapefile generation and other functions

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Things we like

- Message Queue Service works really well for asynchronous processing – We were expecting this to be difficult, but .Net Framework made development of Windows service very straightforward.
- Geocoding, Service Requests and Nearest Facilities are really fast – but we think Service Requests and Nearest Facilities could be dramatically faster using ArcGIS Engine or ArcGIS Server rather than ArcIMS.

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Things we don't like

- More testing required - b/c we didn't use web services for sample app, we need to do more testing before rolling out to agencies and will also have to produce some more sample apps.

- Flying blind – we're a little ahead of where most agency developers are, so we are uncertain how much the web services or the batch geocoding will be used. It's tough to spec and purchase equipment in that environment.

- Technology Shortcomings – .Net Framework lacks some features, would benefit from ArcGIS Engine and Server.

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Technologies

Software

ArcIMS

ArcSDE

MapObjects

Web Supergoo ABCpdf

Visual Studio .Net

Hardware

Application Server: Dual Processor
Xeon Server

Database Server: HP Unix server +
Hitachi storage array
enterprise GIS server