

# **Changing World of GIS**

**DOI Executive Workshop  
July 14, 2004**

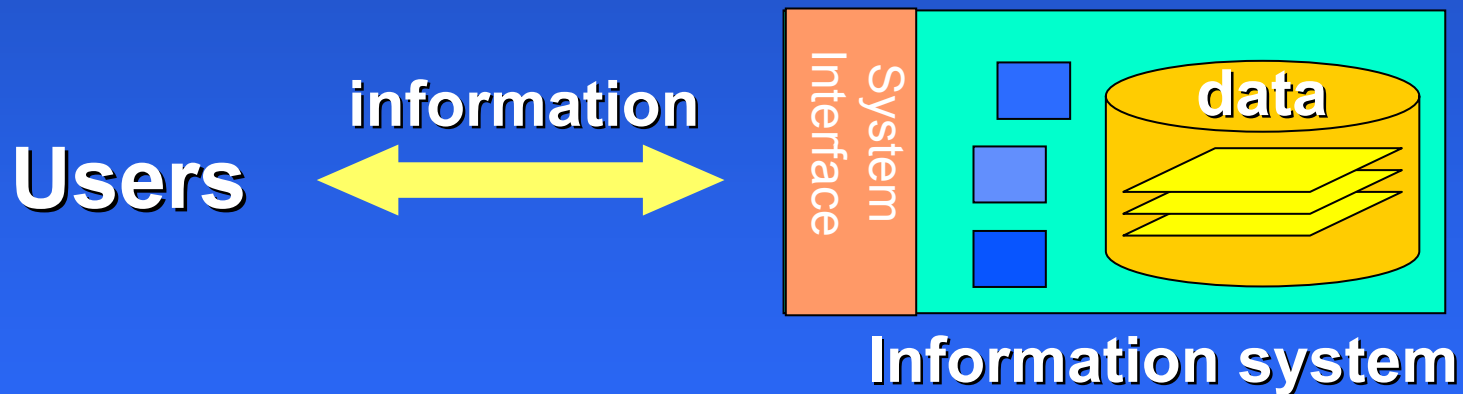
**Clint Brown, ESRI**



# What is an information system?

**Driven by mission and business needs**

- An information system is a tool for providing useful **information** through management and analysis of **data**.



- The design of the system is based on the information we want the system to provide and manage.



# Outline

- Quick Intro to GIS
- GIS is evolving
- GIS and IT
- GIS Interoperability



# **A Quick Intro to GIS**



# Database

## "Not Easy to Interpret"

File Edit Table Field Window Help

51 selected

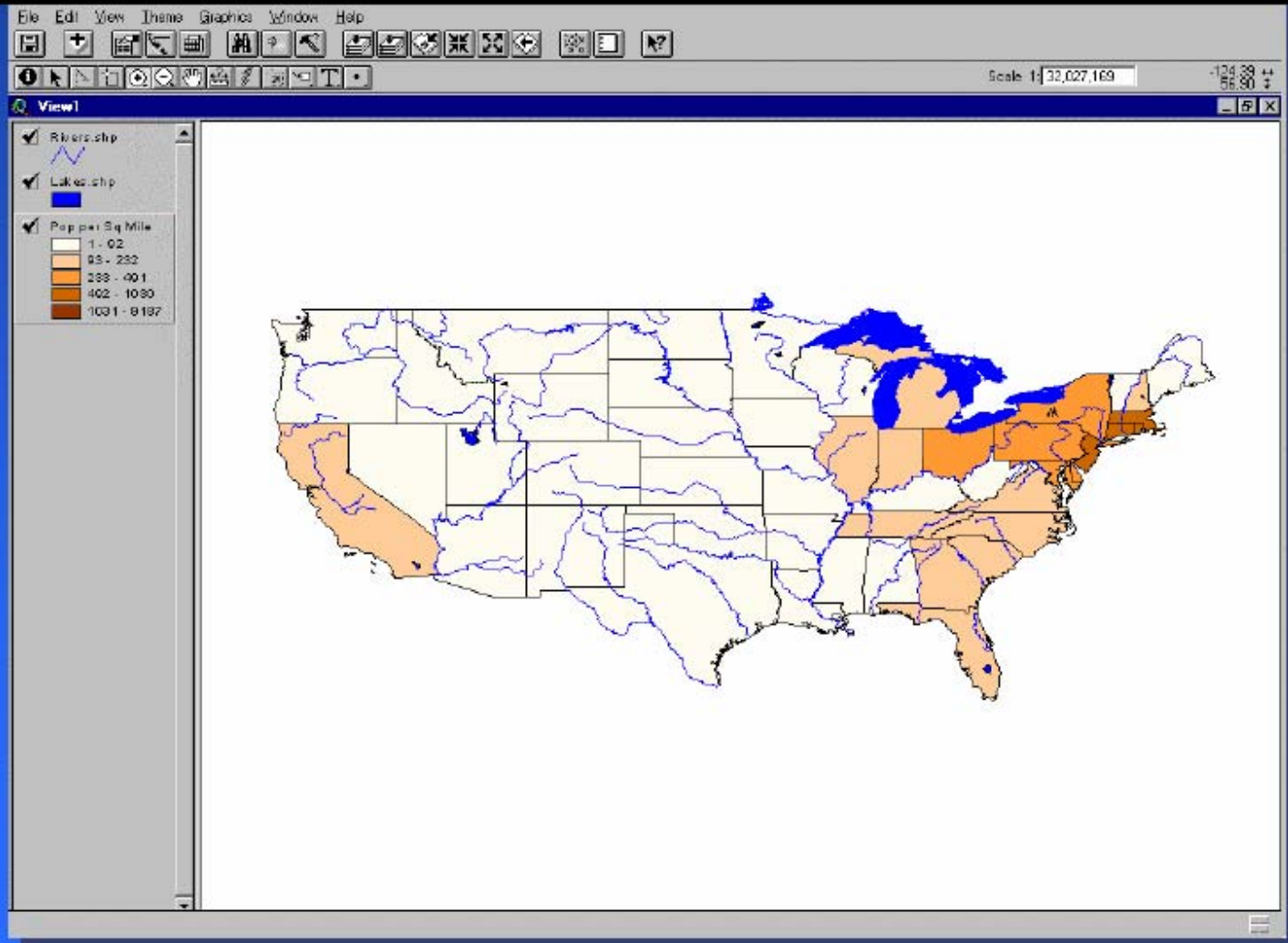
Attributes of States.shp

| Shape   | Area       | State name          | State_fips | Sub_region | State_abbr | Pop1990  | Pop1997  | Pop90_97 | Household | Male     | Female   | White    | Black   | Asian_Or | A... |
|---------|------------|---------------------|------------|------------|------------|----------|----------|----------|-----------|----------|----------|----------|---------|----------|------|
| Polygon | 57265.978  | Washington          | 53         | Pacific    | WA         | 4865952  | 5604250  | 72       | 1972431   | 2413747  | 2452345  | 4308937  | 149001  | 81463    | 2    |
| Polygon | 147236.028 | Montana             | 30         | Mtn        | MT         | 799065   | 888723   | 5        | 306163    | 395763   | 403296   | 741111   | 2381    | 47679    |      |
| Polygon | 32161.664  | Maine               | 23         | N Eng      | ME         | 1227528  | 1244828  | 38       | 465312    | 597050   | 630078   | 1200360  | 5138    | 5596     |      |
| Polygon | 70810.153  | North Dakota        | 38         | W N Cen    | ND         | 538800   | 644792   | 9        | 240876    | 316201   | 320599   | 604142   | 3524    | 25917    |      |
| Polygon | 77193.624  | South Dakota        | 46         | W N Cen    | SD         | 696004   | 736949   | 9        | 259034    | 342498   | 363606   | 637515   | 3258    | 50575    |      |
| Polygon | 97799.492  | Wyoming             | 56         | Mtn        | WY         | 453688   | 484529   | 5        | 168839    | 227007   | 235581   | 427061   | 3606    | 9479     |      |
| Polygon | 56088.066  | Wisconsin           | 55         | E N Cen    | WI         | 4891769  | 5189399  | 87       | 1822118   | 2352935  | 2498834  | 4512523  | 244539  | 39387    |      |
| Polygon | 63340.595  | Idaho               | 16         | Mtn        | ID         | 1008749  | 1210819  | 12       | 380723    | 500866   | 506793   | 950451   | 3370    | 13780    |      |
| Polygon | 9603.218   | Vermont             | 50         | N Eng      | VT         | 562758   | 591659   | 59       | 210650    | 275492   | 287266   | 555088   | 1951    | 1696     |      |
| Polygon | 84617.465  | Minnesota           | 27         | W N Cen    | MN         | 4379389  | 4690847  | 52       | 1647853   | 2146183  | 2229816  | 4130395  | 54944   | 49808    |      |
| Polygon | 97070.748  | Oregon              | 41         | Pacific    | OR         | 2942321  | 3245429  | 29       | 1103313   | 1387073  | 1446248  | 2636787  | 46178   | 38496    |      |
| Polygon | 5259.514   | New Hampshire       | 33         | N Eng      | NH         | 1105252  | 1171443  | 120      | 411186    | 543544   | 565708   | 1087433  | 7198    | 2134     |      |
| Polygon | 56257.220  | Iowa                | 19         | W N Cen    | IA         | 2776755  | 2850263  | 49       | 1054325   | 1344802  | 1431353  | 2680390  | 48090   | 7349     |      |
| Polygon | 8172.482   | Massachusetts       | 25         | N Eng      | MA         | 6016425  | 6106994  | 736      | 2247110   | 2888745  | 3127580  | 5405374  | 300130  | 12441    | 1    |
| Polygon | 77320.337  | Nebraska            | 31         | W N Cen    | NE         | 1578305  | 1660613  | 20       | 602363    | 769439   | 809046   | 1400596  | 57404   | 12410    |      |
| Polygon | 48560.579  | New York            | 36         | Mid Atl    | NY         | 17990485 | 18177296 | 370      | 6539322   | 8625673  | 9364782  | 13385255 | 2859055 | 62651    | 6    |
| Polygon | 45359.239  | Pennsylvania        | 42         | Mid Atl    | PA         | 11881643 | 12051902 | 252      | 4495966   | 5594265  | 6197378  | 10520201 | 1089795 | 14733    | 1    |
| Polygon | 4976.434   | Connecticut         | 09         | N Eng      | CT         | 3287116  | 3277113  | 661      | 1230479   | 1552873  | 1634243  | 2859353  | 274269  | 6654     |      |
| Polygon | 1044.850   | Rhode Island        | 44         | N Eng      | RI         | 1003464  | 988970   | 960      | 377977    | 461495   | 521368   | 917375   | 36661   | 4071     |      |
| Polygon | 7507.302   | New Jersey          | 34         | Mid Atl    | NJ         | 7730188  | 8018326  | 1030     | 2794711   | 3735695  | 3994503  | 6130465  | 1036825 | 14970    | 2    |
| Polygon | 36359.515  | Indiana             | 18         | E N Cen    | IN         | 5544159  | 5874844  | 152      | 2065355   | 2686291  | 2856878  | 5020700  | 432092  | 12720    |      |
| Polygon | 11067.293  | Nevada              | 32         | Mtn        | NV         | 1201833  | 1652993  | 11       | 466297    | 611880   | 599953   | 1012695  | 76771   | 19637    |      |
| Polygon | 84870.185  | Utah                | 49         | Mtn        | UT         | 1722850  | 2034167  | 20       | 537273    | 895759   | 867091   | 1615845  | 11576   | 24289    |      |
| Polygon | 157774.187 | California          | 06         | Pacific    | CA         | 29760021 | 32197302 | 189      | 10381206  | 14897627 | 14862394 | 20624327 | 2208801 | 242164   | 28   |
| Polygon | 41182.862  | Ohio                | 39         | E N Cen    | OH         | 10847115 | 11200891 | 263      | 4087546   | 5226340  | 5620775  | 9521756  | 1154828 | 20358    |      |
| Polygon | 56297.964  | Illinois            | 17         | E N Cen    | IL         | 11430602 | 11890919 | 203      | 4202240   | 5562233  | 5878369  | 8952978  | 1694273 | 21836    | 2    |
| Polygon | 66.063     | Distric of Columbia | 11         | S Atl      | DC         | 608900   | 536027   | 9187     | 248634    | 282970   | 323830   | 179667   | 389604  | 1466     |      |
| Polygon | 2054.506   | Delaware            | 10         | S Atl      | DE         | 666168   | 731218   | 324      | 247497    | 322968   | 343200   | 536094   | 112460  | 2018     |      |
| Polygon | 24228.213  | West Virginia       | 54         | S Atl      | WV         | 1793477  | 1828802  | 74       | 688557    | 861536   | 931941   | 1725523  | 56295   | 2458     |      |
| Polygon | 9739.753   | Maryland            | 24         | S Atl      | MD         | 4781468  | 5100039  | 491      | 1748991   | 2318671  | 2462797  | 3393964  | 1189699 | 12972    | 1    |
| Polygon | 10409.108  | Colorado            | 08         | Mtn        | CO         | 3294364  | 3899515  | 32       | 1282489   | 1631295  | 1653099  | 2905474  | 130146  | 27776    |      |
| Polygon | 40318.777  | Kentucky            | 21         | E S Cen    | KY         | 3688536  | 3906565  | 91       | 1379762   | 1785235  | 1900061  | 3391832  | 262907  | 5769     |      |
| Polygon | 82195.436  | Kansas              | 20         | W N Cen    | KS         | 2477574  | 2582903  | 30       | 944726    | 1214645  | 1252929  | 2231986  | 143076  | 21965    |      |
| Polygon | 39819.194  | Virginia            | 51         | S Atl      | VA         | 6187358  | 6728895  | 155      | 2291830   | 3033974  | 3153384  | 4791735  | 1162594 | 15262    | 1    |
| Polygon | 59631.624  | Missouri            | 29         | W N Cen    | MO         | 5117073  | 5387753  | 73       | 1961206   | 2464315  | 2652758  | 4486228  | 546208  | 19635    |      |
| Polygon | 113711.522 | Arizona             | 04         | Mtn        | AZ         | 3665228  | 4528666  | 32       | 1368843   | 1810691  | 1854537  | 2963186  | 110524  | 203527   |      |
| Polygon | 70002.392  | Oklahoma            | 40         | W S Cen    | OK         | 3145585  | 3318622  | 45       | 1206135   | 1530819  | 1614766  | 2503512  | 236801  | 252420   |      |
| Polygon | 49046.813  | North Carolina      | 37         | S Atl      | NC         | 6628637  | 7411239  | 135      | 2517026   | 3214290  | 3414347  | 5008491  | 1456323 | 80195    |      |



# Visualization

## "Worth a Thousand Words"



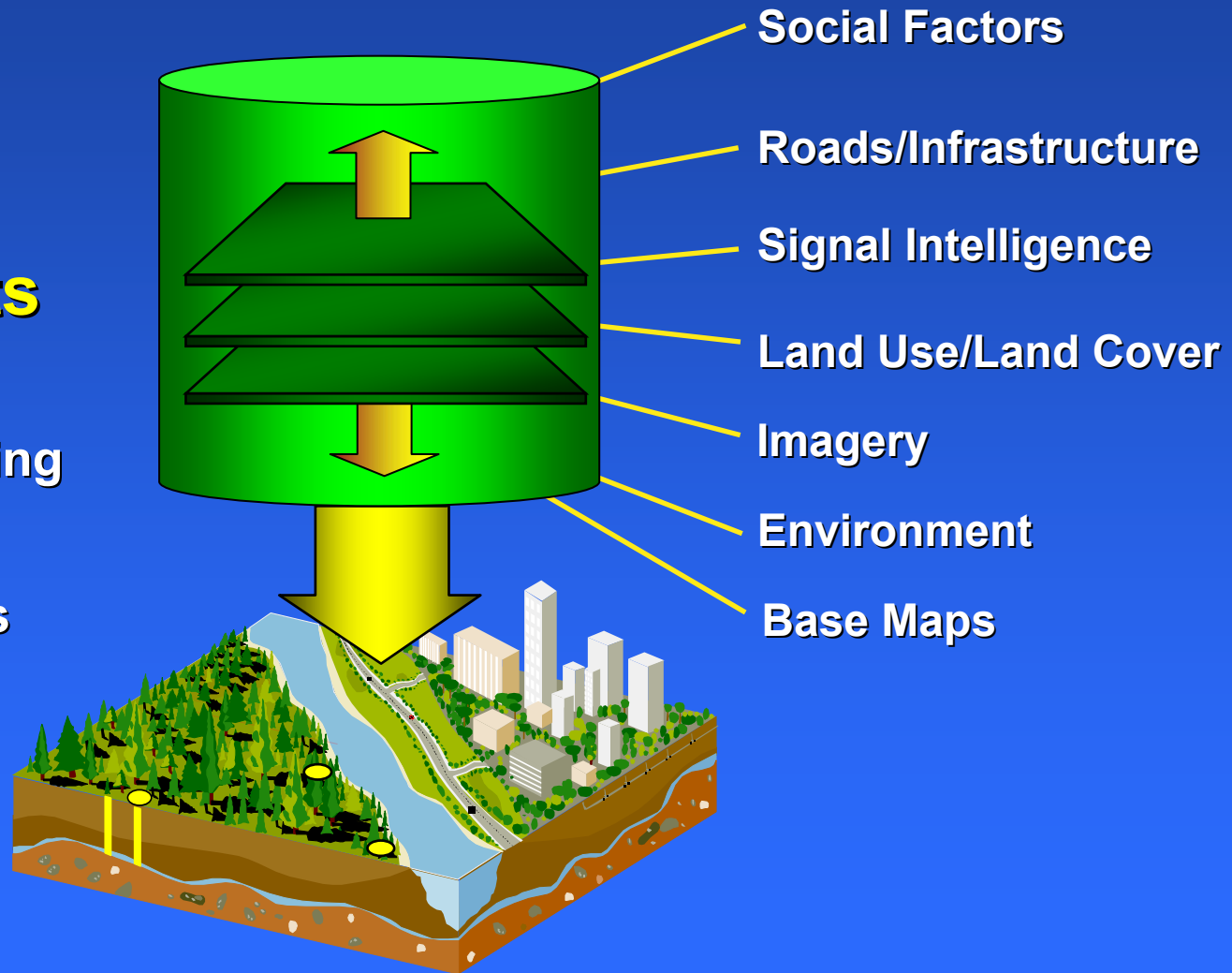


# GIS Integrates All Types of Data

Geography is a “Key”

## Key Concepts

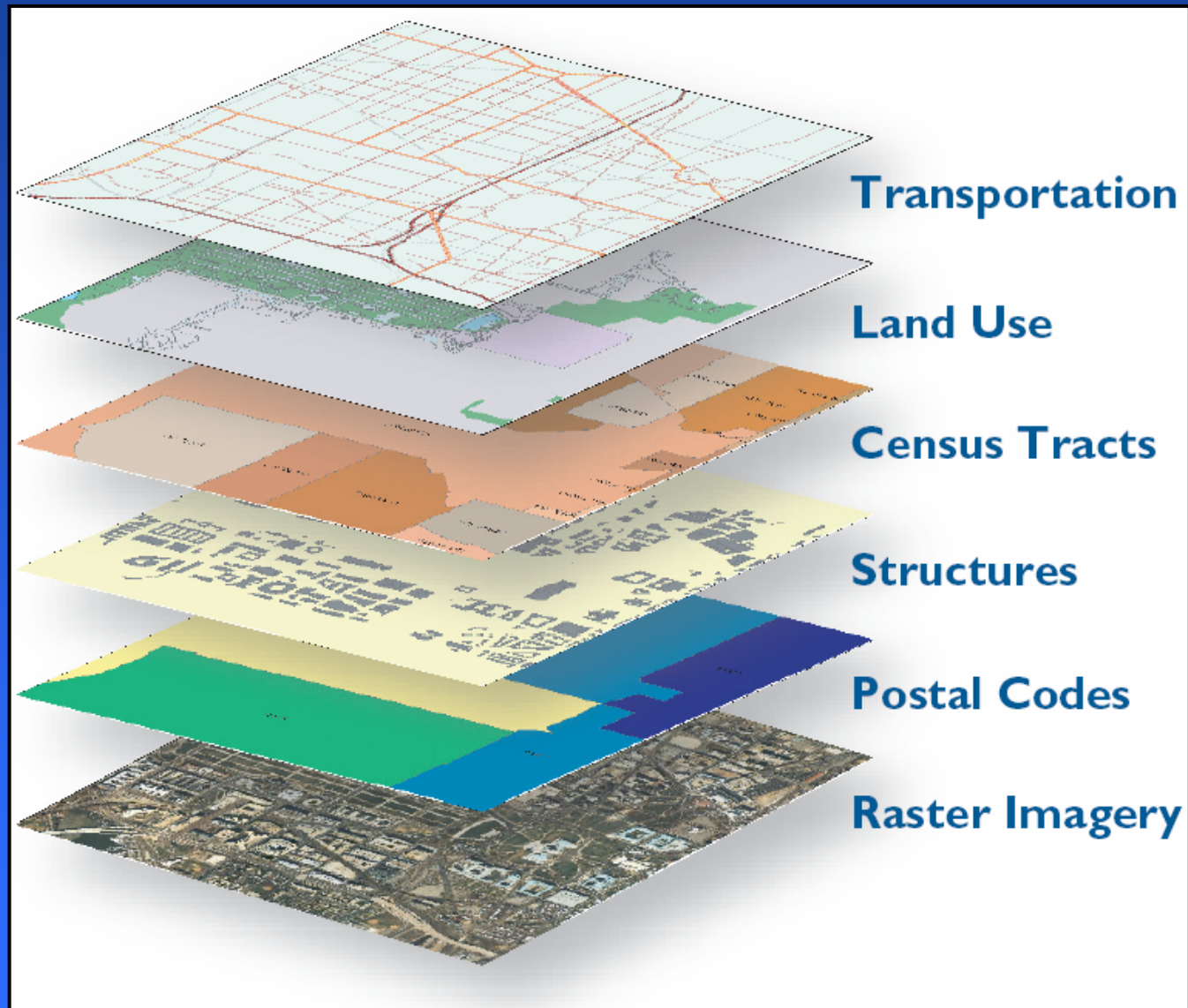
- Georeferencing
- Digital Processing
- Map Overlay
- Spatial Analysis
- Visualization



... Integrating Disciplines, Organizations and Activities



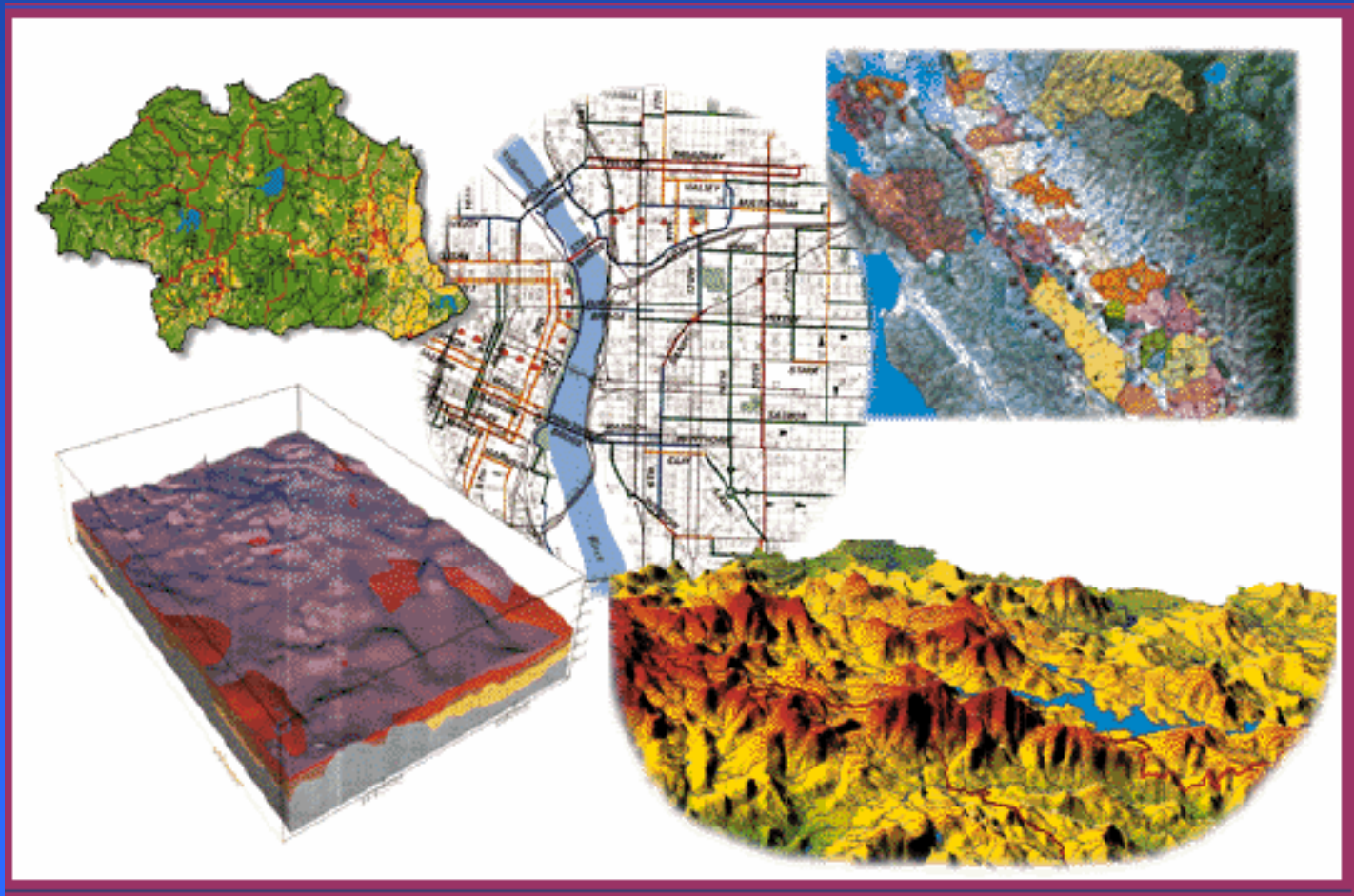
# GIS is Layer-Centric



*...Layers referenced by location*



# Combine Data from Many Sources





# GIS Applications

- Population
- Bio-Diversity
- Global Warming
- **Facilities**
- Urbanization
- Pollution
- Congestion
- Conservation
- **Land Use**
- Oceans
- Business Efficiency
- Water
- **Economic Development**
- Crime
- Health
- **Education**
- **Logistics**
- Energy
- Defense/Security
- **Environment**
- **eGovernment**
- Globalization
- Agriculture/Forestry
- **Public Safety**
- **Transportation**

**...Are Serving Our World**



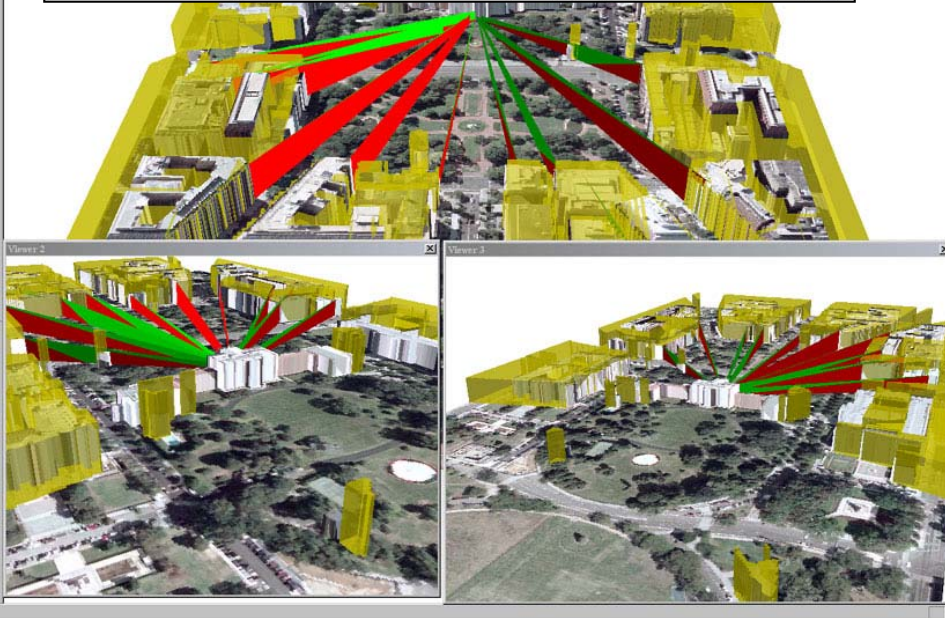
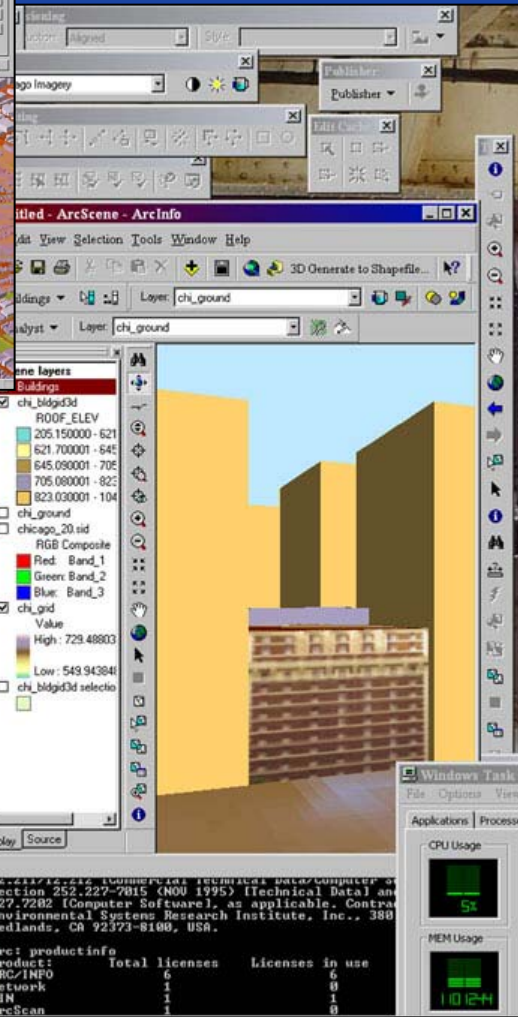
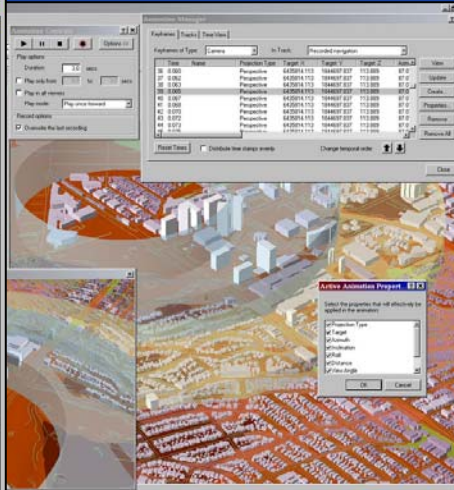
The screenshot displays the ArcGIS Desktop environment. The 'Spatial Adjustment' toolbar is at the top left. The 'Layer List' on the left shows the 'Buildings' layer selected. The 'Selected Attributes of Buildings' table is open, showing a list of building footprints. The table has columns: FID, Shape, BLDGNAME, BLDGNUM, STPRE, and SNAME. The 'Buildings' layer is highlighted in red in the Layer List. The map view shows a street map of Los Angeles with building footprints highlighted in red. The 'Spatial Adjustment' toolbar is visible at the top left.

| FID  | Shape   | BLDNAME                   | BLDNUM | STPRE        | SNAME |
|------|---------|---------------------------|--------|--------------|-------|
| 7693 | Polygon | WALT PLAZA NORTH TOWER    | 1875   | CENTURY      |       |
| 654  | Polygon | NORTHROP GRUMMAN PLAZA II | 1901   | CENTURY      |       |
| 6761 | Polygon | NORTHROP GRUMMAN PLAZA II | 1940   | CENTURY      |       |
| 3803 | Polygon | FRANKS CLUB               | 9000   | SANTA MONICA |       |
| 6600 | Polygon | CENTURY PARK PLAZA        | 1867   | CENTURY      |       |
| 2263 | Polygon | BEVERLY HILTON HOTEL      | 3072   | WILSHIRE     |       |
| 6381 | Polygon | 0.25-0.50                 | 241    | MORENO       |       |
| 4200 | Polygon | BEVERLY HILLS HIGH SCHOOL | 9103   | SANTA MONICA |       |
| 3616 | Polygon | BEVERLY HILLS CXC         | 9915   | SANTA MONICA |       |
| 1096 | Polygon | 1096                      | 9000   |              |       |

Record 1 of 4 | 0 of 4 | Show All Selected | Records (77 out of 27279 Selected) | Options -

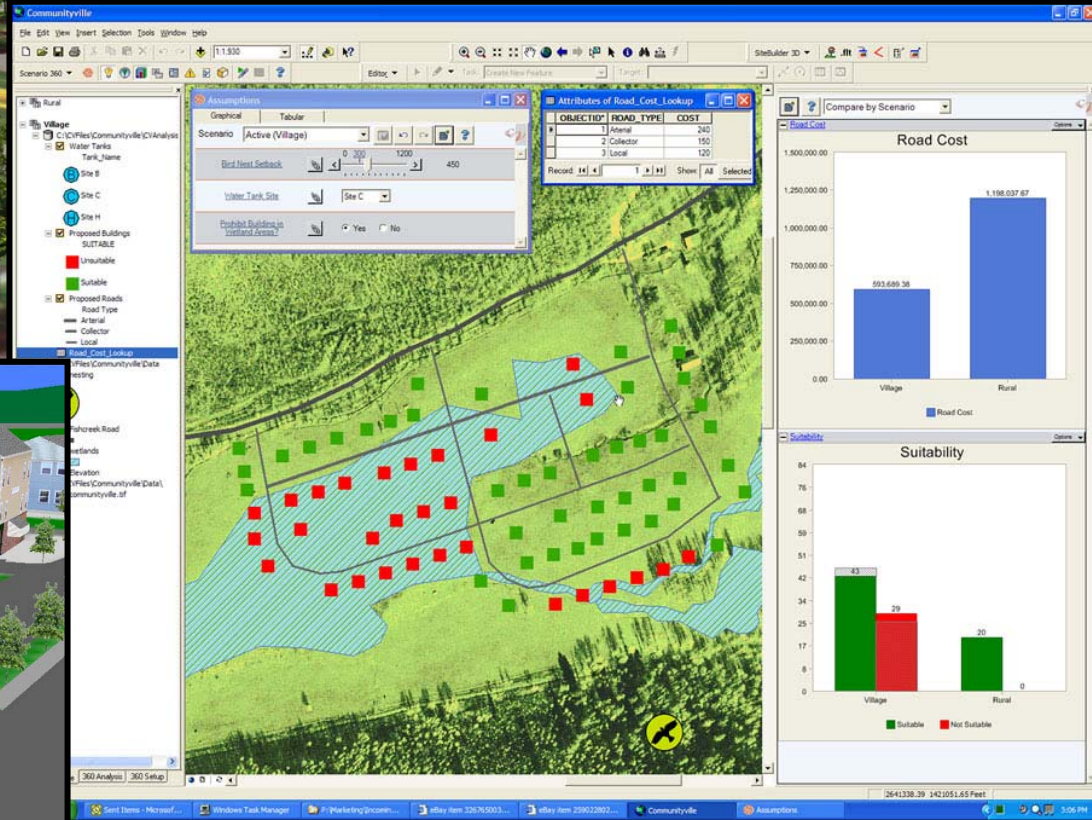
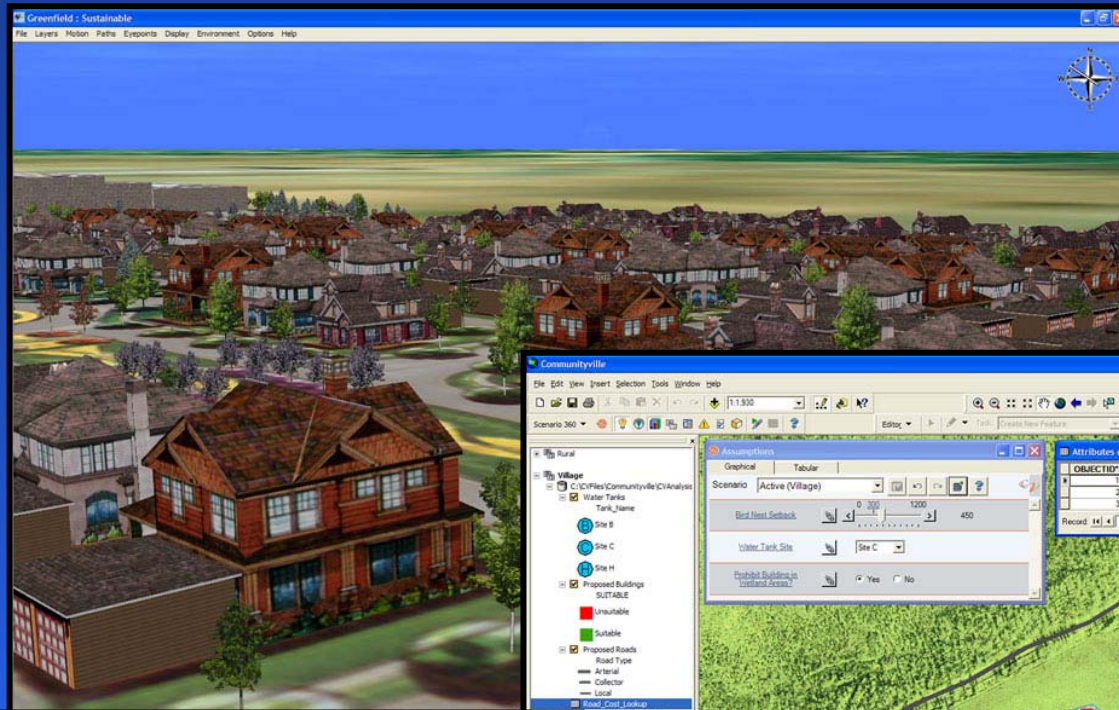
Choose which layers can have their features selected interactively with the Select Features tool. The Select By Graphics command, the Edit tool, etc.

Select All  
Clear All  
Close





# Community Planning

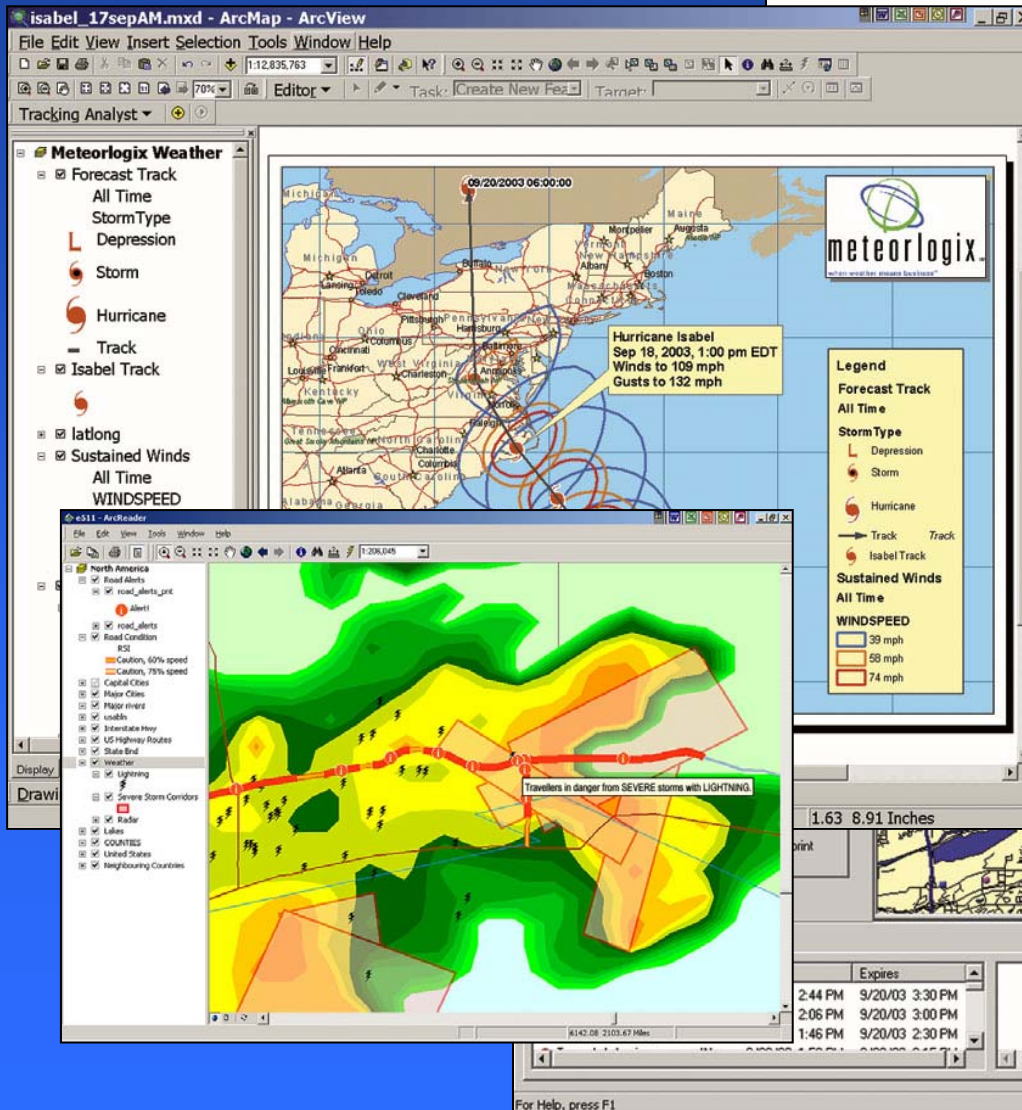




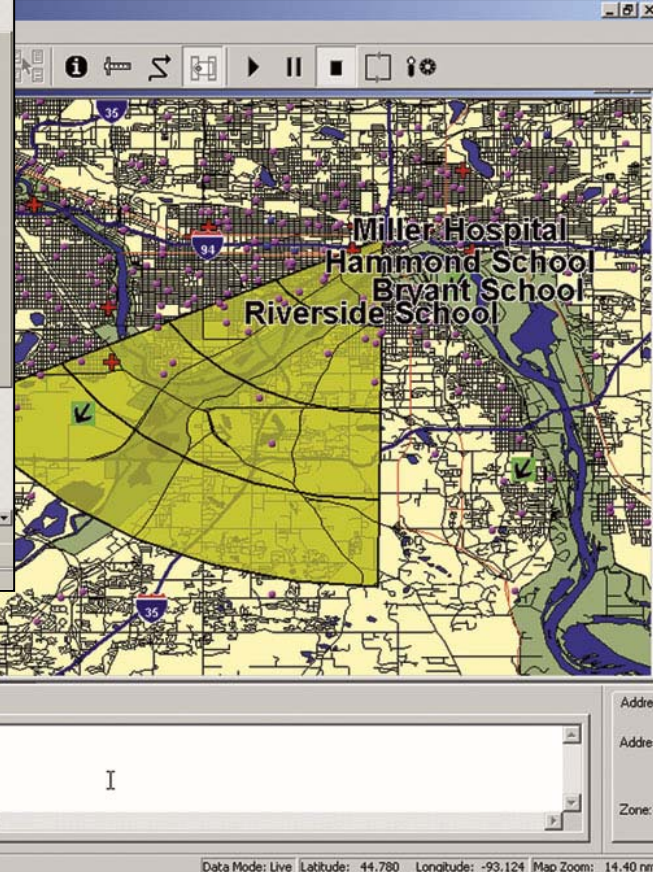
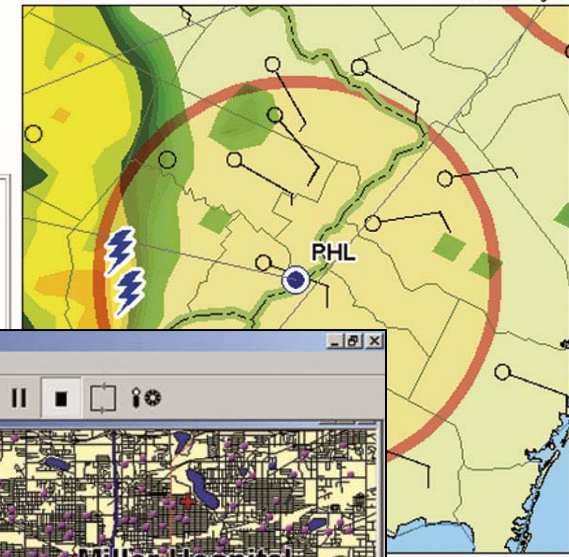
# Real Time Weather Integration

MxInsight  
AviationWatch

meteorlogix



International (PHL):  
0:00 GMT  
es 25 nmi W of  
dBZ) is falling 26





# BEAUFORT

## SOUTH CAROLINA

[Home](#)
[Registration](#)

### Property Map

[Home](#)

Registration:

[Login](#)

[Register](#)

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Search:

[Permit](#)

[Inspection](#)

[Codes Enforcement Complaints](#)

[Parcel By Address](#)

[Parcel By Owner](#)

[Map](#)

Submit

Application For:

[Building Permit](#)

[Development Permit](#)

[Mobile Home Placement and Moving Permit](#)

[Sign Permit](#)

[Zoning Permit](#)

[Schedule Inspection](#)

[Codes Enforcement Complaints](#)

Building

Development

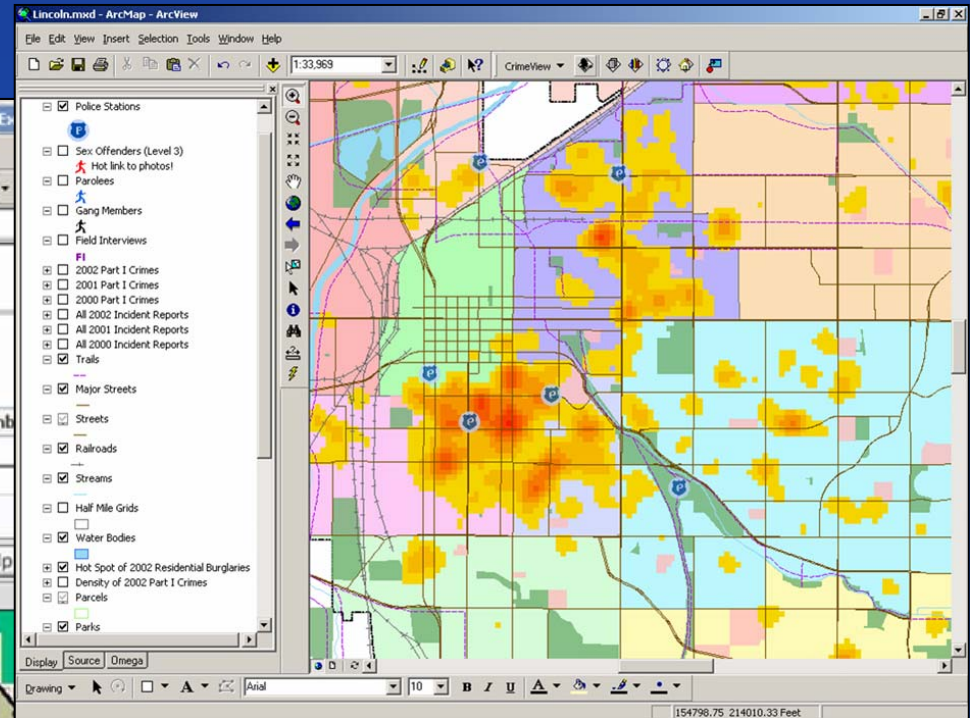
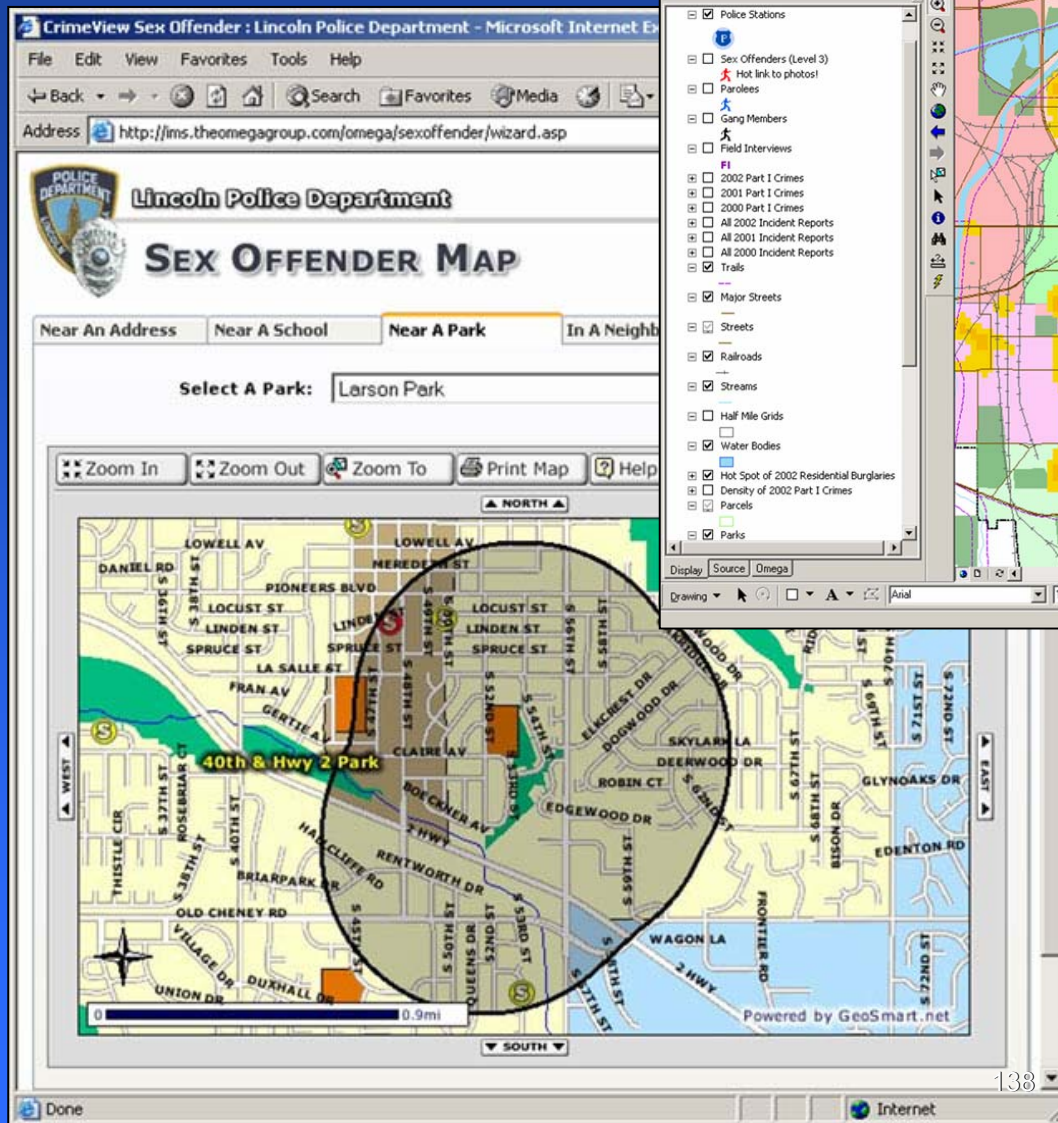
Sign

Zoning

Copyright 2003 B



# Crime Analysis



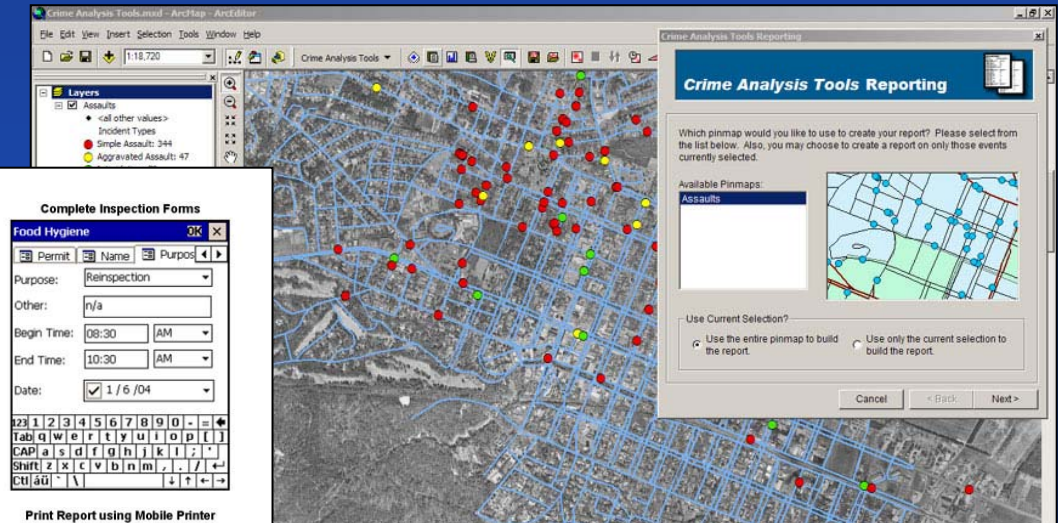
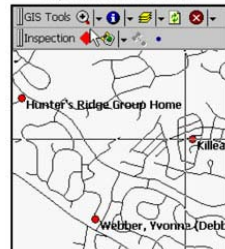


# Health And Public Safety Systems

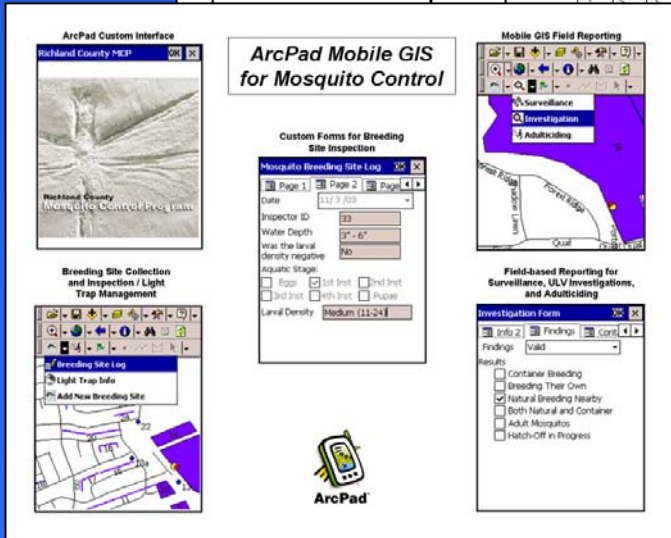


## ArcPad Mobile GIS for Health Inspection

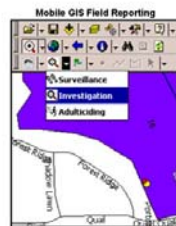
Select Health Facility using Map Click or GPS Location



Print Report using Mobile Printer



## ArcPad Mobile GIS for Mosquito Control

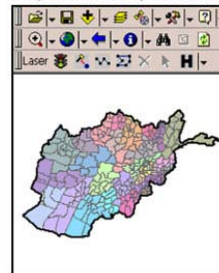


Field-based Reporting for Surveillance, ULV Investigations, and Adultciding

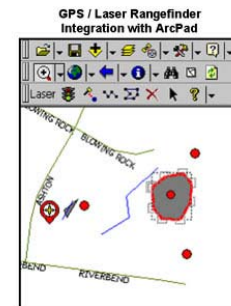


## ArcPad Mobile GIS for Civil Affairs

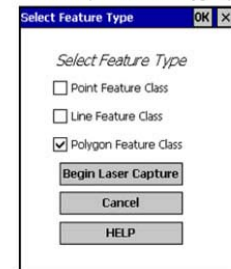
US Army CA Teams Deployed in Afghanistan and Iraq with ArcPad



Tools for Equipment Assignment, Project Management, and POCs



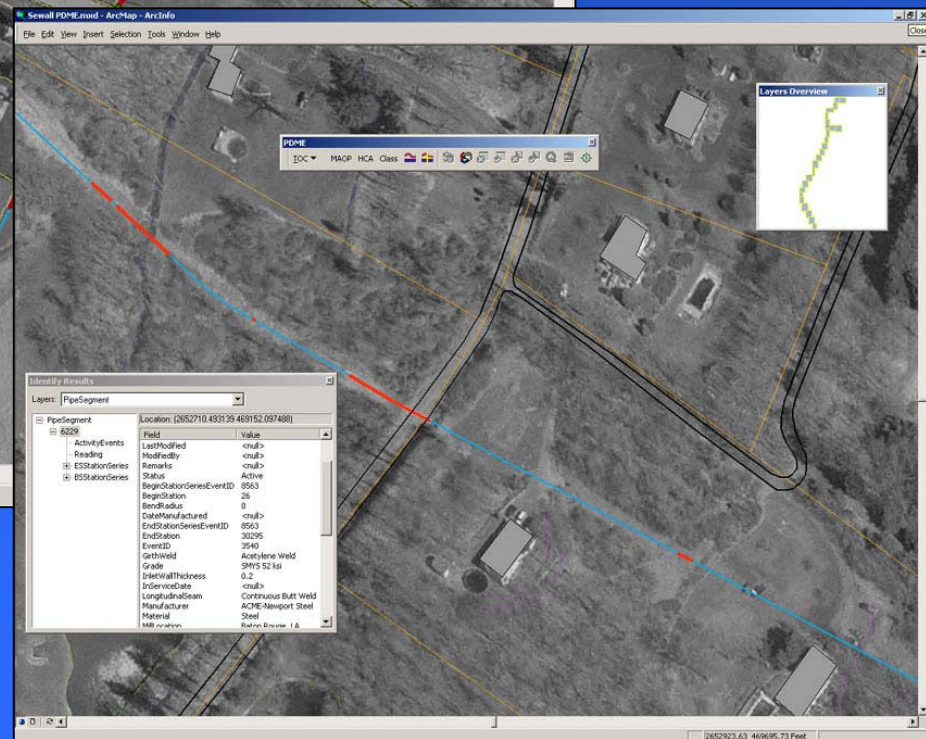
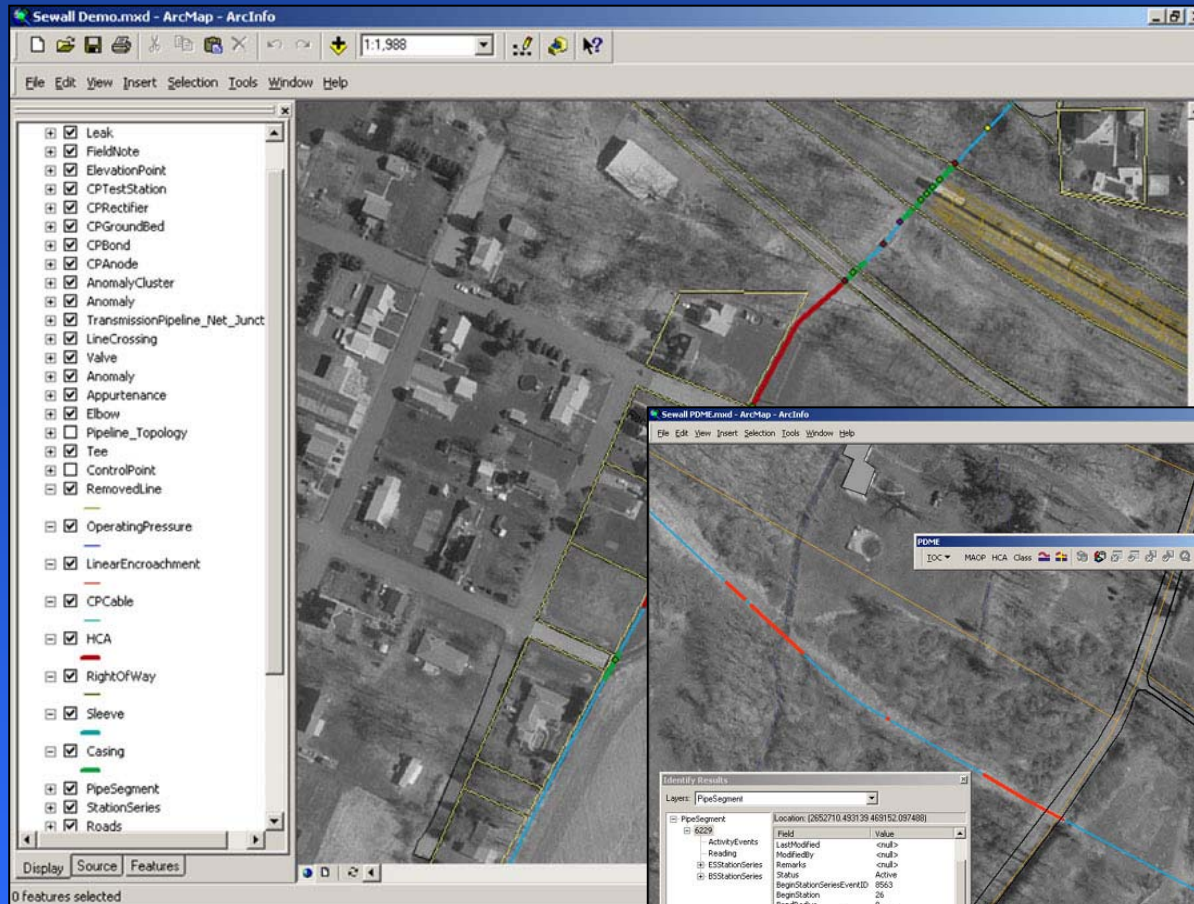
Laser Rangefinder interface for Capturing Offset Data in Remote Locations (Points, Lines, Polygons)



| Day of Week | Case Disposition |
|-------------|------------------|
| Tuesday     | OPEN OR ACTIVE   |
| Saturday    | OPEN OR ACTIVE   |
| Thursday    | OPEN OR ACTIVE   |
| Saturday    | OPEN OR ACTIVE   |
| Tuesday     | OPEN OR ACTIVE   |
| Wednesday   | OPEN OR ACTIVE   |
| Thursday    | OPEN OR ACTIVE   |
| Sunday      | OPEN OR ACTIVE   |
| Wednesday   | OPEN OR ACTIVE   |
| Saturday    | OPEN OR ACTIVE   |

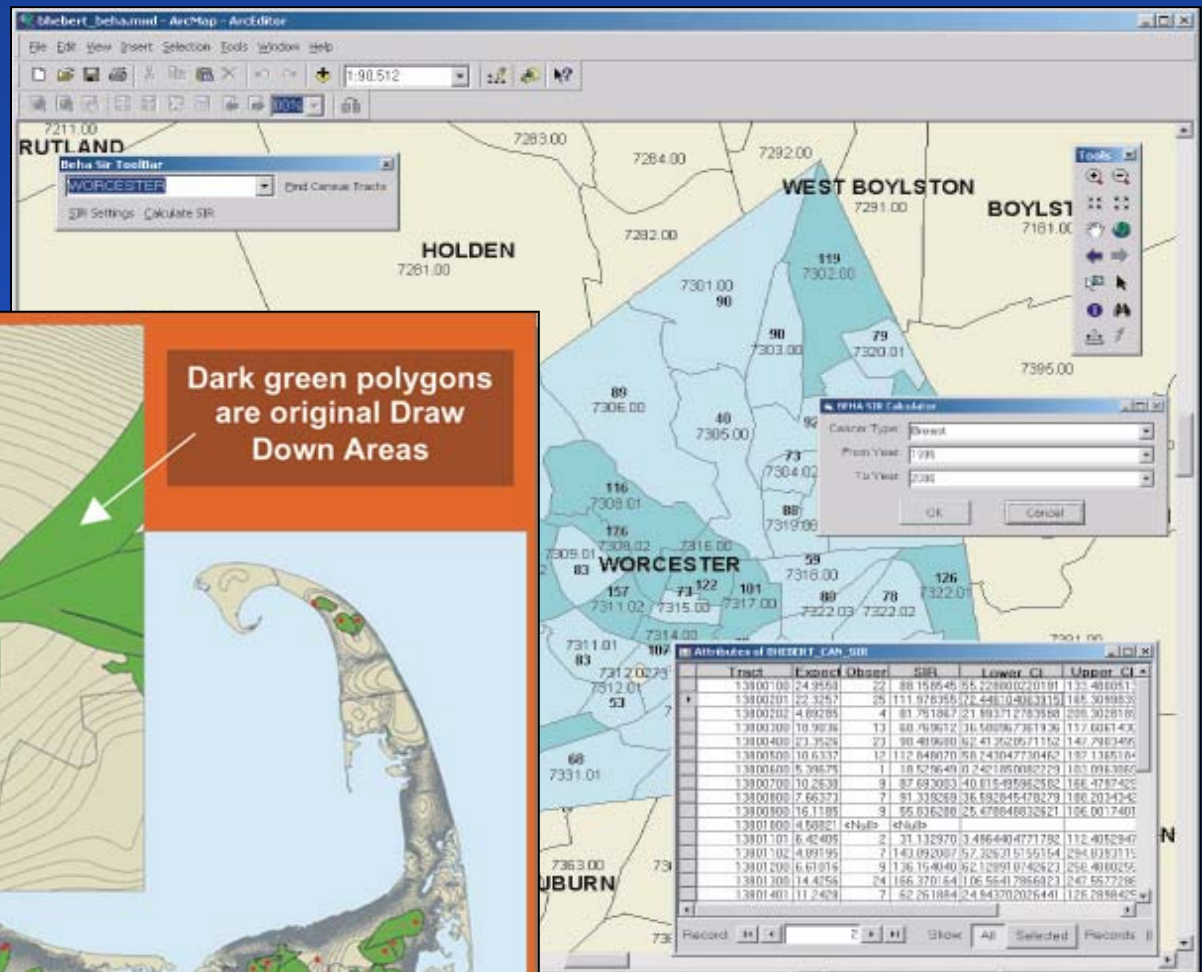


# Pipeline Analysis





# Cancer Probability & Research Application

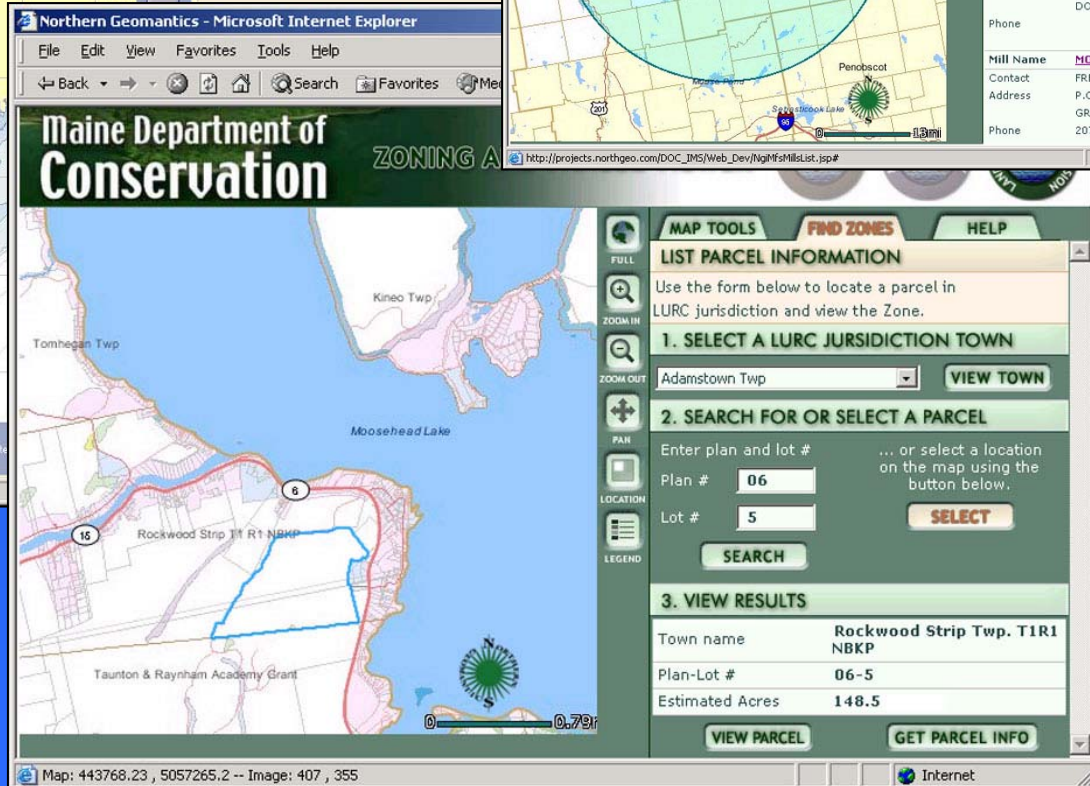
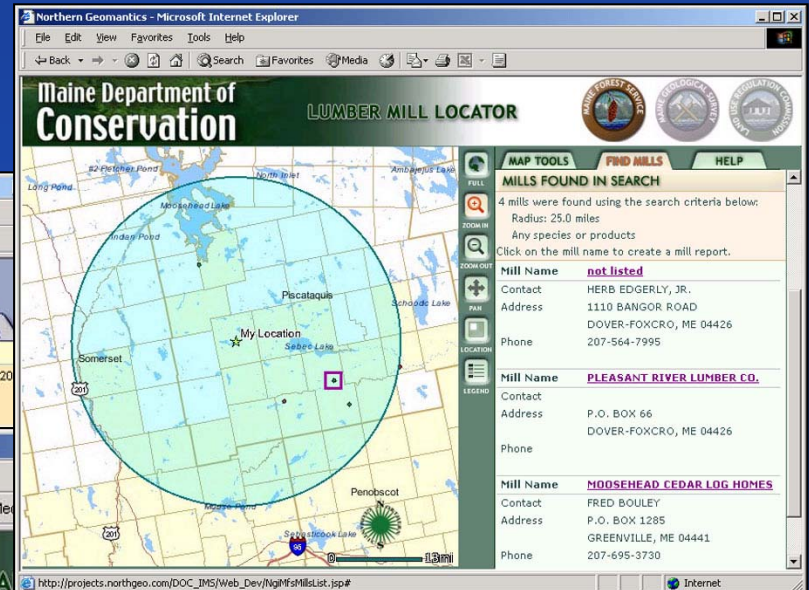
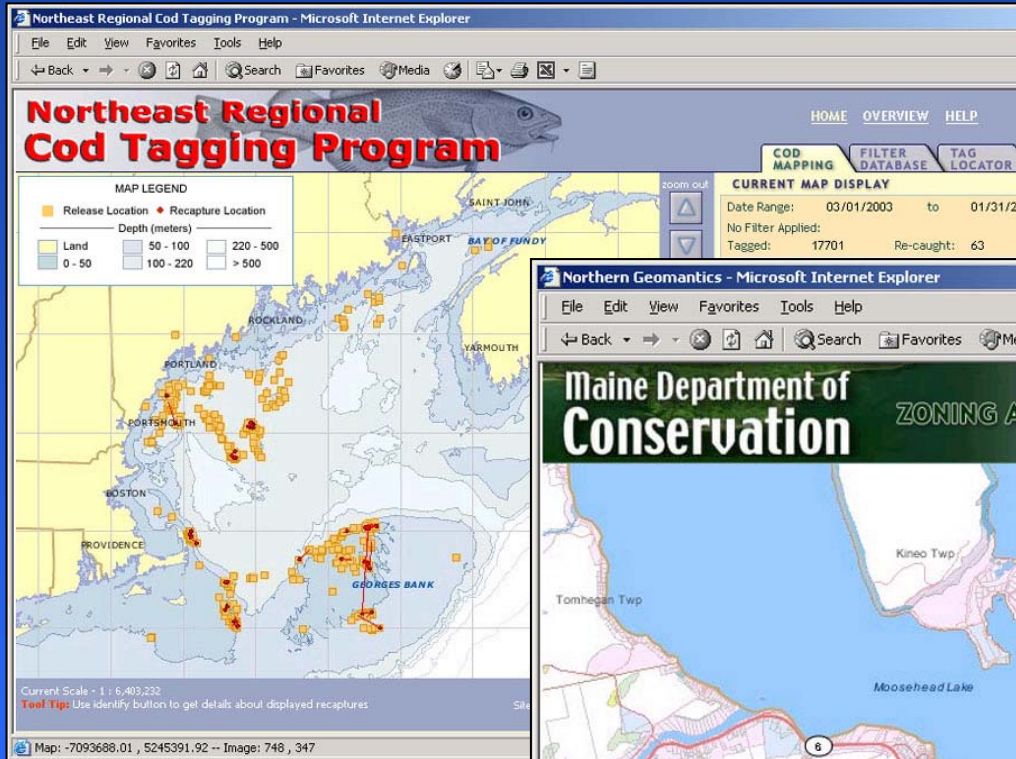


Dark green polygons  
are original Draw  
Down Areas

Light green  
polygons are  
recalculated  
Draw Down Areas

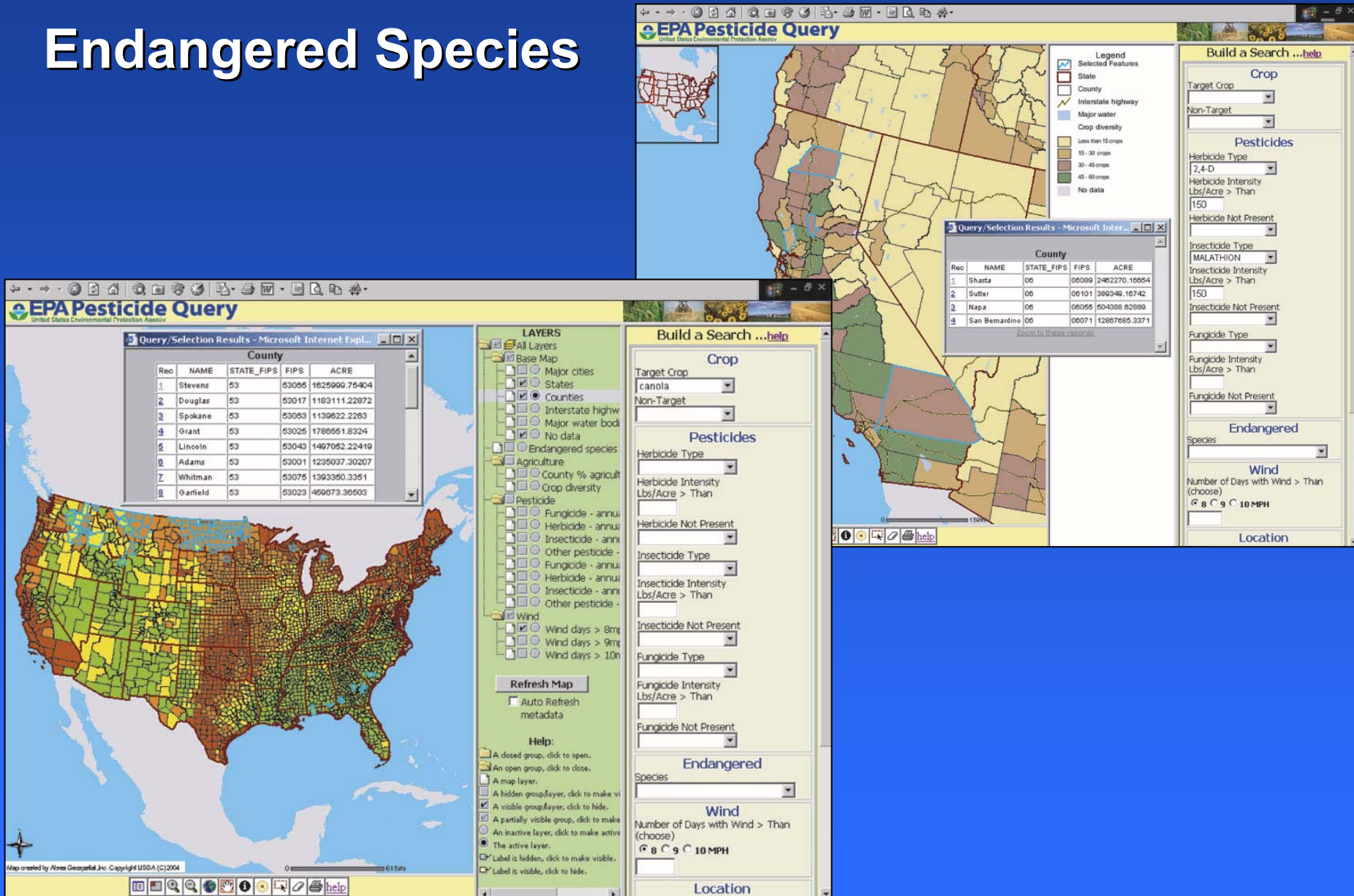


# Conservation Management



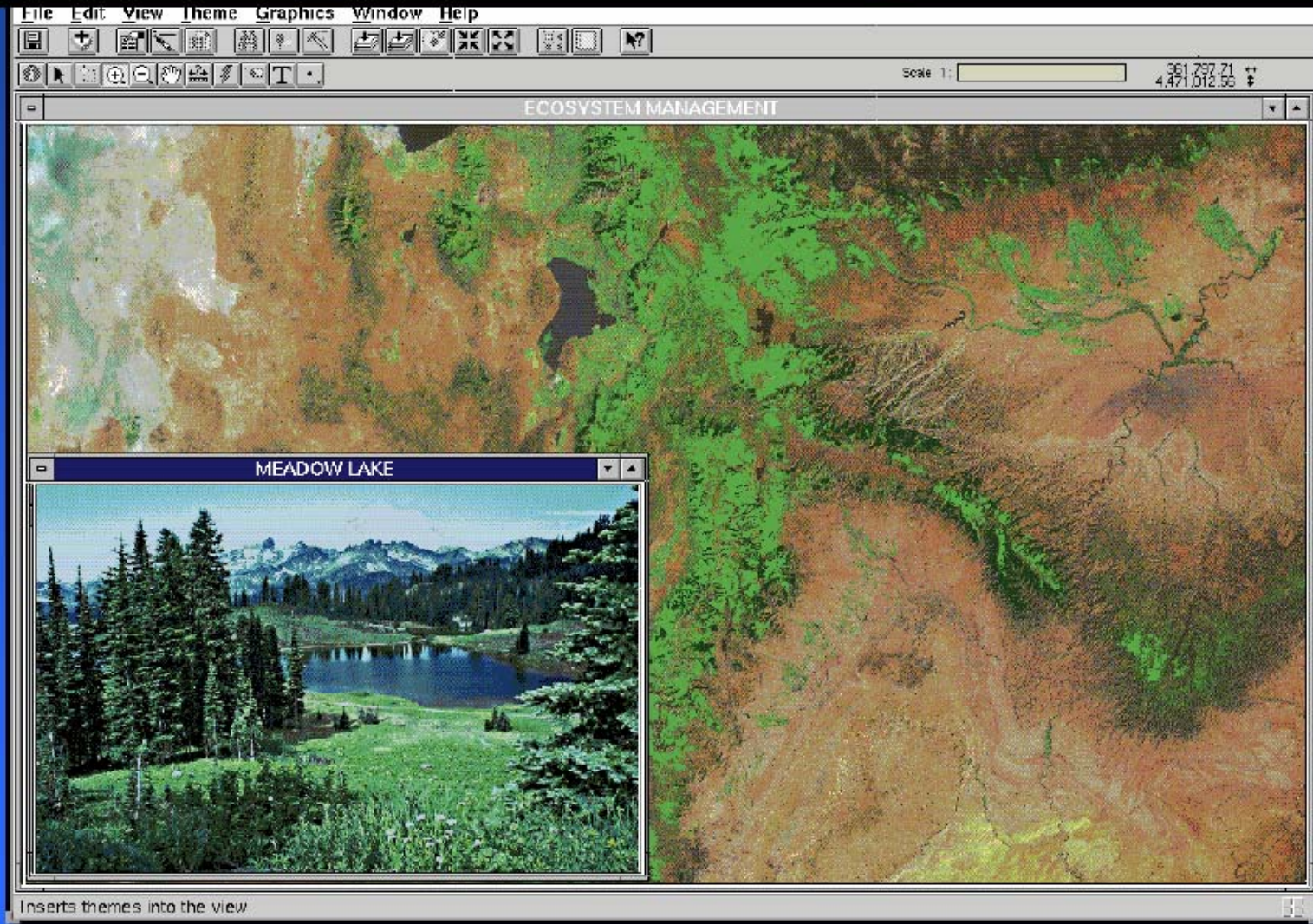


# Endangered Species



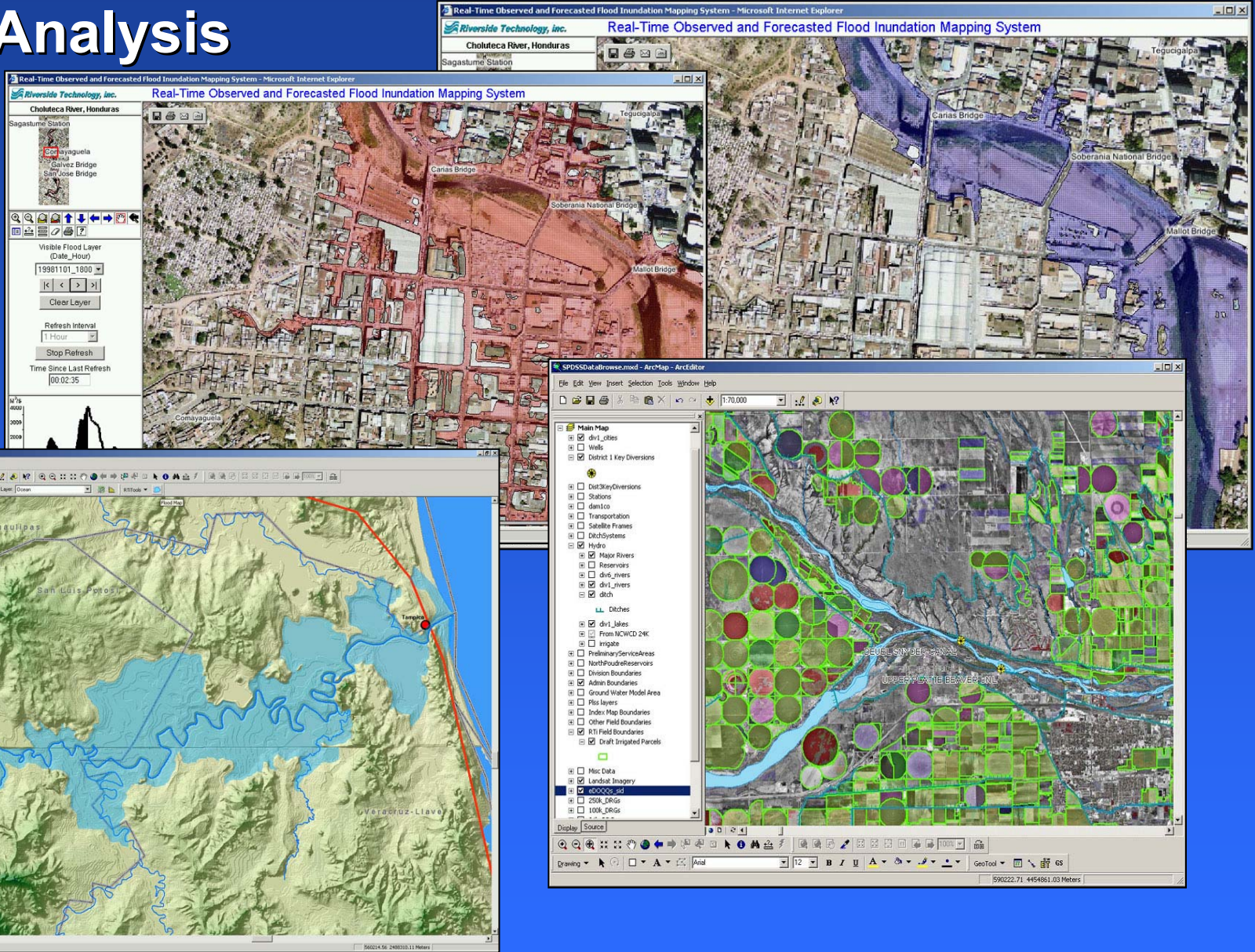


# Ecosystem Management



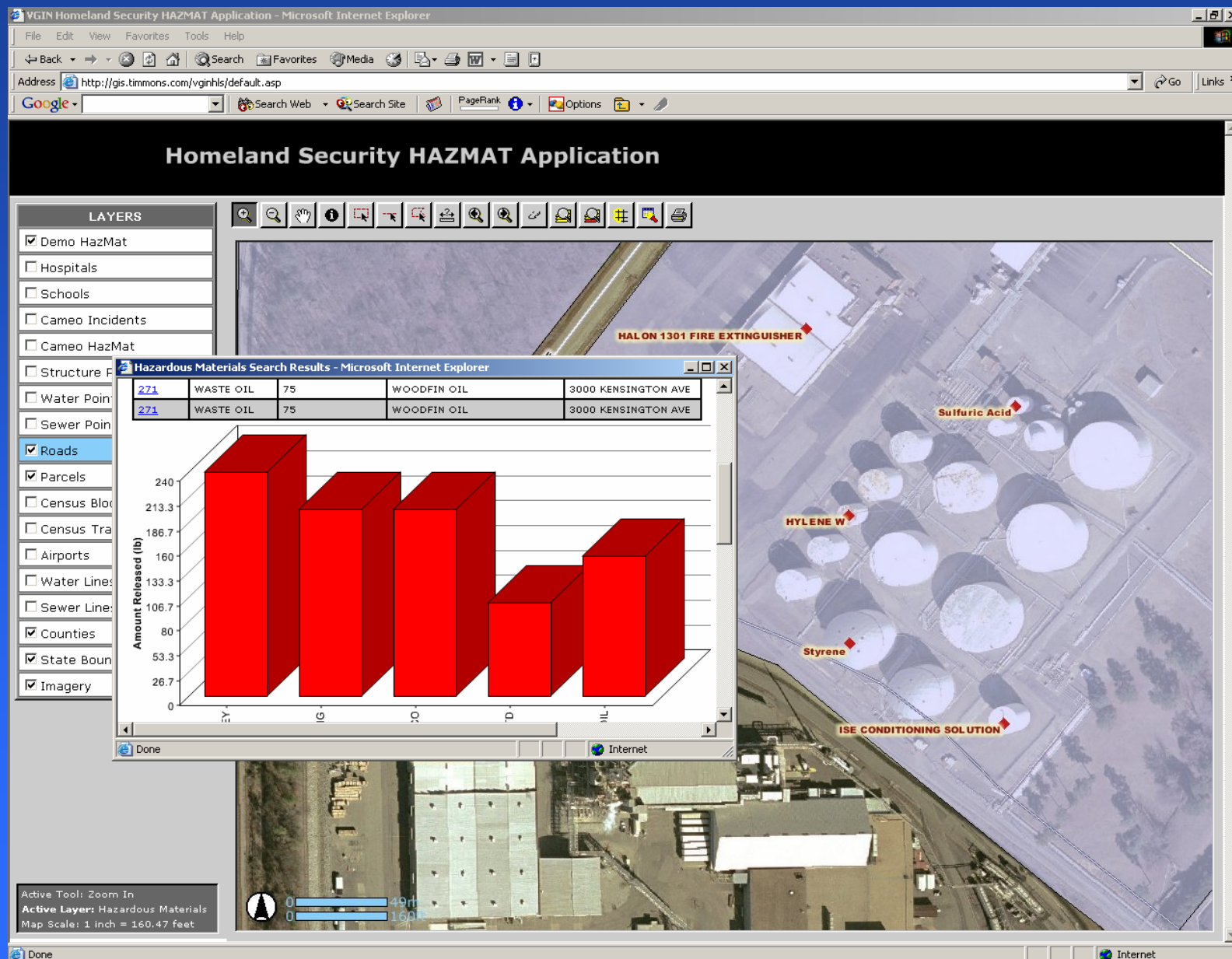


# Analysis





# Hazardous Materials Assessment



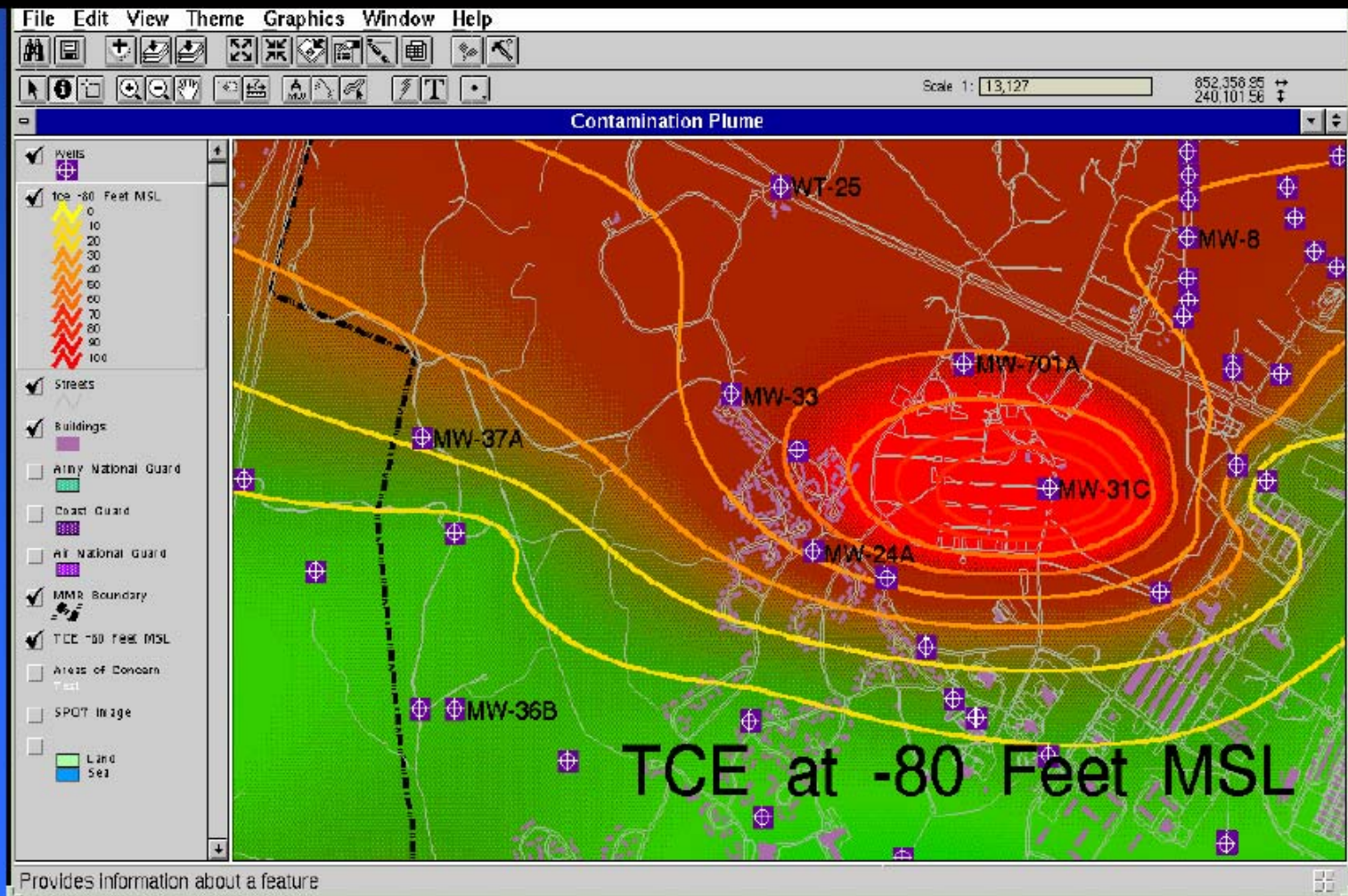


# Document Management Integration





# Environmental Monitoring Toxic Plume





### Fuel Tanks Near the World Trade Center Within Secured Area

- 1) PB6# 2-601825  
250 Vesey Street  
400 gallons  
Fuels: #1, 2, or 4  
Steel Storage Tank, Above Ground

- 2) PBS# 2-200212  
90 West Street  
2 x 10,000 gallons  
Fuels: #5 or 6  
Steel Tanks, Above Ground

- 3) PBS# 2-511536  
130 Cedar Street  
9,500 gallons, #5 or 6,  
Underground, Vaulted Access  
3,000 gallons, #1, 2, or 4  
Steel Tank

- 4) PBS# 2-357885  
124 Liberty Street  
330 gallons, Above ground, Steel tank  
1,000 gallons  
Below ground, Fiberglass reinforced plastic  
Diesel Fuel

- 5) P88# 2-604662  
120 Liberty Street  
4,000 gallons  
Fuels #1, 2, or 4  
Steel Tank, Above ground

- 6) PBS# 2-332941  
114 Liberty Street  
5,000 gallons  
Fuels: #5 or #6  
Steel Tank, Above Ground

- 7) PB#2-258822  
47 West Street  
3,000 gallons  
Fuels: #5 or 6  
Steel Storage Tank, Above Ground

- 8) PBS# 2-601553  
7 World Trade Center  
2 x 6,000 gallons  
Diesel Fuel  
Underground Storage Tank

- Q) P88# 2-602283  
7 World Trade Center  
2 x 11,680 gallons  
Fuels: 1, 2, or 4  
Fiberglass reinforced plastic tanks, Underground

- 10) PB8# 2-802234  
1 World Trade Center  
10,000, 3 x 275, & 100 gallons  
Fuels: #1, 2, or 4  
Steel Storage Tank

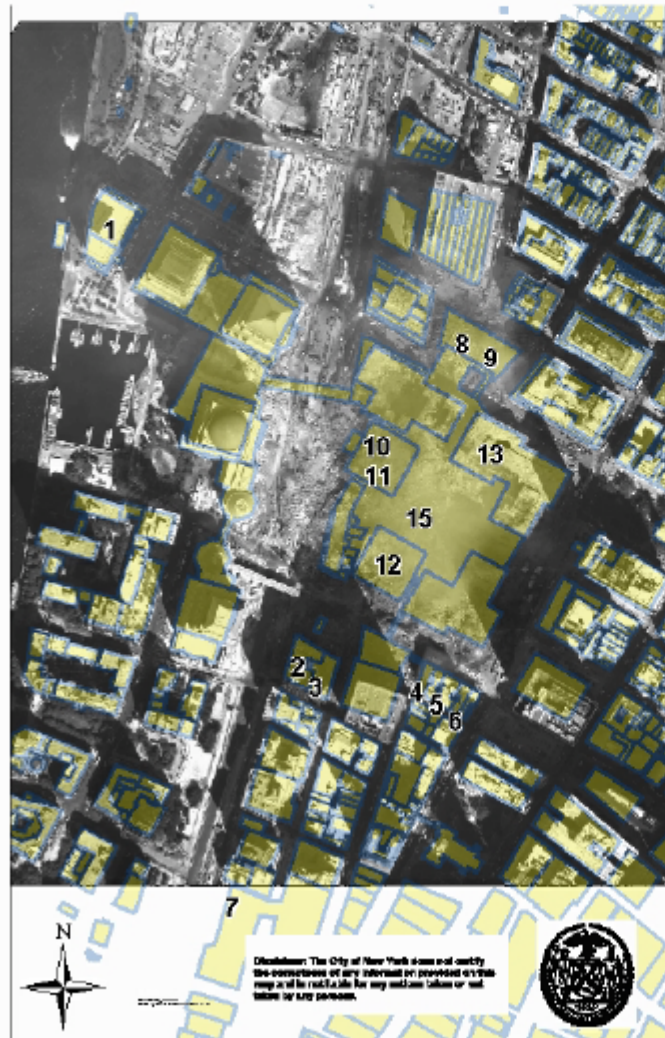
- 11) PB8# 2-293583  
1 WORLD TRADE CENTER  
10,000, 5,000, 1,800, & 3 x 275 gallons  
Fuels: 1, 2, or 4  
Above Ground, Stainless Steel Tanks

- 12) PB6# 2-344737  
2 World Trade Center  
2 x 2,500 gallons  
Fuels: #1, 2, or 4  
Steel Storage Tanks, Above Ground

- 13) PB8# 2-804231  
5 World Trade Center  
2 x 10,000 gallons  
Fuels: #1, 2, or 4  
Steel Storage Tanks, Above Ground, Level B2

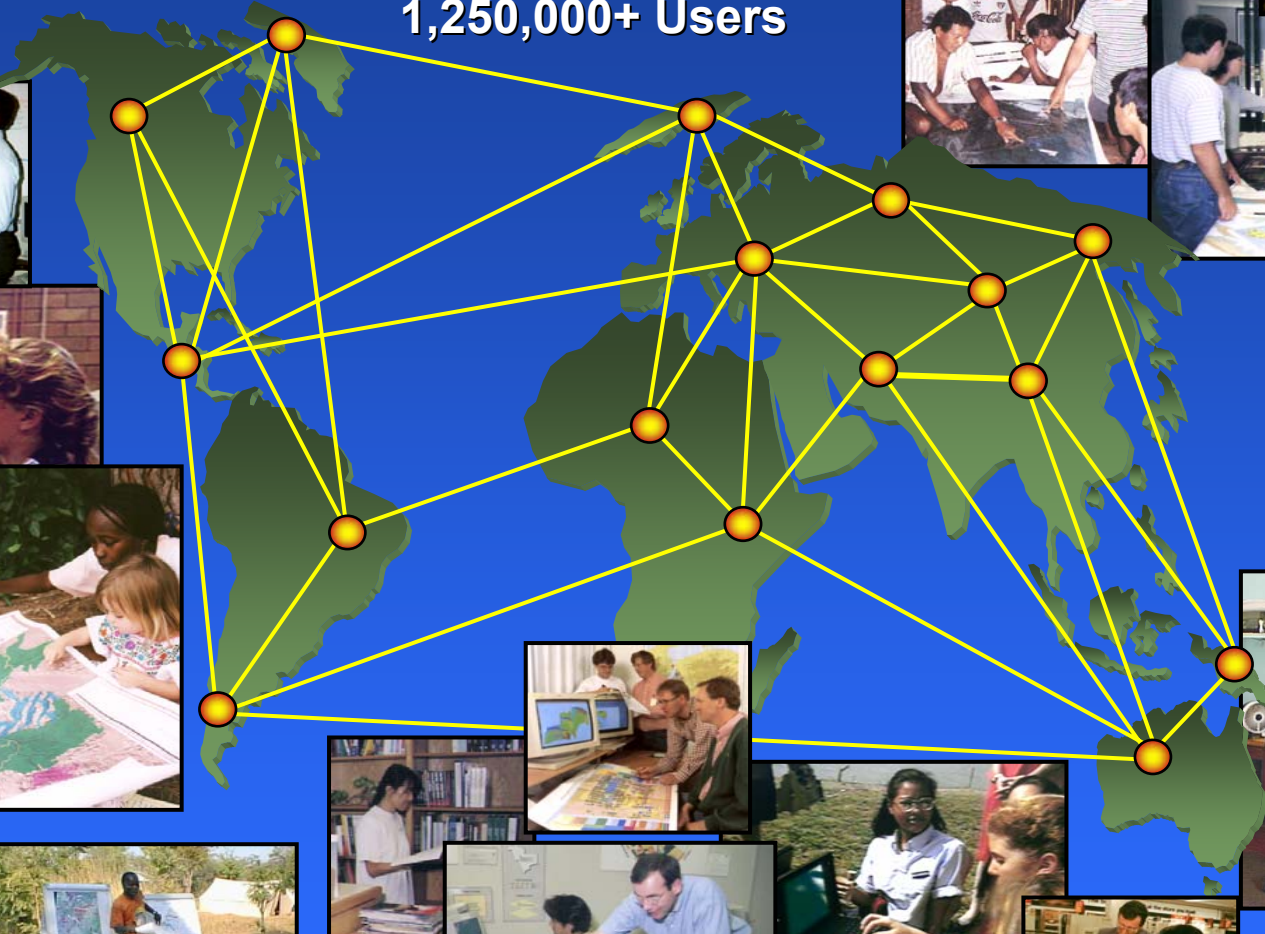
- 14) PBS# 2-000204  
River Water Pump Station  
(Actual Location Unknown)  
2x 4000 gallons  
Sodium Hypochlorite  
Fiberglass Reinforced Plastic Tank

- ### 15) Large Freon Tank





The collage consists of six photographs arranged in a grid-like fashion. The top-left photo shows a group of five people, including three men and two women, gathered around a table, looking at a large map or document. The top-right photo shows a close-up of hands pointing at a large map or document. The middle-left photo shows a man in a striped shirt pointing at a large map or document on a table. The middle-right photo shows a man in a striped shirt pointing at a large map or document on a table. The bottom-left photo shows a man wearing a yellow hard hat and safety glasses, holding a tablet. The bottom-right photo shows a man in a plaid shirt holding a tablet next to a yellow Seattle City Light utility box. The box has the text "Seattle City Light" and "625.3000" on it. In the bottom-left corner of the collage, there is a green map of Washington state with yellow lines connecting several orange circular nodes, representing a network or project structure.



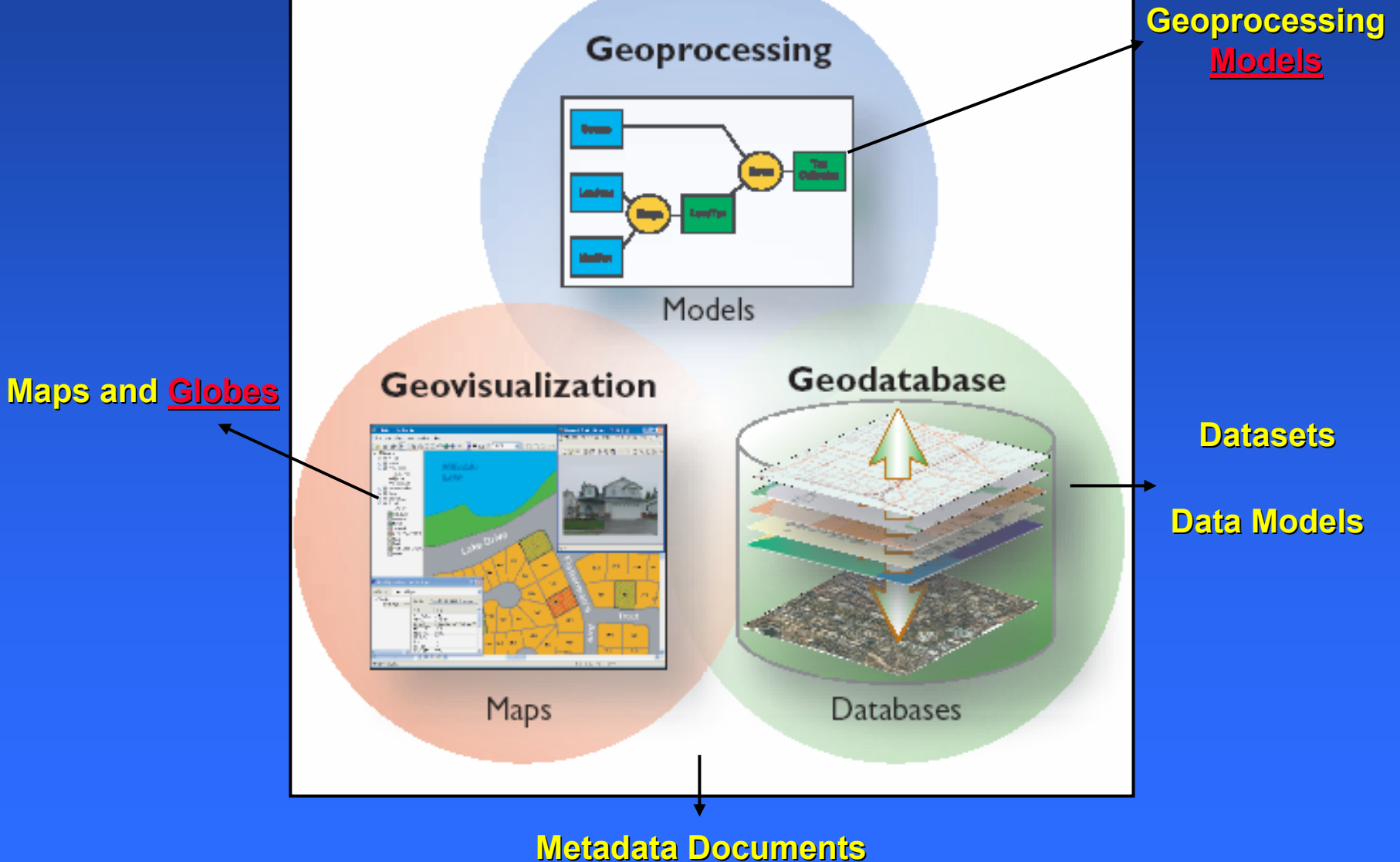


# Emerging GIS Technologies Will Improve Implementations

- **Intelligent GIS**
- **Web Services**
  - GIS Services
  - Networks
  - GIS Portals
- **Distributed GIS**
  - Server
  - Embedded
  - Desktop
  - Mobile
- **Component Software**
- **New GIS Functionality**
  - Geoprocessing Models
  - Global Visualization
  - Cartography & Labeling
  - Image Integration
  - Real Time
  - Mobile GIS/LBS
- **Interoperability**



# Three views of GIS





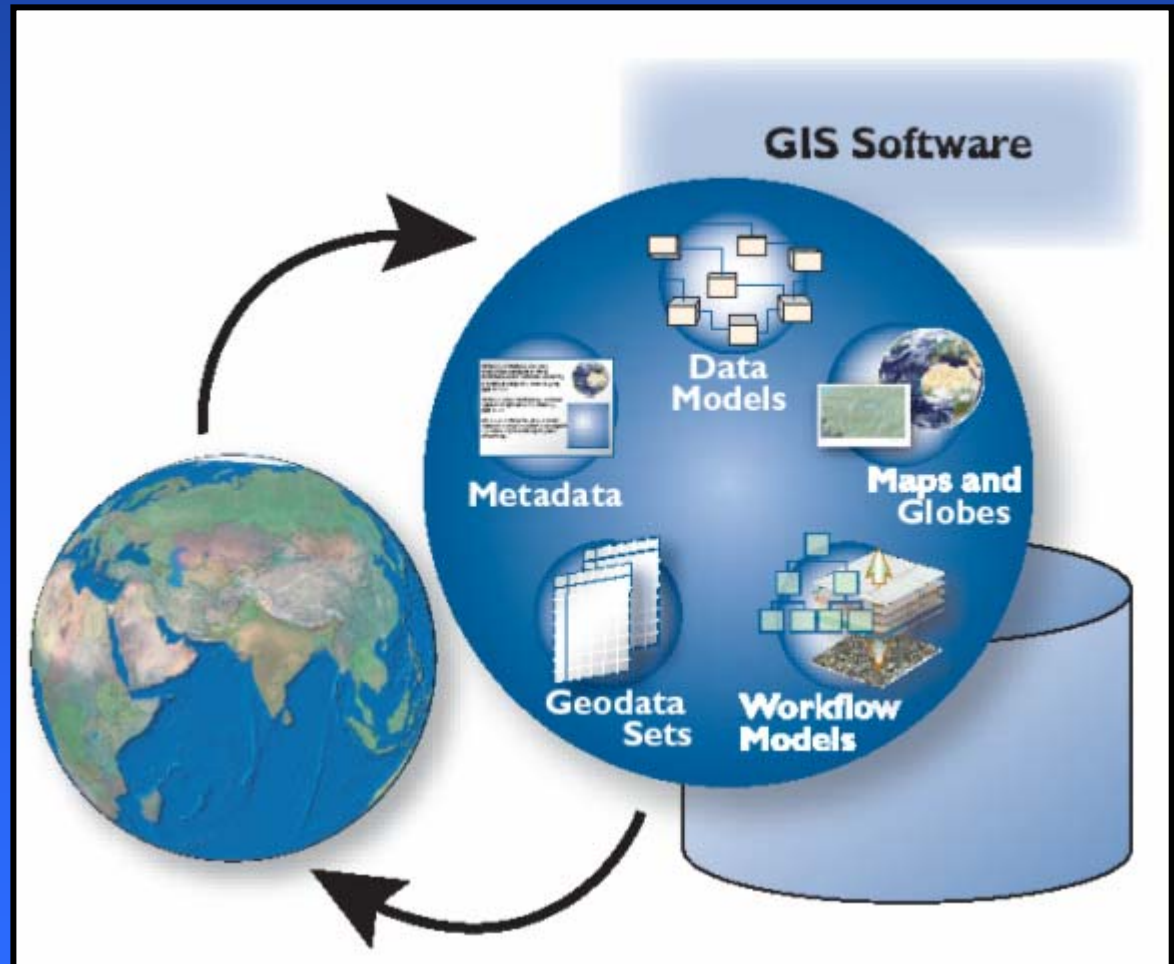
**GIS is evolving from a database  
approach to a knowledge  
approach**



# GIS Is Becoming More Intelligent

Managing Datasets, Workflows in a Common Environment

...Encapsulating  
Five Basic  
Elements



...Abstracting Geographic Knowledge



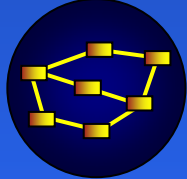
# GIS “Abstracts” Geography Into Five Basic Elements



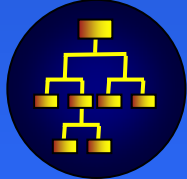
**Maps and Globes**



**Geodata Sets**



**Workflow Models**



**Data Models**



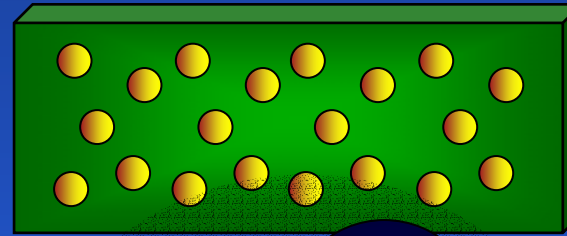
**Metadata**

**... Together They Represent Geographic  
Knowledge**



# These Five Basic Elements

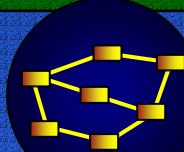
**Plus GIS  
Software  
Objects**



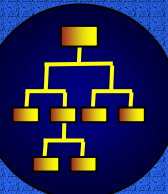
**GIS  
Software**



**Maps**



**Models**



**Data  
Models**



**Metadata**



**Geodata Sets**

**Geodatabases**

**... Provide the Building Blocks for *Intelligent GIS***



**GIS users work with many databases  
and datasets in many schemas and  
produce and share results**

**Requires a unique combination of  
“scientific computing” and, increasingly,  
“business computing”**



# GIS is distributed

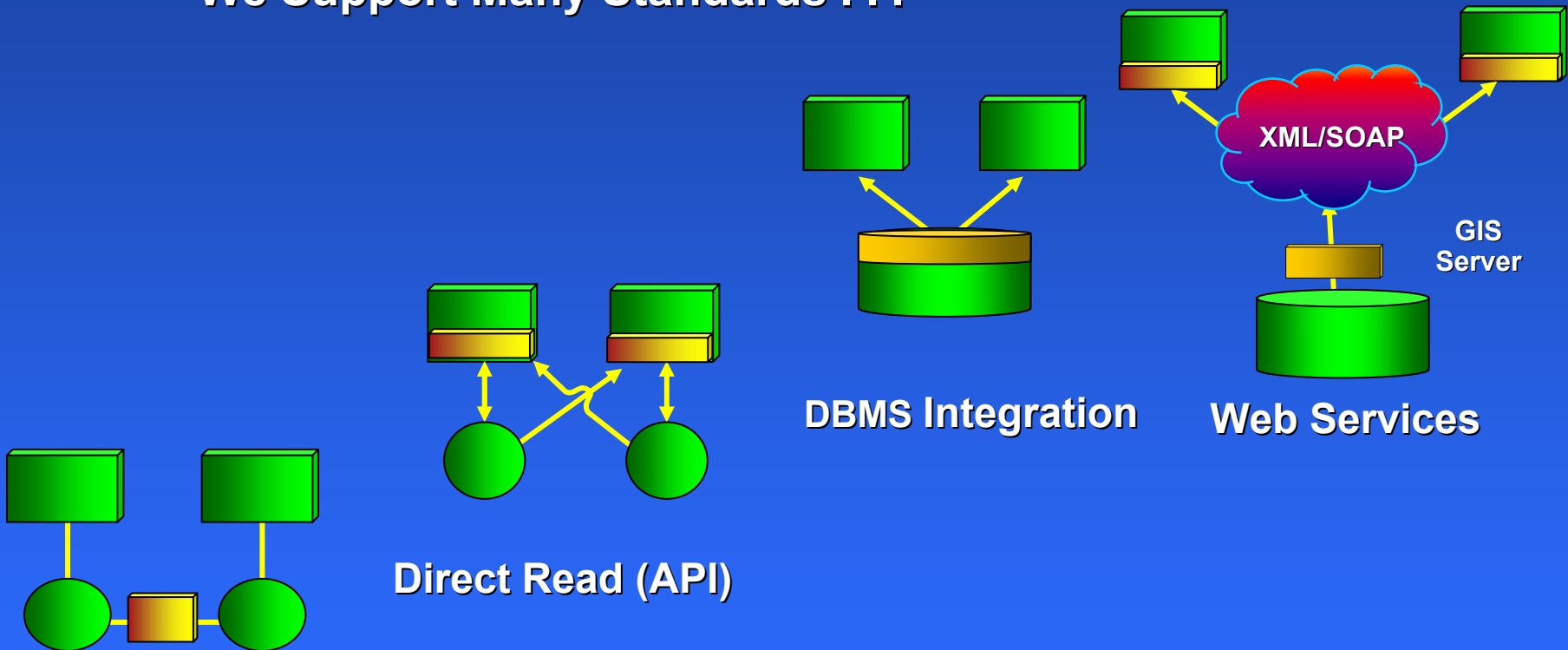
- Each GIS must access and use many datasets
- Geodata compilation is an expensive, specialist activity that requires
  - Comprehensive tools and systems
  - Mechanism to share data
- Compiled & maintained by many organizations
- Distributed update and sharing

**Implications ...**



# Interoperability is Important

We Support Many Standards . . .



Conversion

Direct Read (API)

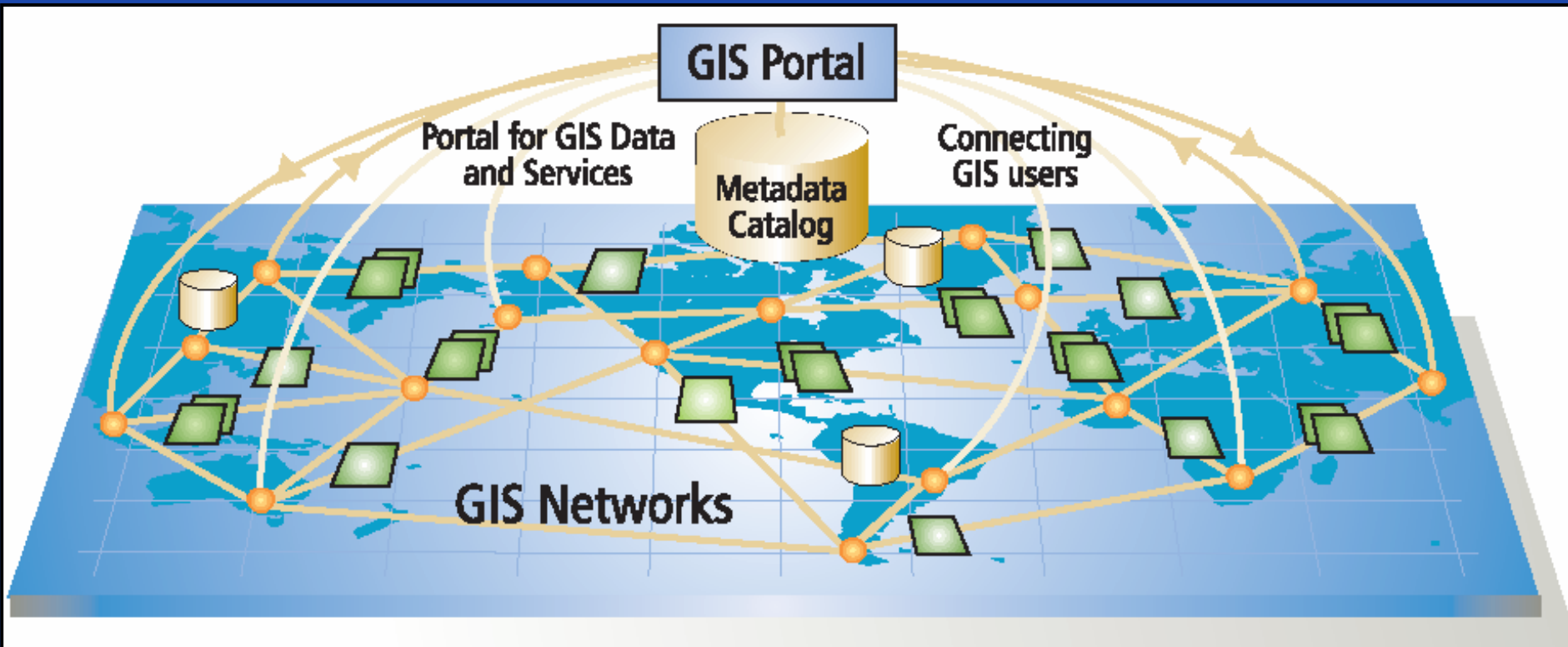
DBMS Integration

Web Services

**... Our Focus Is On Simple and  
Practical Approaches That Work**



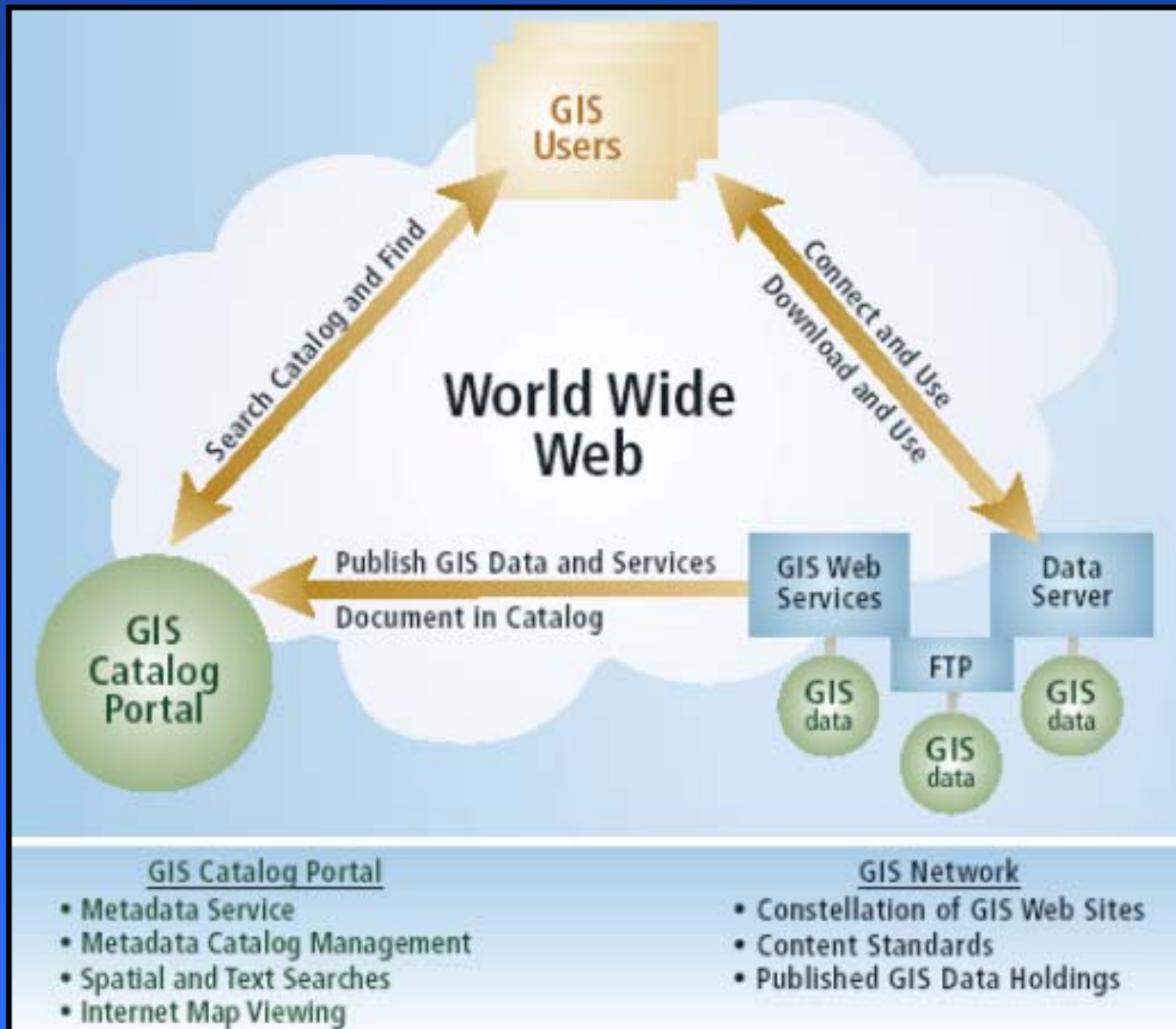
# GIS Networks



GIS Catalog Portals centralize access to distributed information nodes



# Three Key Building Blocks





# GIS Portals

## Access to Distributed Information & Web Services

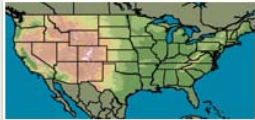
geodata.gov  
U.S. Maps & Data

your one stop for federal,  
state & local geographic data

### Make a Map

#### Launch:

The National Map



### Search for Data

Search all the data in this site

### About This Site

How to find the maps & data you need  
and how to publish your data here,  
GOS Partnerships

### Help

Quick Start Guide  
How Do I Publish Data Collection  
Activities  
Contact Us

### The geodata.gov Marketplace

Find out about the latest geographic  
data sharing and acquisition initiatives.

### Information Center

Standards, tools, and resources.

### Publish Data

Login

### What's New

Latest events

geodata.gov is a web-based portal for one-  
geospatial services that will simplify the ab-  
to find geospatial data and learn more about

geodata.gov is part of the Geospatial One-  
government initiatives that will enhance gov  
will accelerate the development and implem-  
Infrastructure (NSDI) and includes state, lo-  
private sector and academia as participants  
Quick Start Guide.

### Data Categories

→ Admin

→ Agriculture

→ Atmosphere

→ Biology

→ Business

→ Cadastre

→ Cultural

→ Elevation

→ Environment

→ Geology

→ Human

→ Imagery

→ Inland

→ Location

→ Oceans

→ Transport

→ Utilities

→ Water

→ Weather

→ Wildlife

→ Other

→ Search

→ Tools

→ Training

→ Support

→ About

→ Contact

→ Privacy

→ Terms

geodata.gov MAP VIEWER

Home | Search | Help | How To Add Data

geodata.gov Map Viewer - Microsoft Internet Explorer

geodata.gov Map Viewer - Microsoft Internet Explorer

geodata.gov Map Viewer - Microsoft Internet Explorer

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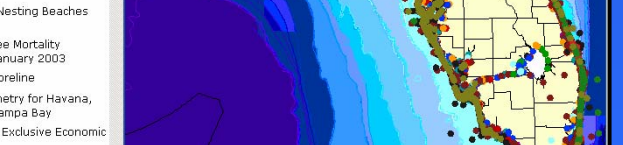
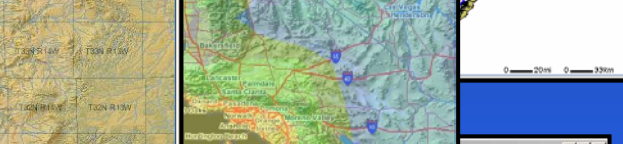
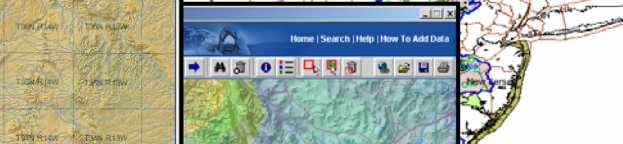
geodata.gov Map Viewer - Microsoft Internet Explorer

geodata.gov Map Viewer - Microsoft Internet Explorer

geodata.gov Map Viewer - Microsoft Internet Explorer

geodata.gov Map Viewer - Microsoft Internet Explorer

geodata.gov Map Viewer - Microsoft Internet Explorer



Examples: GeoSpatial One-Stop,  
GeoCommunicator

FIRSTGOV.gov  
The U.S. Government's Official Web Portal

egov  
The Government's Official Web Portal

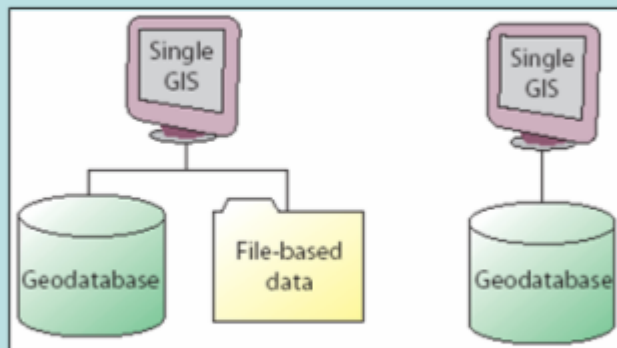
This is a U.S. Government Computer System. Before continuing, please read this [disclaimer](#) and [privacy](#) statement.

Please use the [Contact Form](#) for any questions or comments.



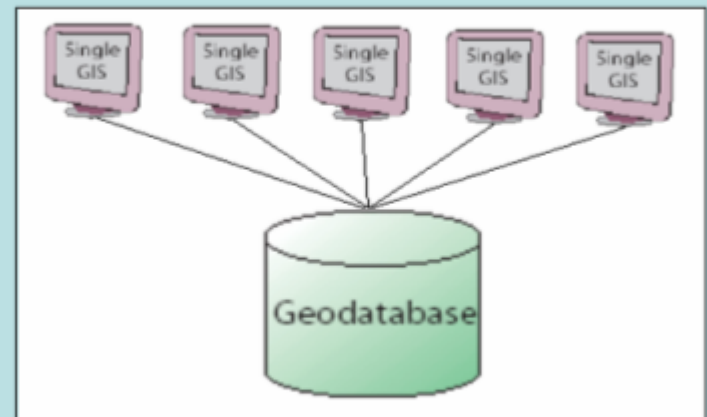
# GIS Is Deployed In Many Ways

## Traditional GIS Workstations



**Client-Server GIS**

## Central GIS

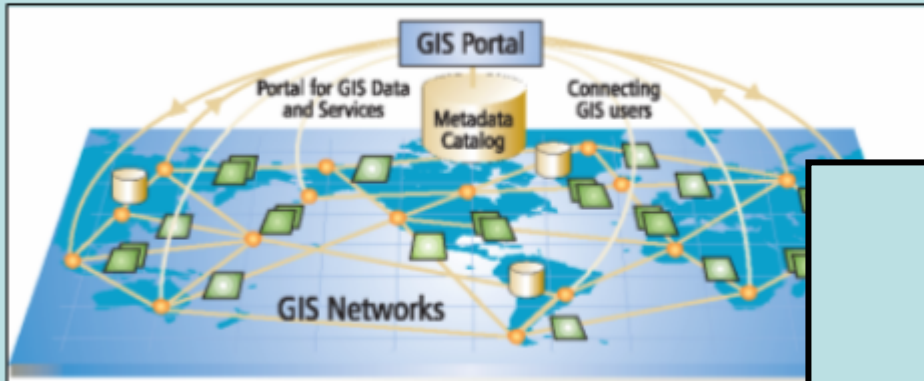


**Central DBMS with Multiple Users**



# Emerging GIS Deployments

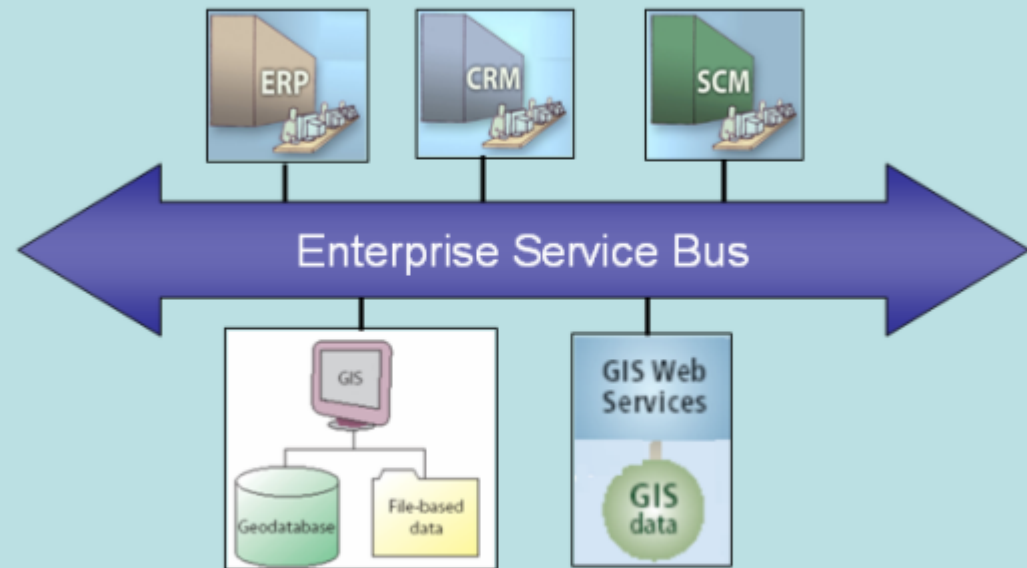
## Federated GIS



Spatial Data Infrastructures  
Stovepipe GIS Integration

**IBM**

## Services-Oriented Architecture

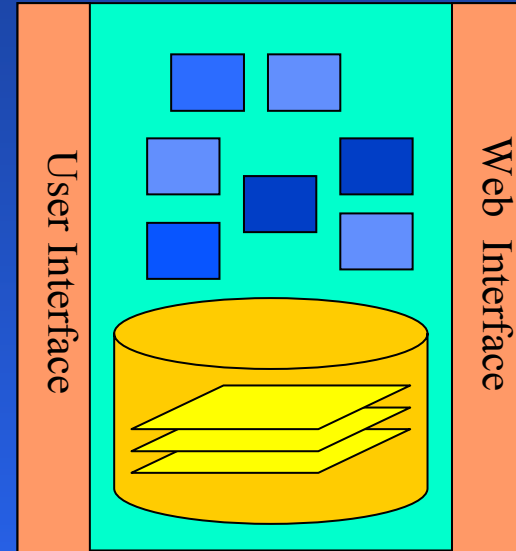
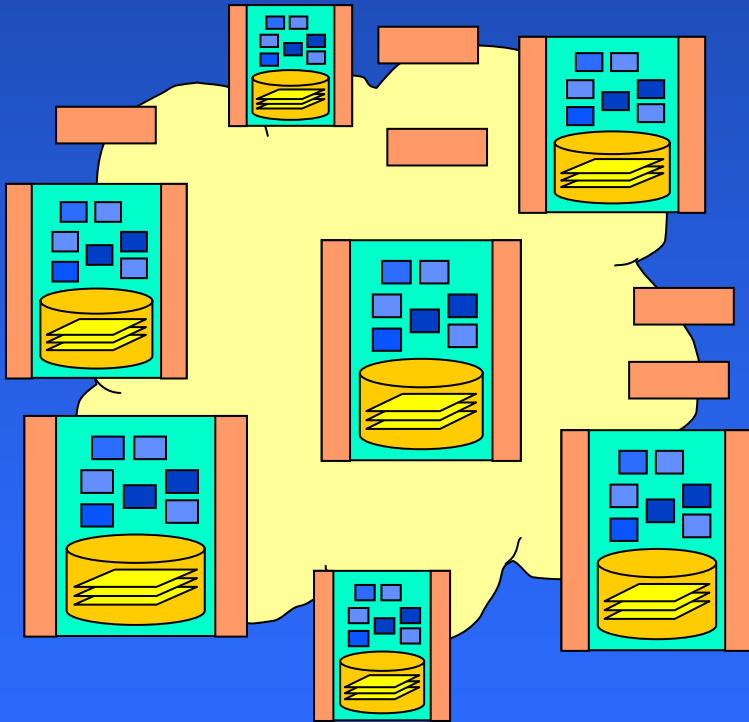


Workflow integration via web services and  
messaging



# Federated GIS

A web of **loosely-coupled**  
Information system nodes



Each node has:

- data & functionality
- a user interface
- a web interface

A network of heterogeneous systems

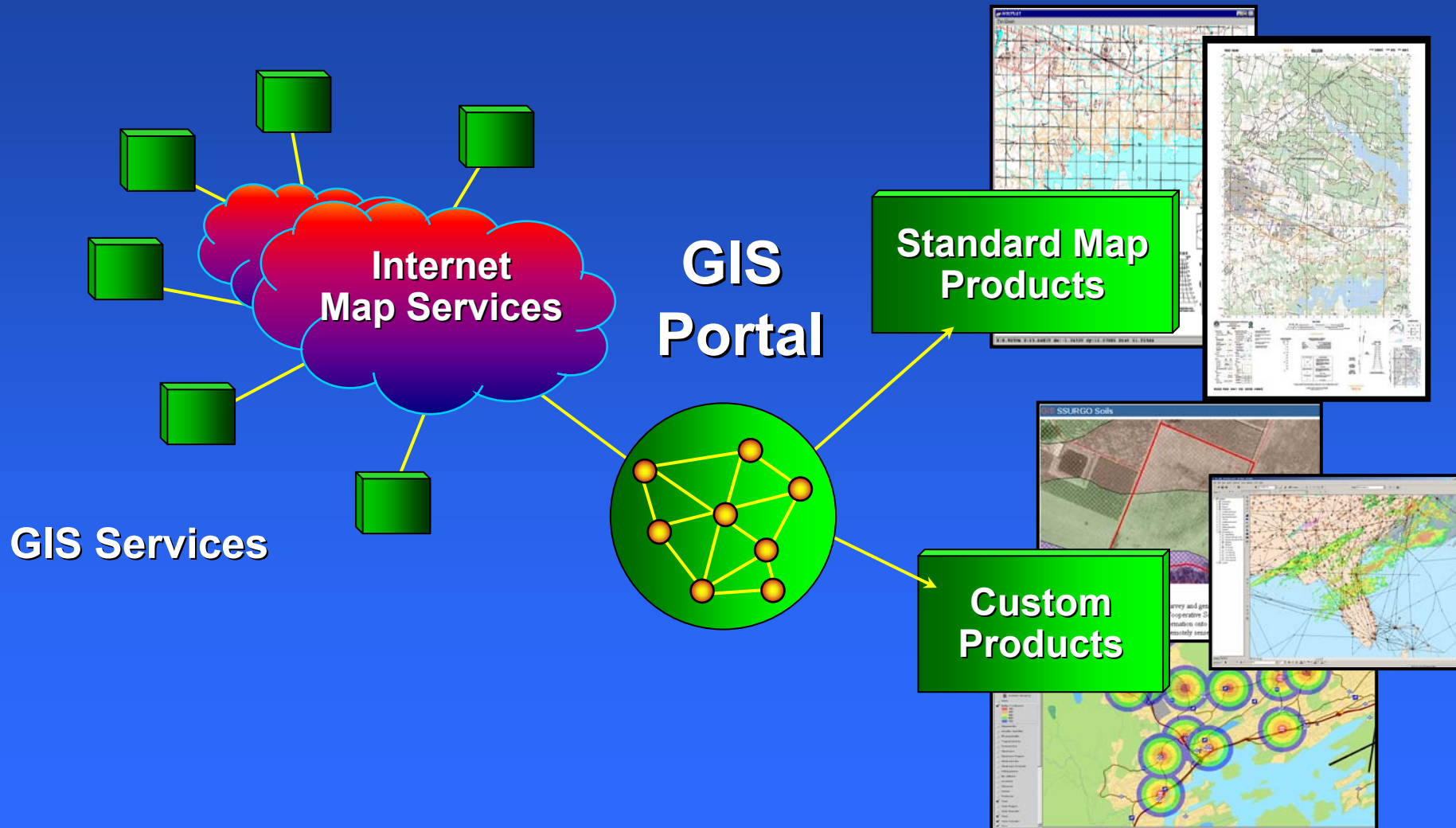


# Federated GIS Requirements

- **Ad-hoc combination of information maintained in separate data stores**
- **Complex information models**
  - **Geometry and imagery**
  - **Relationships and integrity constraints**
    - **Semantic relationships**
    - **Connectivity (graph) relationships**
    - **Shared geometry (topology) relationships**
- **Distributed data compilation (collaboration)**
- **Large datasets**
  - **Number of elements**
  - **Size of elements**
- **Open, standards-based architecture**



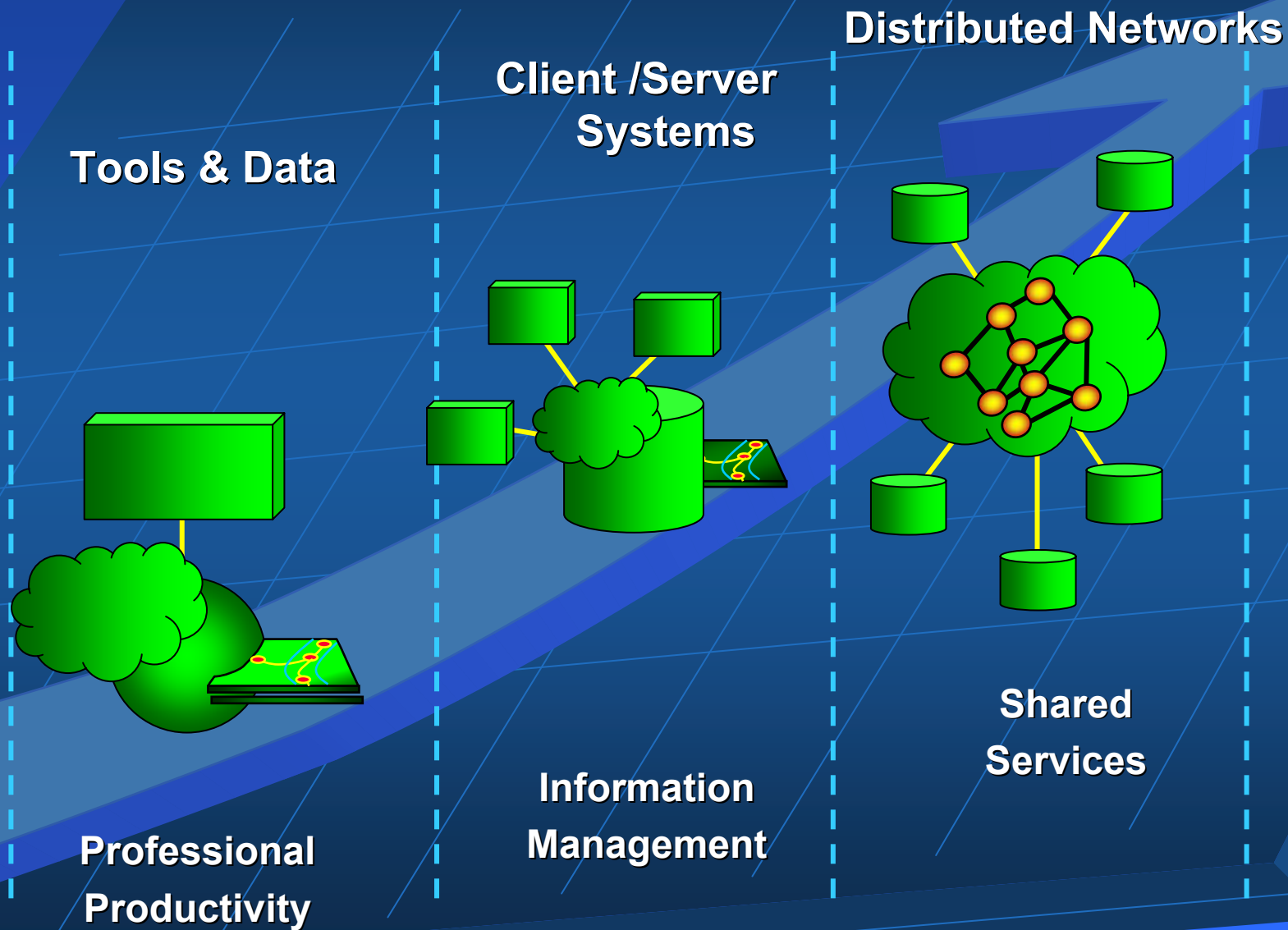
# Web Services Provide A New Architecture For GIS



... They Dynamically Integrate Many Distributed Services



# GIS Architectures Are Expanding



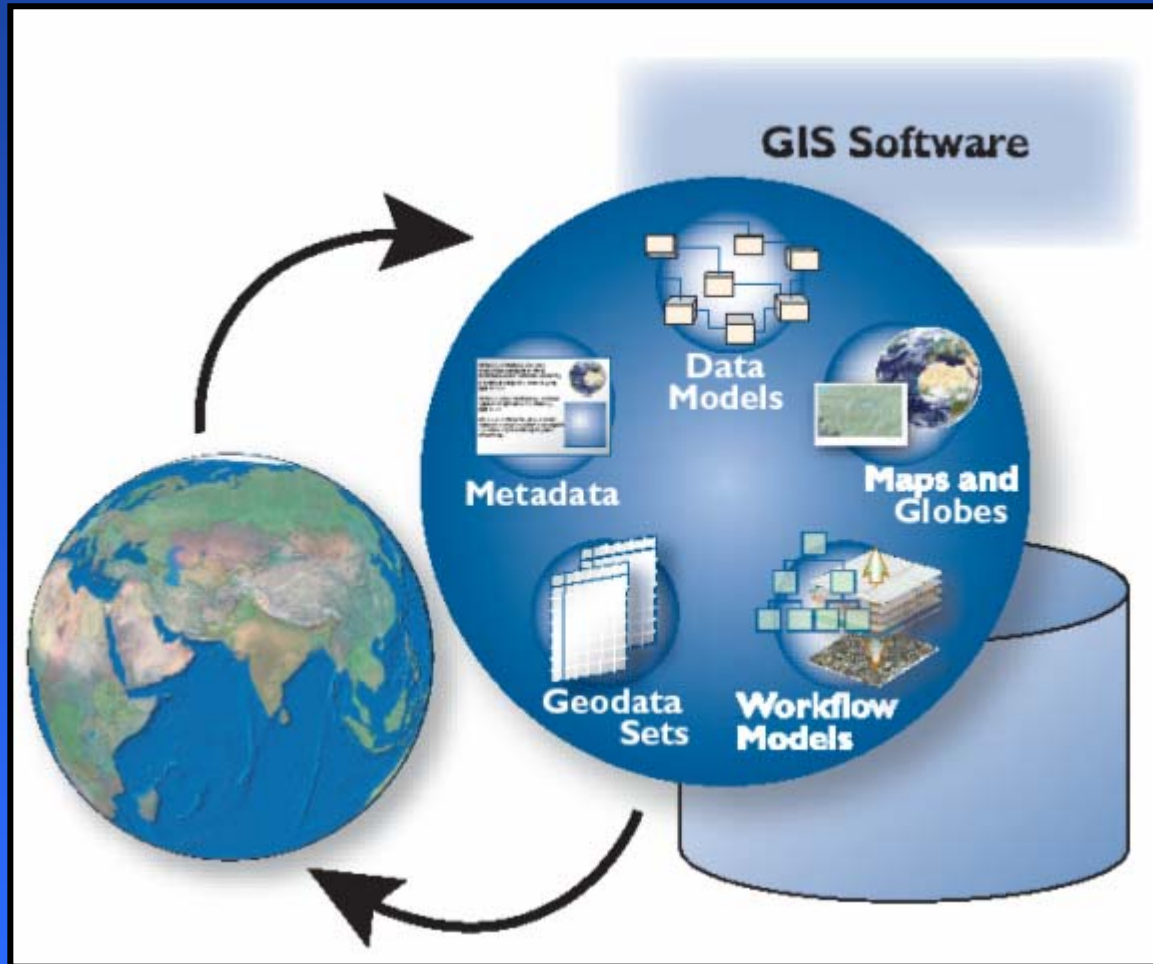
**... Web Services Provide A New Platform**



# **Some important initiatives for DOI**



# Enterprise Data Management

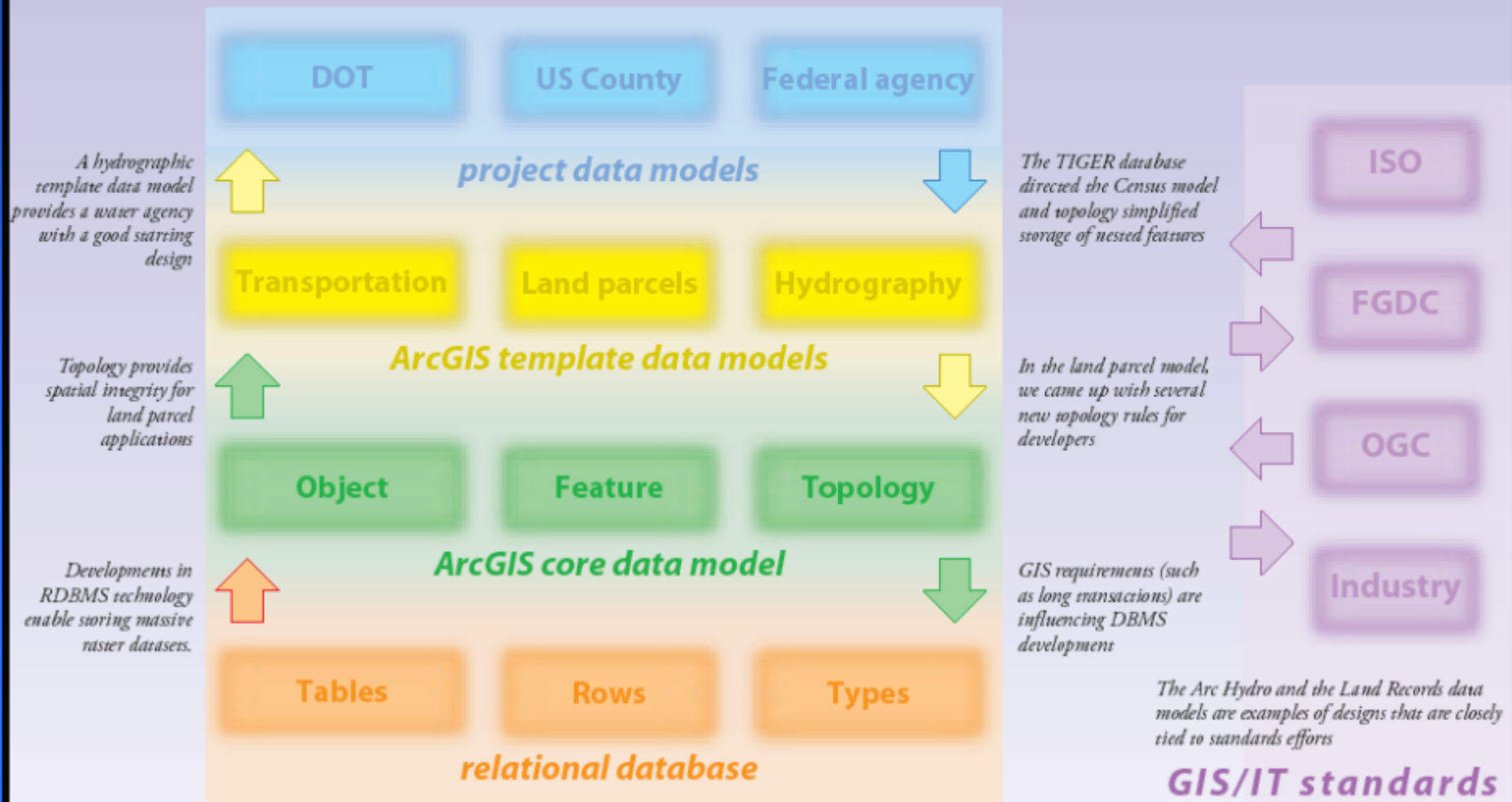


**NILS,  
TNM, NHD,  
GOS, etc.**

**Requires a schema, stewardship responsibilities, and implementation**



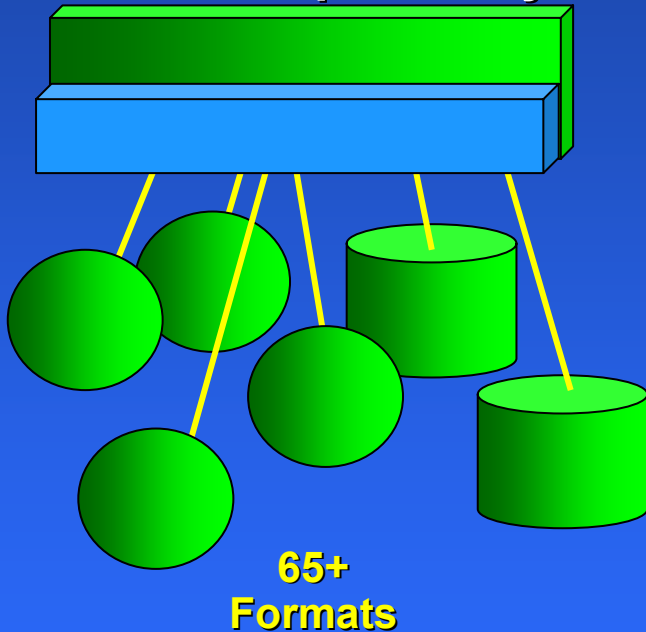
*There are important relationships that exist between the ArcGIS data model, existing GIS and IT concepts, and related standards efforts. The ArcGIS data models implement fundamental DBMS and GIS data concepts. In turn, the templates build on those concepts to provide a useful starting point for each user's GIS database design. In addition, the GIS and IT design techniques used in each data model support, as well as influence, a number of important standards efforts. ESRI will continue to evolve its designs in support of these on-going efforts.*





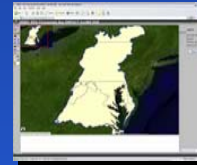
# Interoperability

## Direct Read Data Interoperability

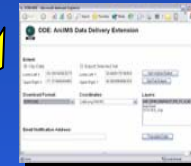


## ... Clip/Zip/Ship

Zoom to Extent



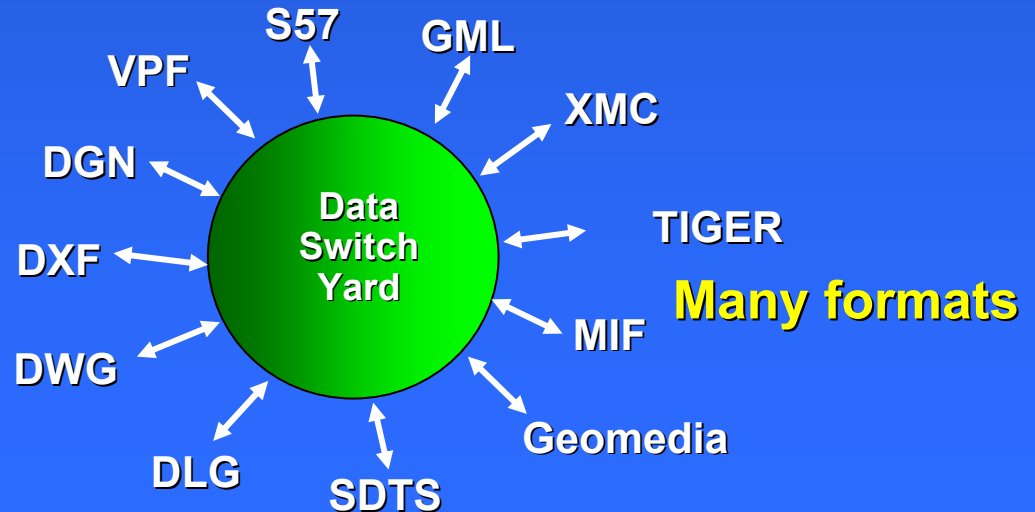
Select Format



Export to  
File



## Data Conversion





# ESRI will support all practical IT and GIS Standards

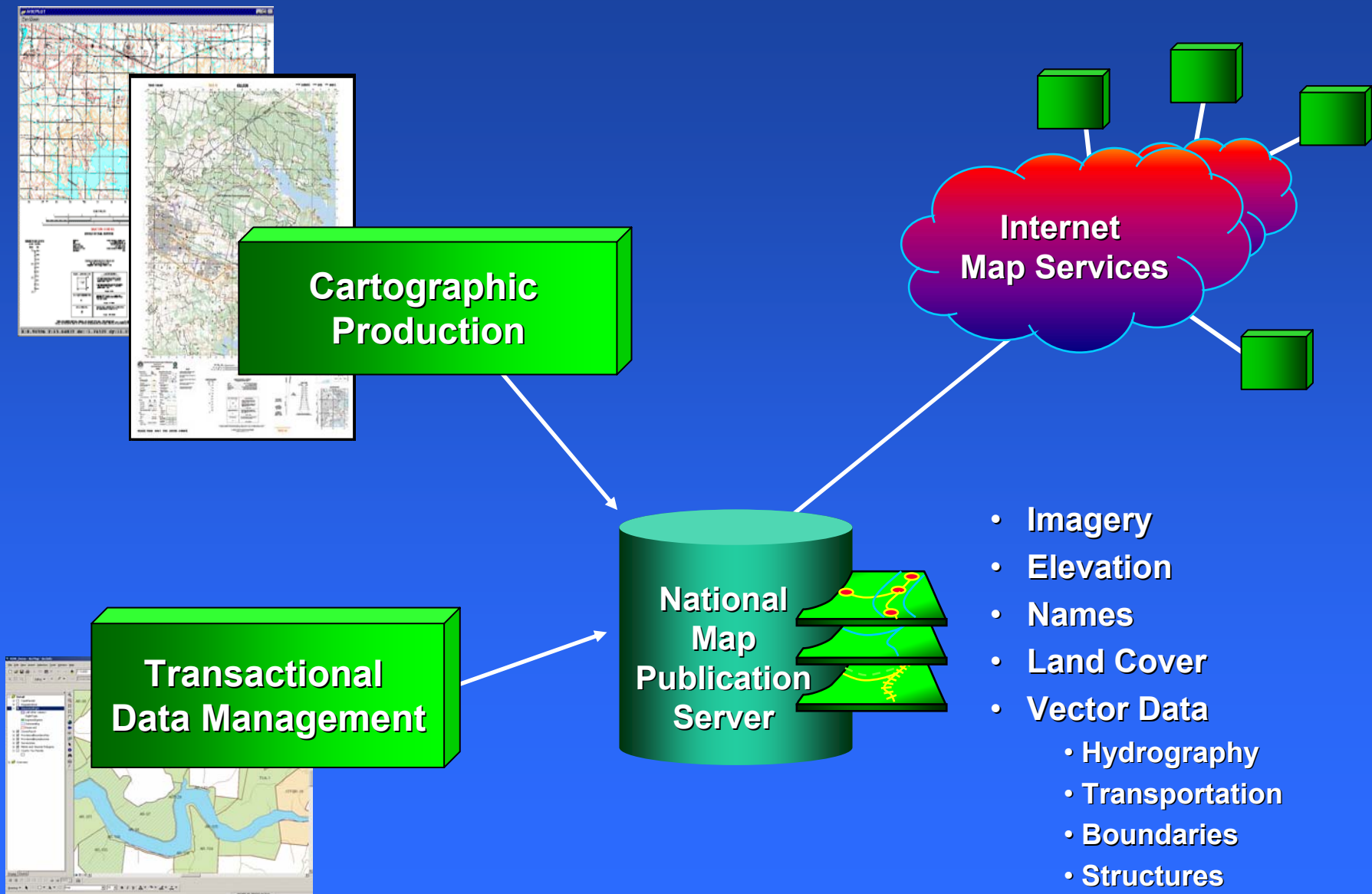
## Responding to User Base

### Examples

- **FGDC / ISO**
  - FGDC Metadata Content, ISO Metadata Content
- **OGC**
  - Simple features (The basis of Geodatabase Storage in RDBMS)
  - OGC Catalog Services
  - Support for Z39.50
  - WMS, WCS, WFS, GML
- **Information Technology**
  - XML Web Services (ArcXML), SOAP, HTTP
  - Open DBMS (Spatial types in Oracle, DB2, Informix)
  - Open Programming (C++, COM, JAVA, .NET)
  - Open Platforms (Windows, Unix, Linux)
  - Direct IS interfaces (SAS, SAP, Bentley, GPS, Image, Survey, Government Data formats, VPF, CAD, more . . .)

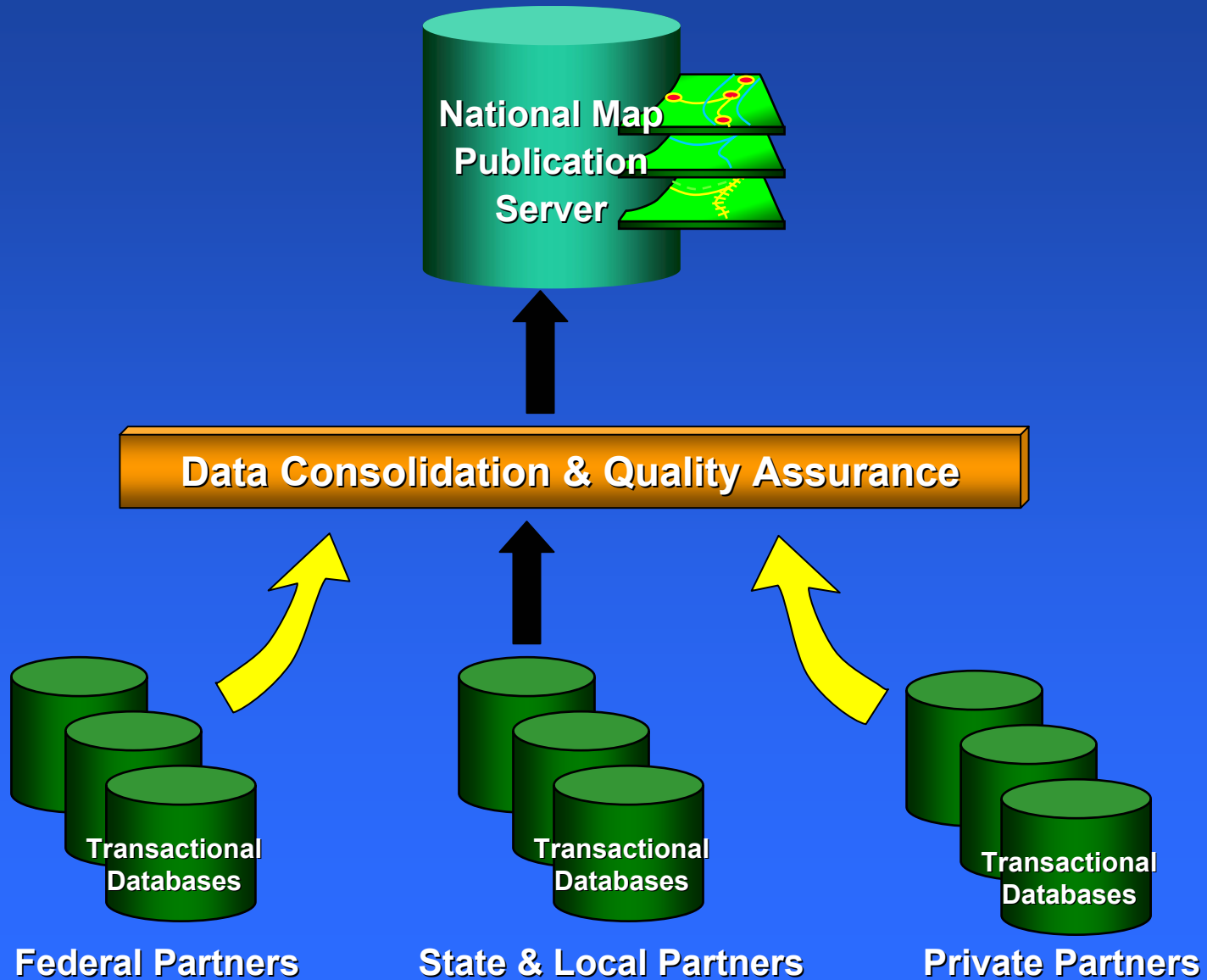


# National Map Deployment





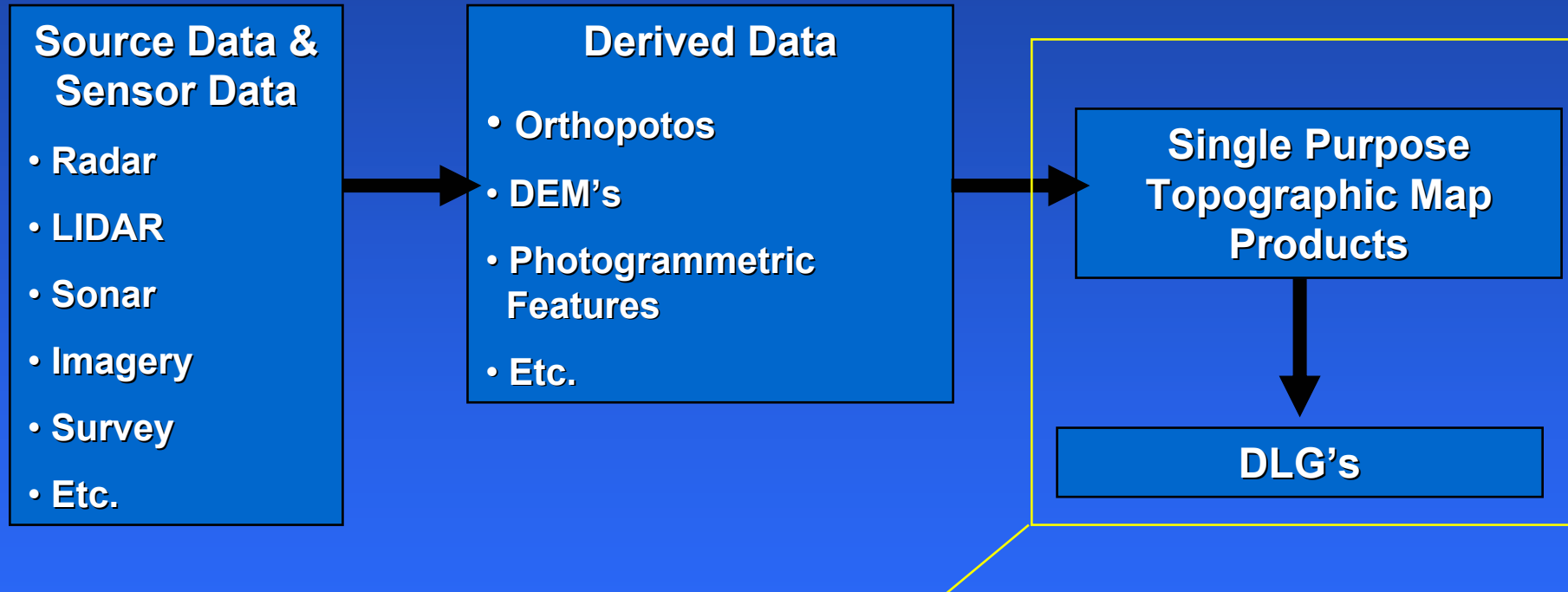
# National Map Development





# Framework Databases

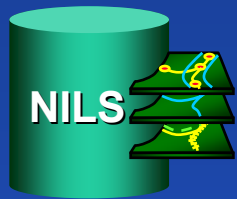
## Multi-purpose & Multi-scale



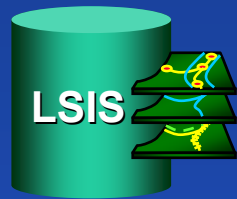
Changing with GIS to be multi-purpose



## Federal Lead Agency Data Provider



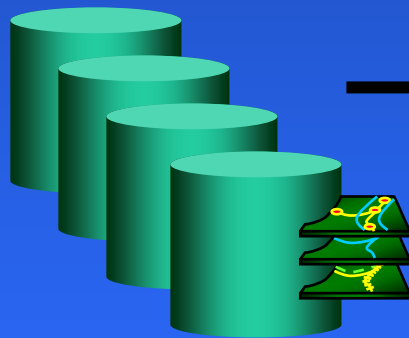
- Spatial Implementation
- Content Implementation



- Metadata Implementation
- Content Implementation
- Map Service Implementation

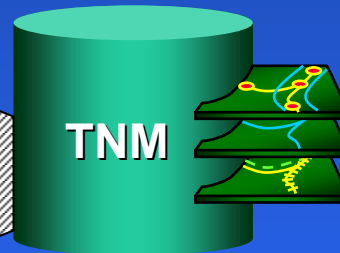
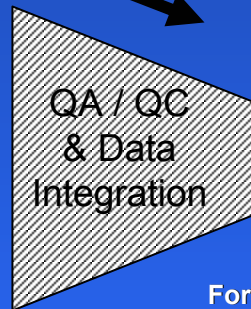


Internet



## State and Local Data Providers

- Spatial Implementation
- Content Implementation
- Metadata Implementation



- For Framework Layers:
- Spatial Specifications
  - Content Specifications



- Metadata Specifications
- Map Service Specifications
- Scale Specifications



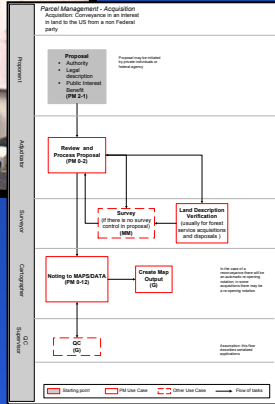
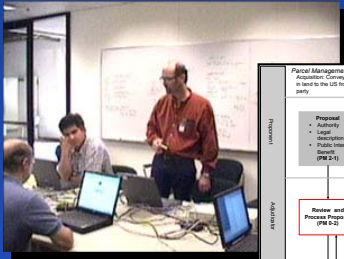
FGDC

Evolution of Standards

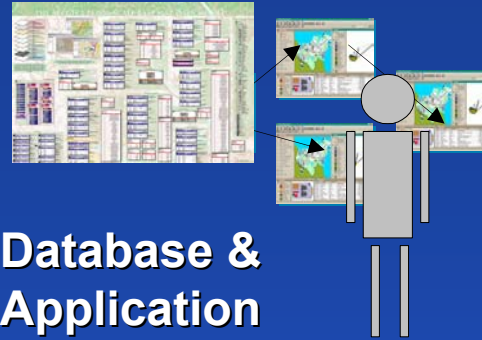
- Coordination of Specifications
- Communication of Specifications & Best Practices



## Business Requirements Analysis

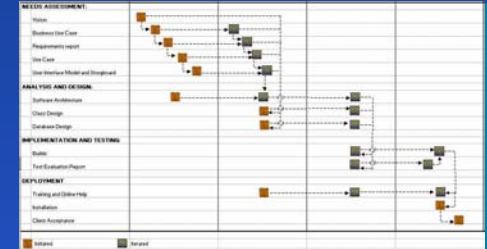


## Database & Application Design



# National Map Implementation

## Project Planning



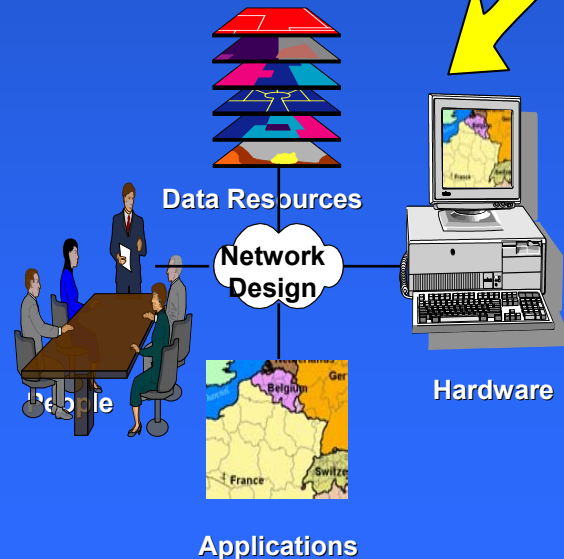
Cartographic Production

Transactional Data Management

National Map Public Server

Internet Map Services

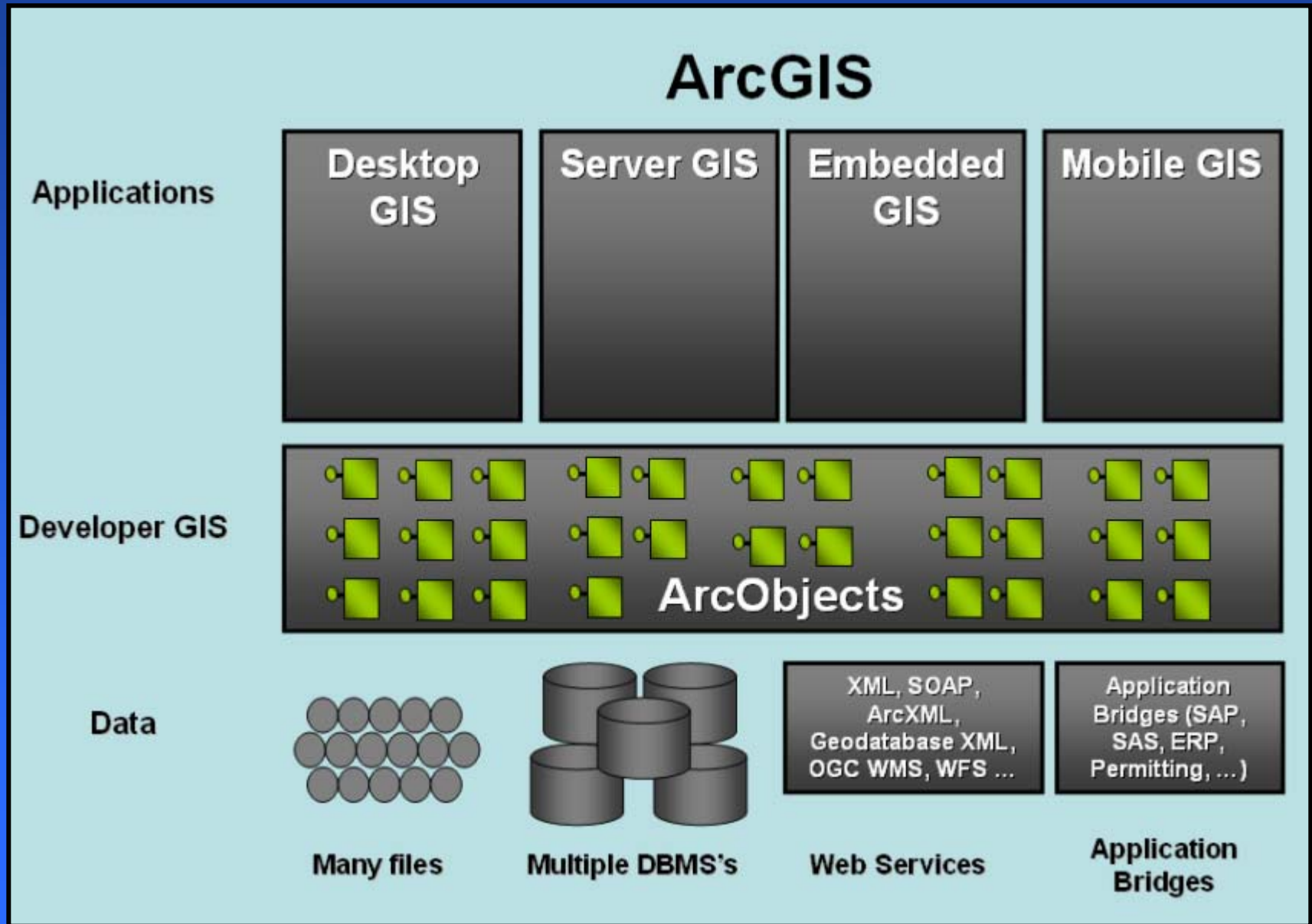
## Pilot Implementation



## System Architecture Design



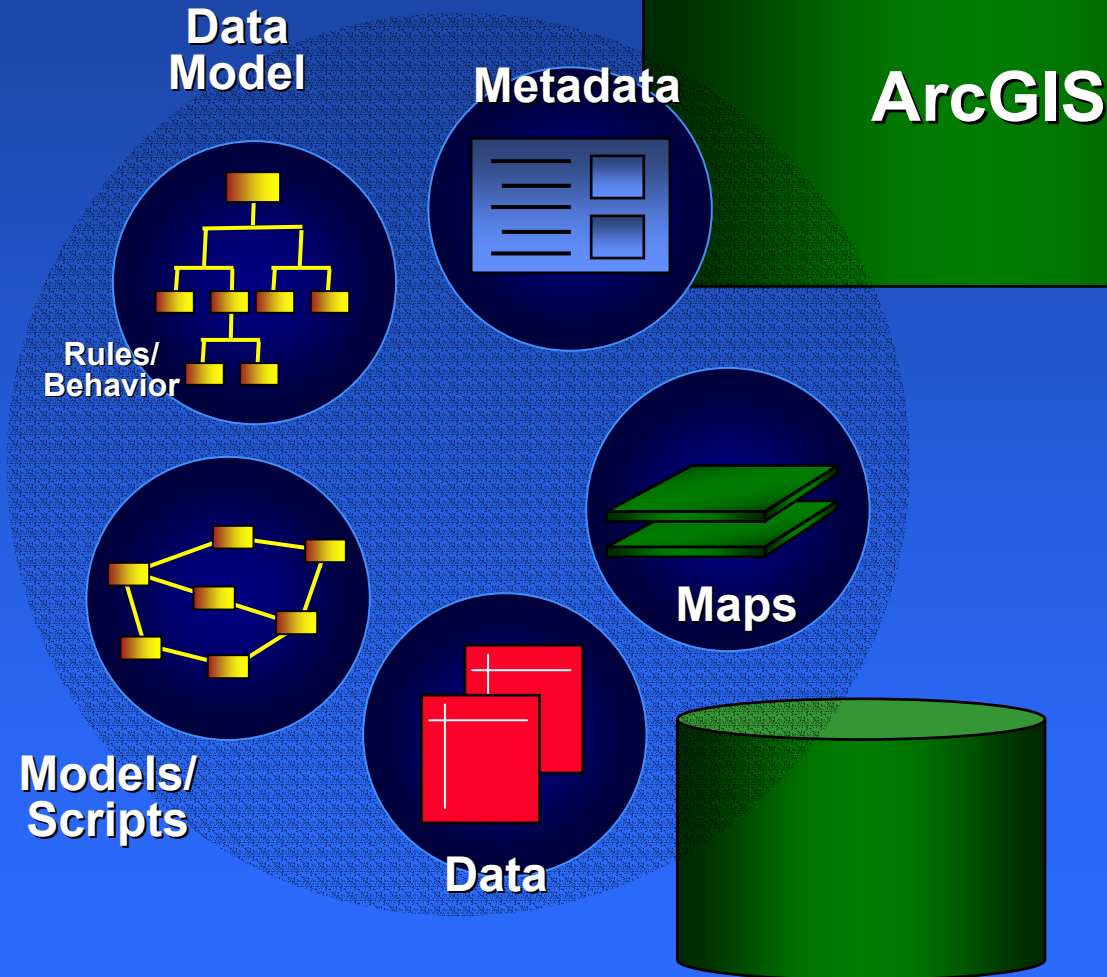
# ArcGIS 9.0 System Architecture





# ArcGIS Manages the Basic Elements of Geographic Knowledge in the

**... Simple, Open,  
and Interoperable**



**... And Makes Them Directly Accessible**



# ESRI Software Strategy

Develop Generic GIS Components . . .

ArcGIS  
Products

Mobile GIS

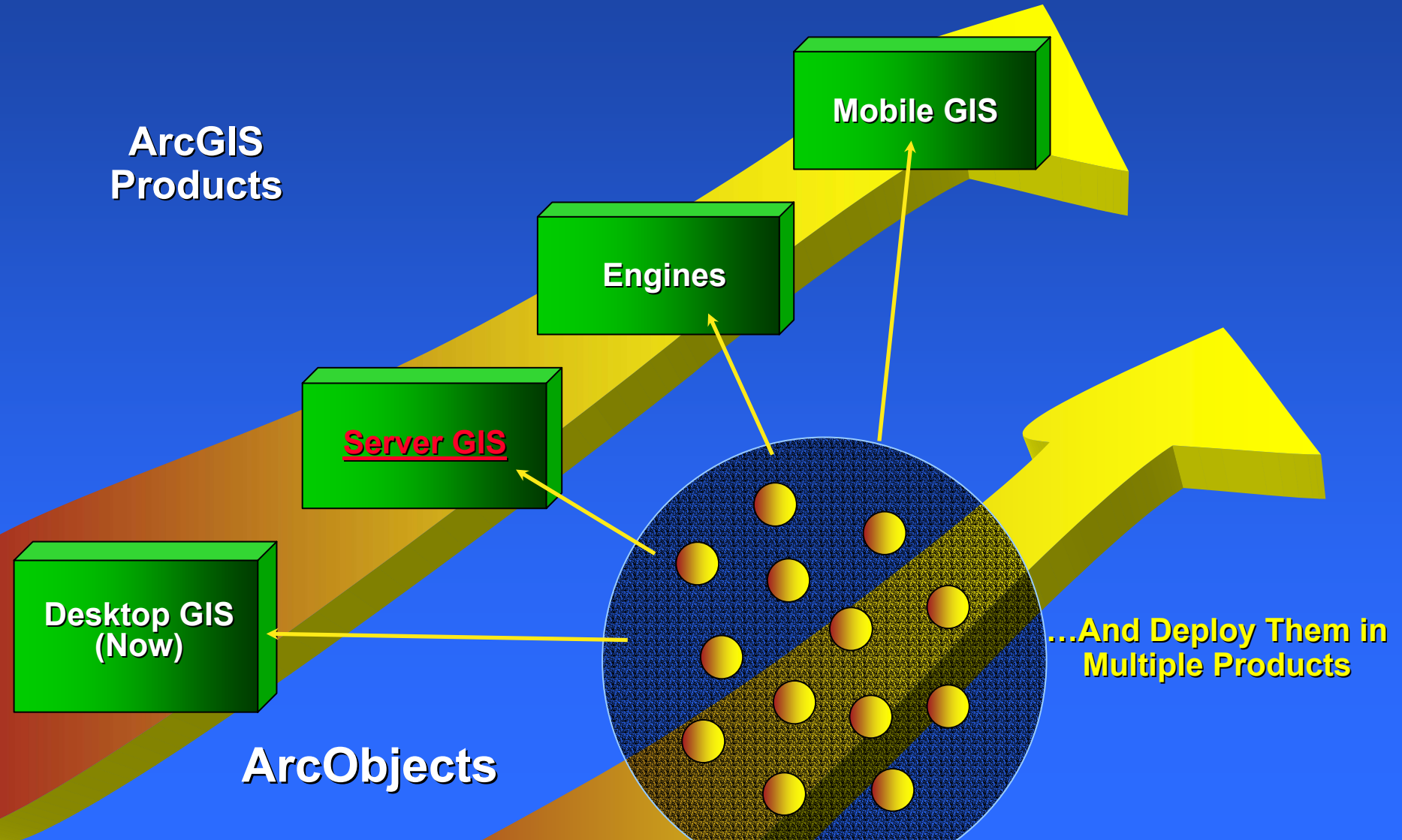
Engines

Server GIS

Desktop GIS  
(Now)

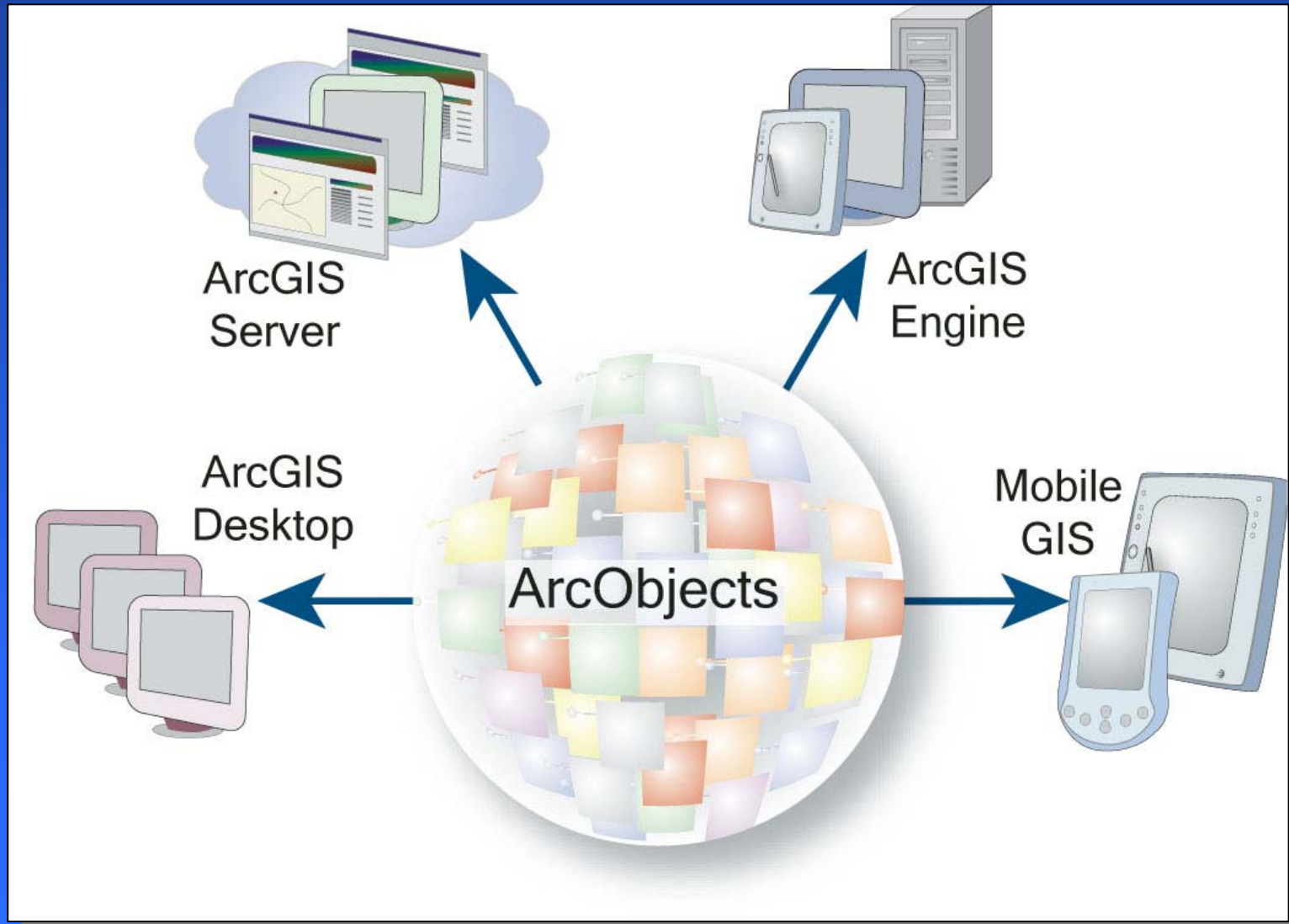
ArcObjects

...And Deploy Them in  
Multiple Products





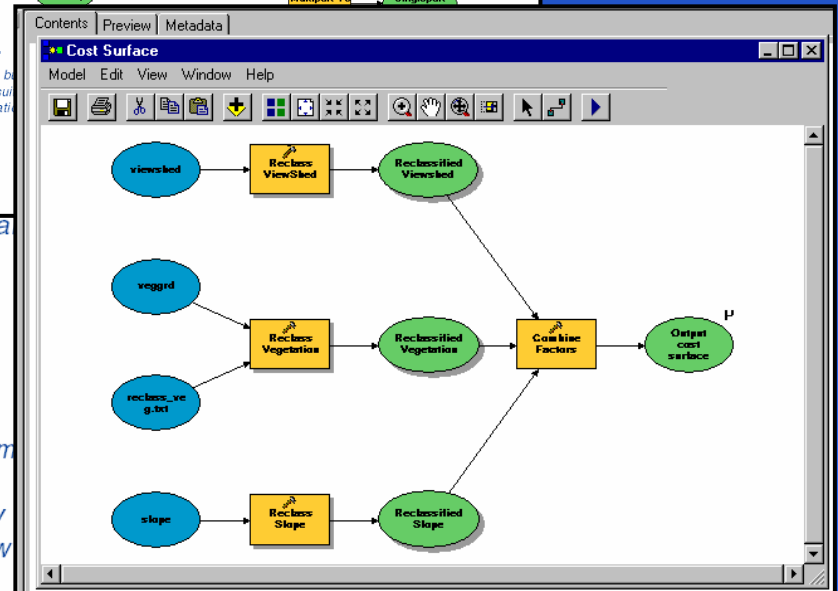
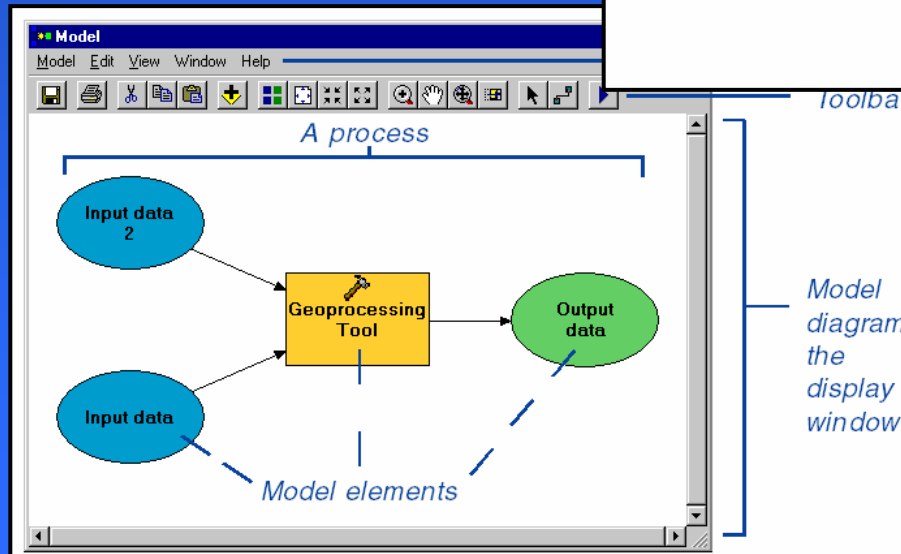
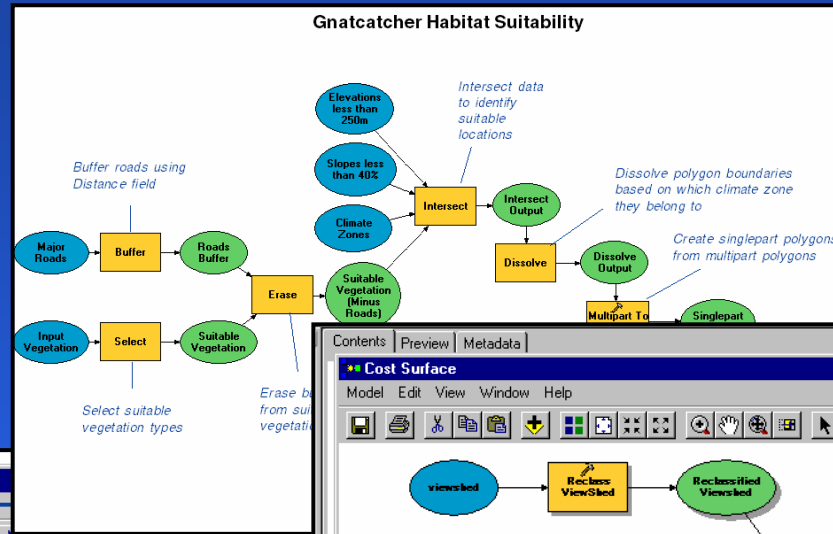
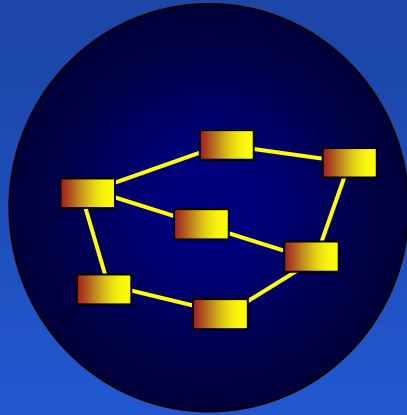
# This Allows GIS Functionality to be Deployed Anywhere . . .





# Geodatabase Encapsulates Models

## – Best Practices and Applications

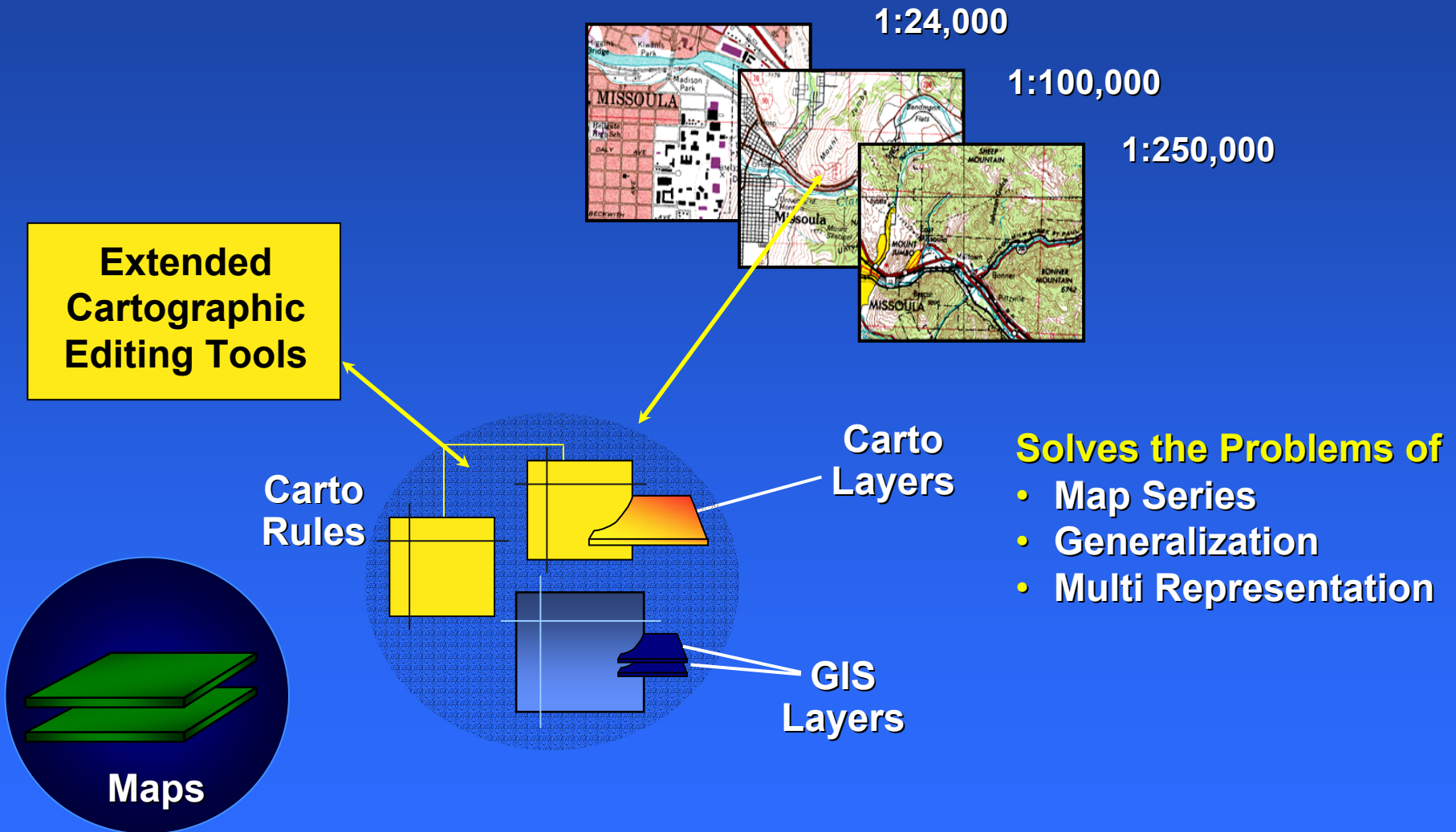


... Sharing Geographic Knowledge



# Geodatabases Will Manage Maps

## Database Cartography



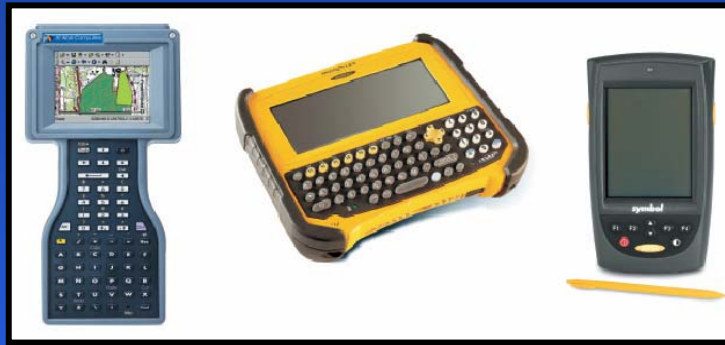
**A New Approach for Production Cartography**



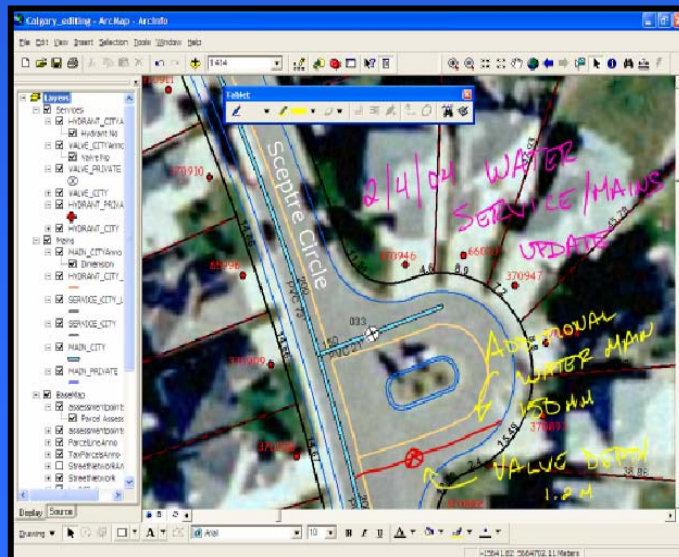
# Mobile GIS

## Tear-off, take GIS to the field

- Focused field applications on Mobile Windows CE and Pocket PC



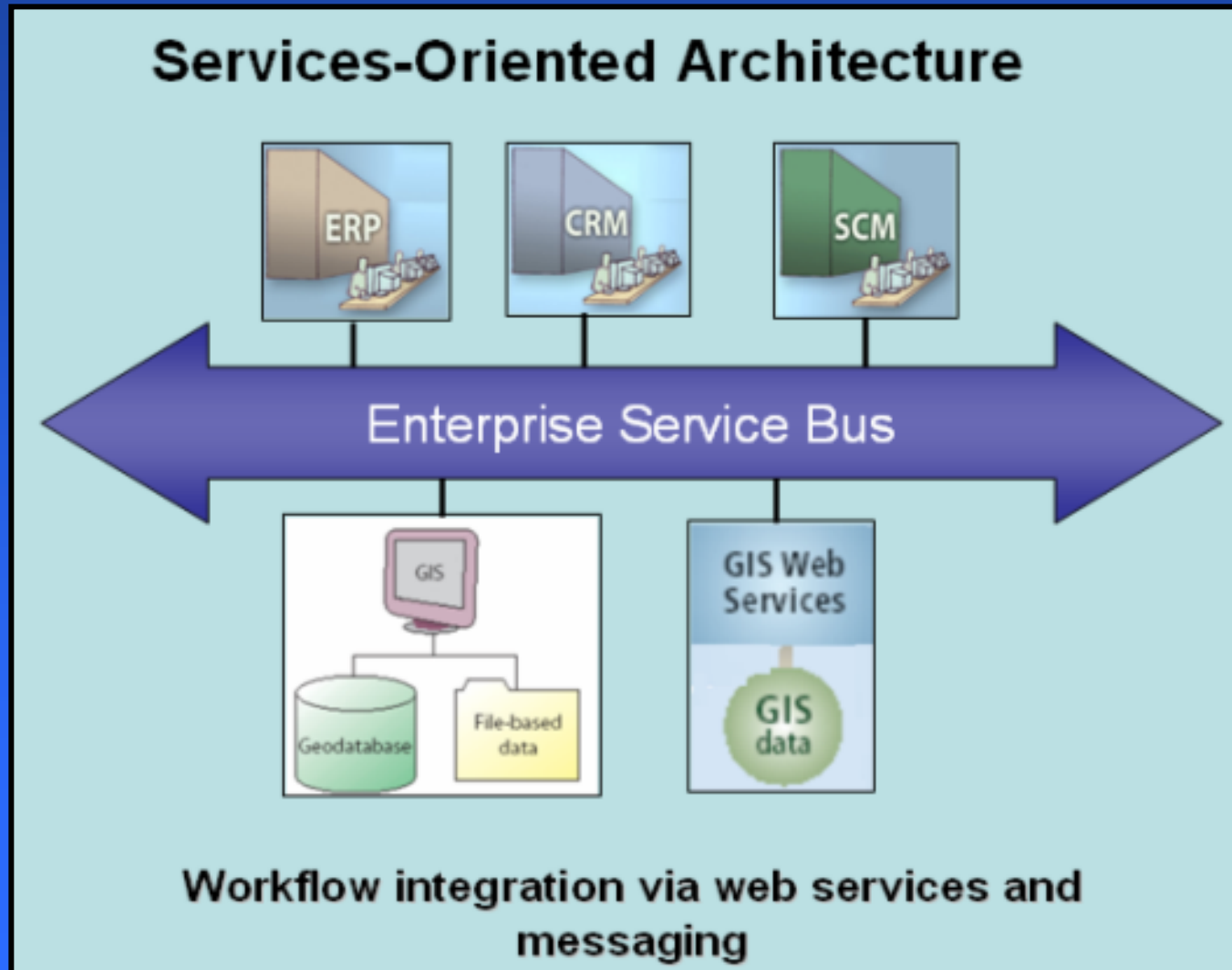
- More advanced field computing. Ink. Complete GIS logic





# Spatially enabling the DOI Enterprise

Starts with modeling (defining) business processes / workflows













# 52 Up To Date GIS Services

- Imagery
- Weather
- Geocoding
- Streets
- Mapping
- Routing
- Demographics
- Much More



...An Affordable Way to Rapidly Build Server Based Applications



