

ECONOMIC AND SOCIAL COUNCIL

**Seventeenth United Nations Regional Cartographic
Conference for Asia and the Pacific
Bangkok, 18-22 September 2006
Item 7 of the provisional agenda***

INVITED PAPERS

**THE ROLE OF GIS SERVICES, DATA AND PORTALS IN DISASTER MANAGEMENT –
PLANNING, RESPONSE AND RECOVERY**

Submitted by Environmental Systems Research Institute (ESRI) **

* E/CONF.97/1

** Prepared by Mr. Bill Shepherd, ESRI, Asia Pacific.

The Role of GIS Services, Data and Portals in Disaster Management – Planning, Response and Recovery

Bill Shepherd
ESRI, Asia Pacific



A faint, light blue world map is visible in the background of the slide, centered behind the main text.

Disaster Management - Why GIS?

Managing Disasters - Why GIS?

Bringing Together Our Complex Data & Knowledge



And Making It Accessible

Managing Disasters - Why GIS?

Better Decisions and Informed Action!



Providing Many Benefits

- Understanding
- Efficiency
- Cost Savings
- Improved Analysis
- Effective Planning
- Better Decision Making
- Better
 - Communication
 - Collaboration
 - Coordination

Historically Largely Applied Individual Systems

GeoWeb – The Geographically-Enabled Web

Many Services and Many of Communities

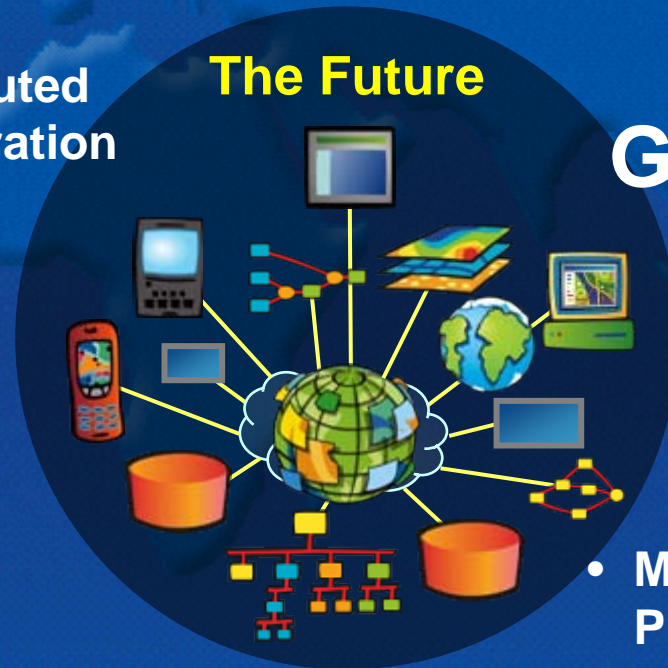
Distributed
Collaboration

The Future

GeoWeb

Mapping &
Visualization

Today



- Many Authors & Publishers
- Interconnected
- Interoperable
- Integrative
- Dynamic

The GeoWeb - Collaboration

Systems & Communities Leveraging One Another's Services

Breaking Down the Earth Into
Domains, Components and
Geographic Areas . . .



. . . Distributing Management

Requires

- Geographic Framework
- Collaboration
- Sharing Content
- Interoperability
- Enabling Technology

. . . Dynamically Integrating Our Common Geospatial Knowledge

A New Framework for “Seeing & Doing”

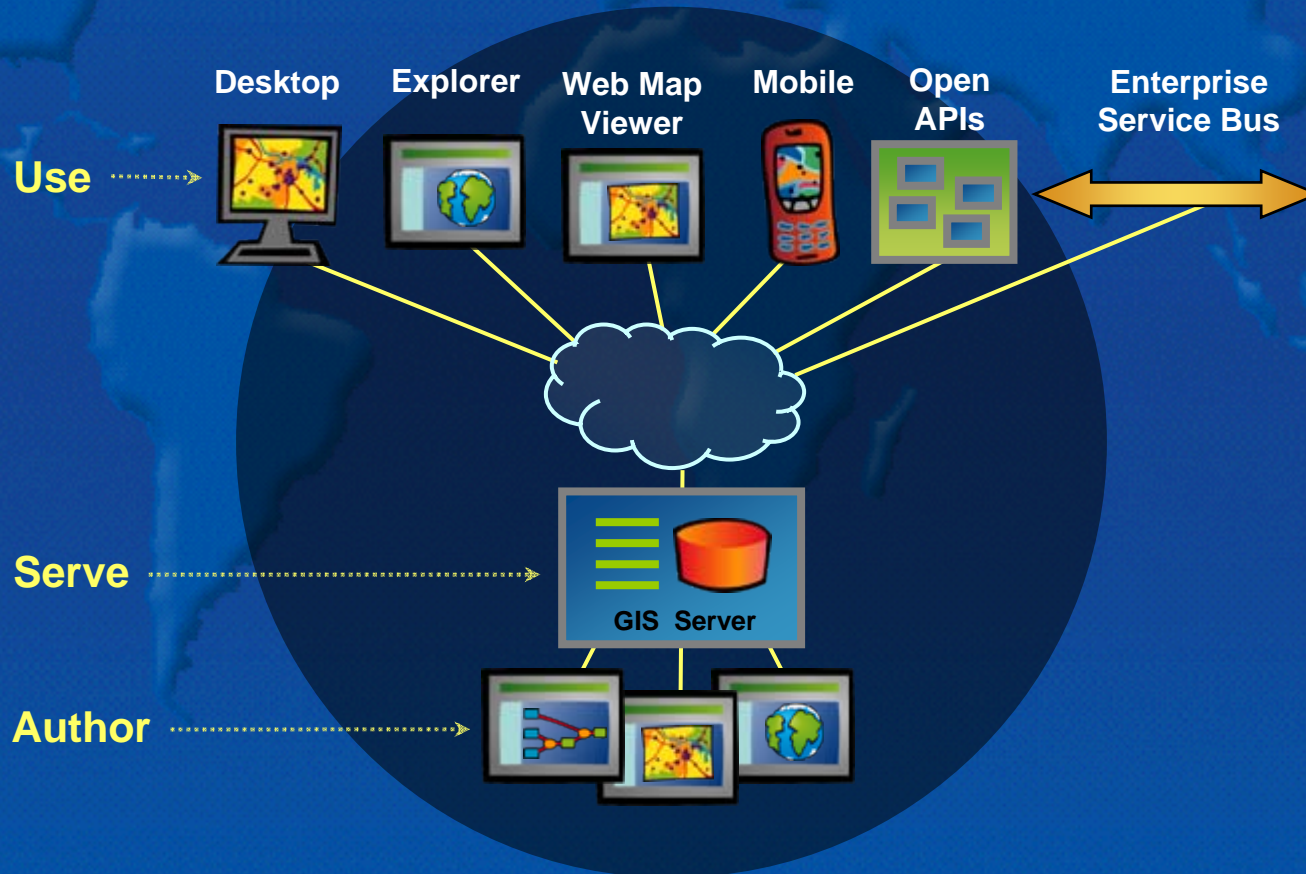
Building Understanding – Empowering Action



**The Common Operational Picture
... Changing How We Communicate**

Server-Based GIS Systems – Powering the GeoWeb

Managing & Disseminating Geographic Knowledge



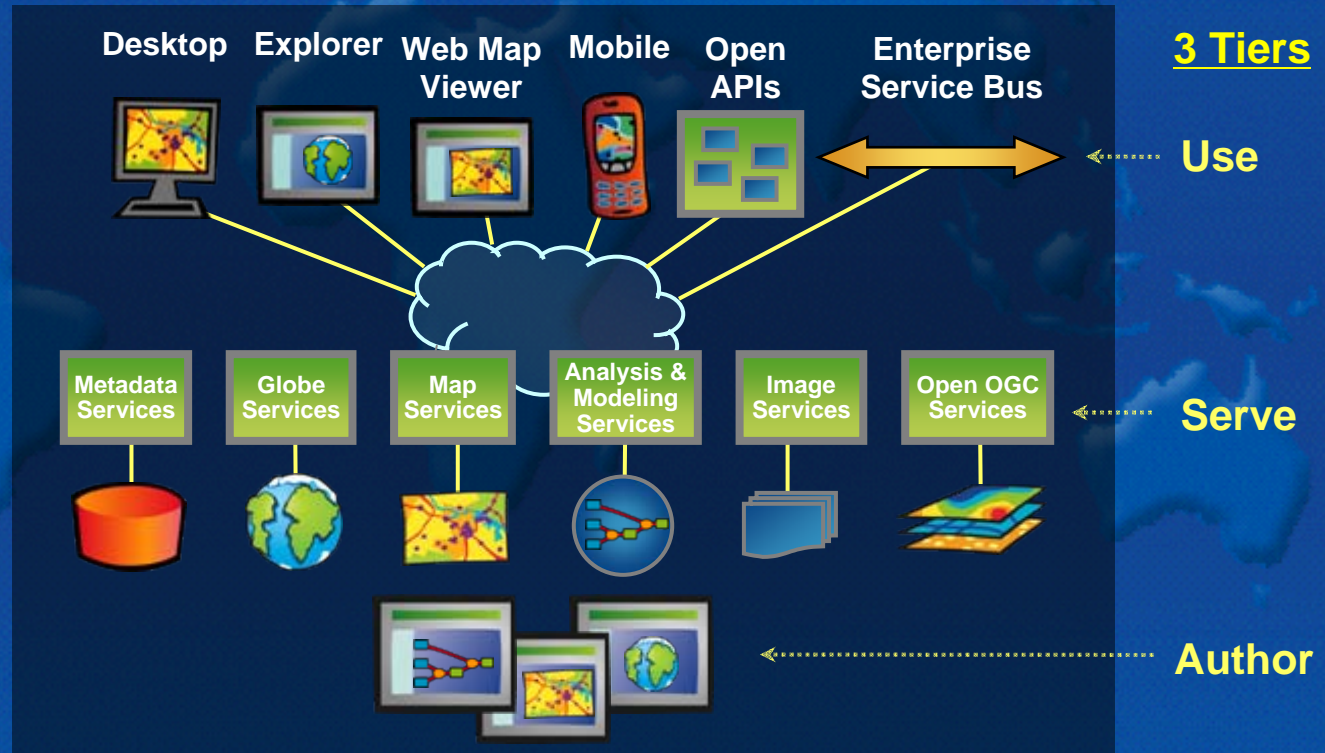
*Making GIS Knowledge Available To Anyone . . .
. . . Integrates With Other Systems Via Standards*

The Geographic Information System

For Authoring, Serving and Using GIS Knowledge

GIS Knowledge

- Metadata
- Maps
- Globes
- Data
- Models
- Data Models
- GeoServices



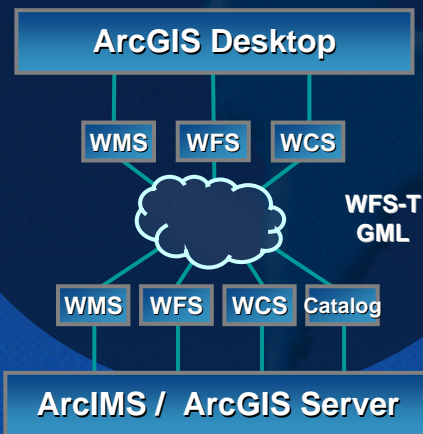
... And Integrates With Other Geospatial Technology and Standard IT Infrastructure

Standards Based Interoperability

Supporting Multiple Approaches

Technology Standards

- Web Services
- OGC/ISO
- DXF, KML . . .



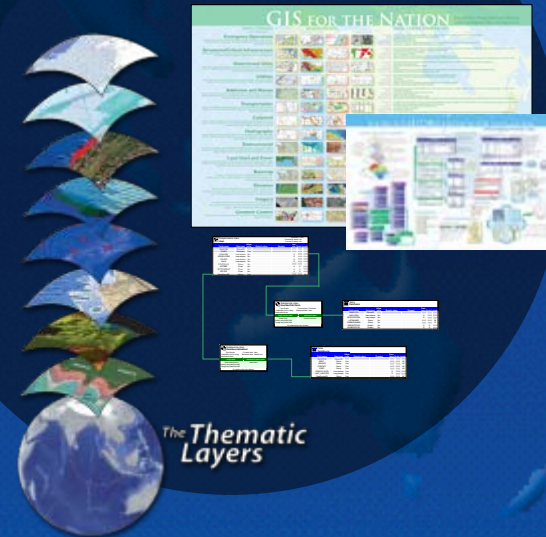
Transformation Procedures

- ETL: Extract – Transform - Load
- Formats
- Schema
- Semantic



Content Standards

- Data Models
- Metadata (19139)



Applying This to Disaster Management

The Context

- Recent World events, natural or human caused, continue to challenge and tax our collective ability to respond.
- In every instance we have witnessed an outpouring of care and a commitment to improve.
- In every case there has been a need for collaborative approaches and integrated systems.
- Each in their own way is dependent on critical information, critical resources and infrastructure.

Common Objectives

- **Protection of life and property.**
- **Provide critical and timely information.**
- **Provide the appropriate and timely response.**
- **Provide for basic life support needs.**
- **Provide for expedited recovery.**
- **Seek improvements and expand capacity.**

Common Challenges

- **Planning and Mitigation to All Phases of the Disaster:**
 - **Planning and Mitigation**
 - **Readiness**
 - **Response**
 - **Recovery**

Common Need

- **Timely acquisition of information**
- **Shared and combined information**
- **Compartmentalize information**
- **Multiple information sources and arrays**
- **Secure and dependable dissemination of information**
- **Appropriate use of information technology**

Desired Outcome

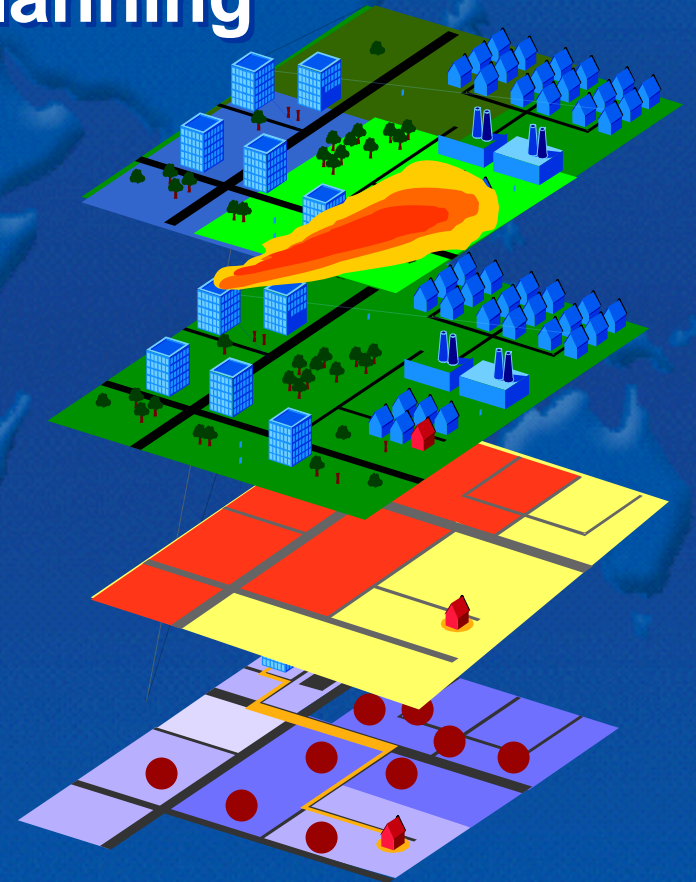
- **Common Information Framework**
- **Base Information**
- **Real Time Information**
- **Simulation Capacity**
- **Uniform Data Standards**

Planning and Analysis

Disaster and Emergency Planning

Event modeling to understand potential incident effects

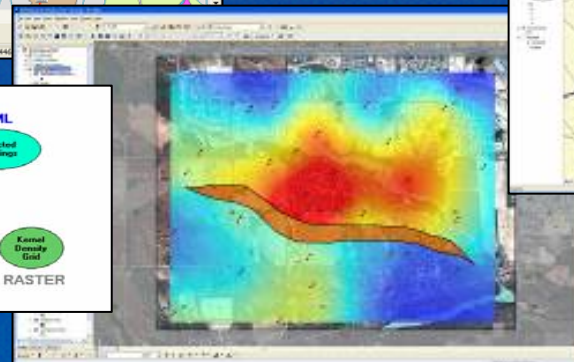
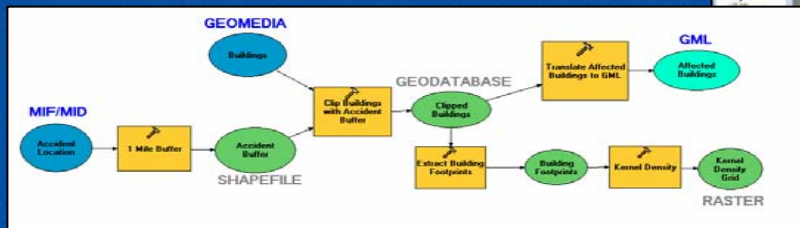
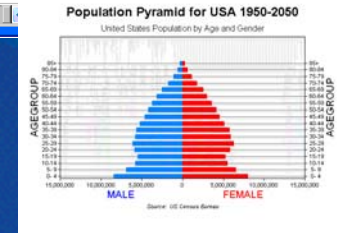
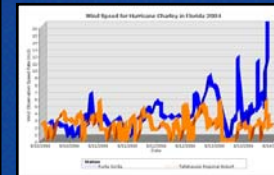
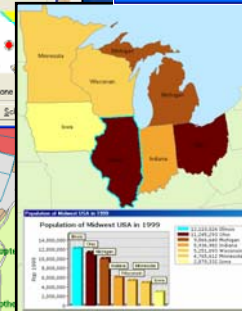
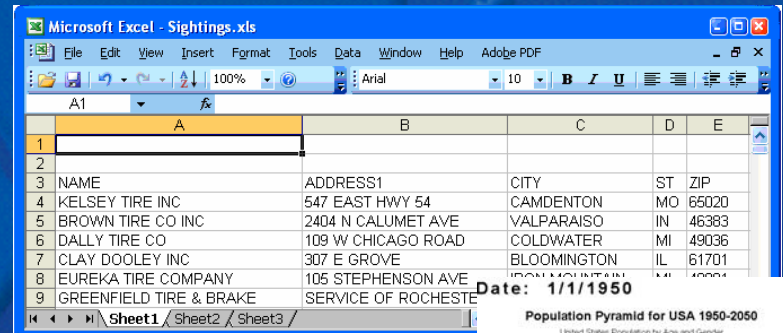
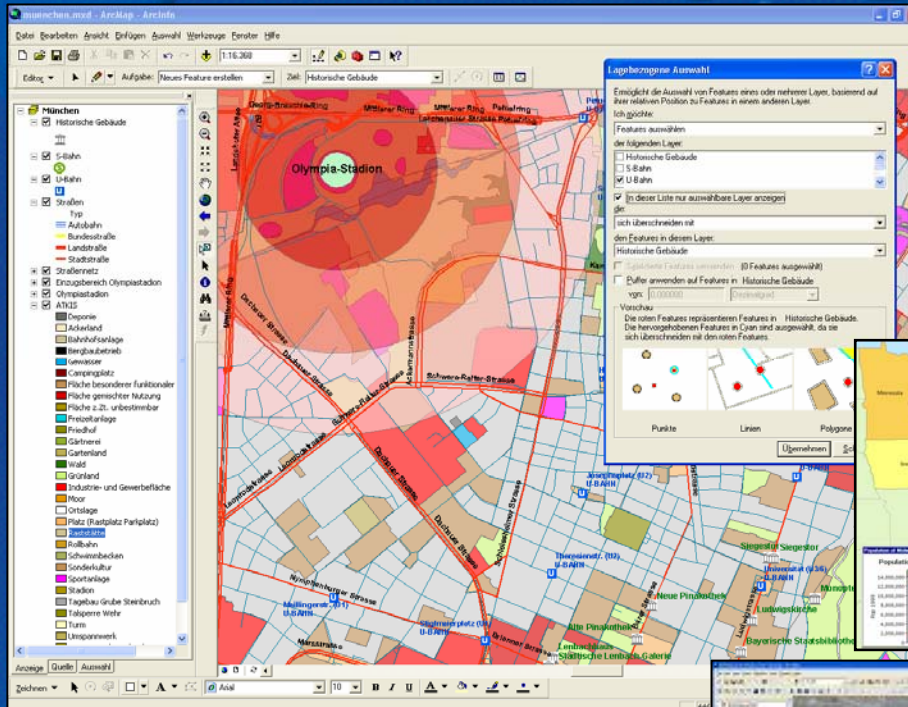
- Locate values at-risk areas for prevention/mitigation needs
- Identify natural and Technological hazards
- Understand the geographic distribution of incidents
- Plan Mitigation efforts



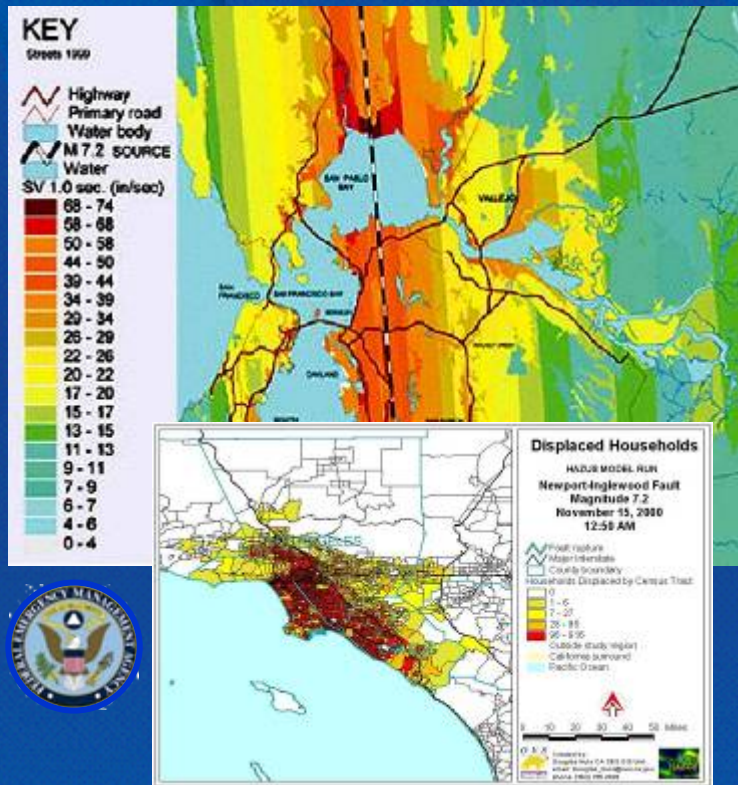
Planning is a process, not an event!

Desktop GIS

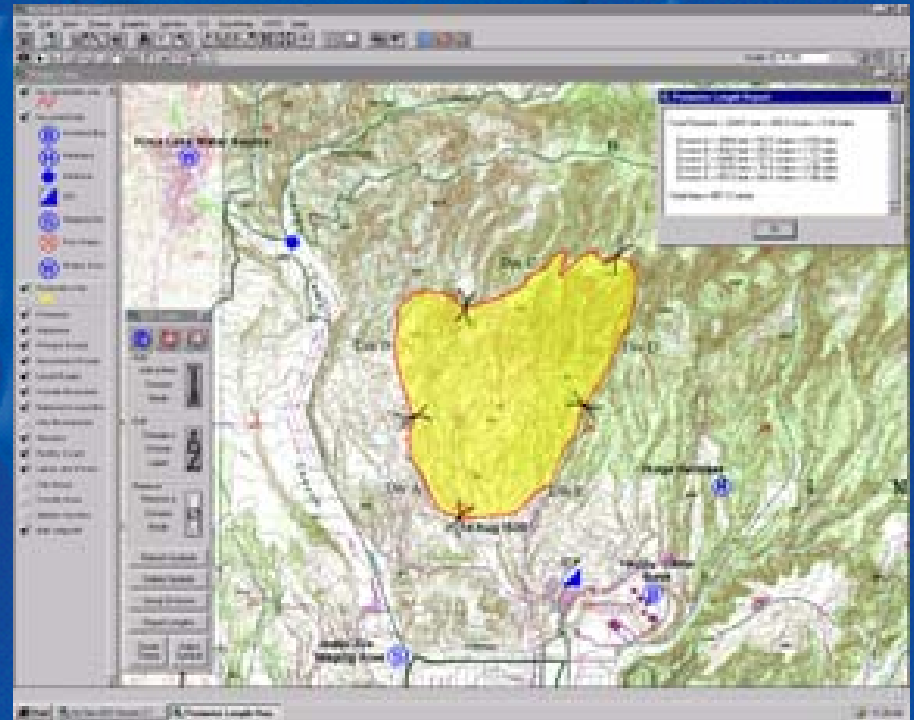
Authoring and Using Geographic Knowledge



Disaster Preparedness – Planning Specialized Tools and Applications

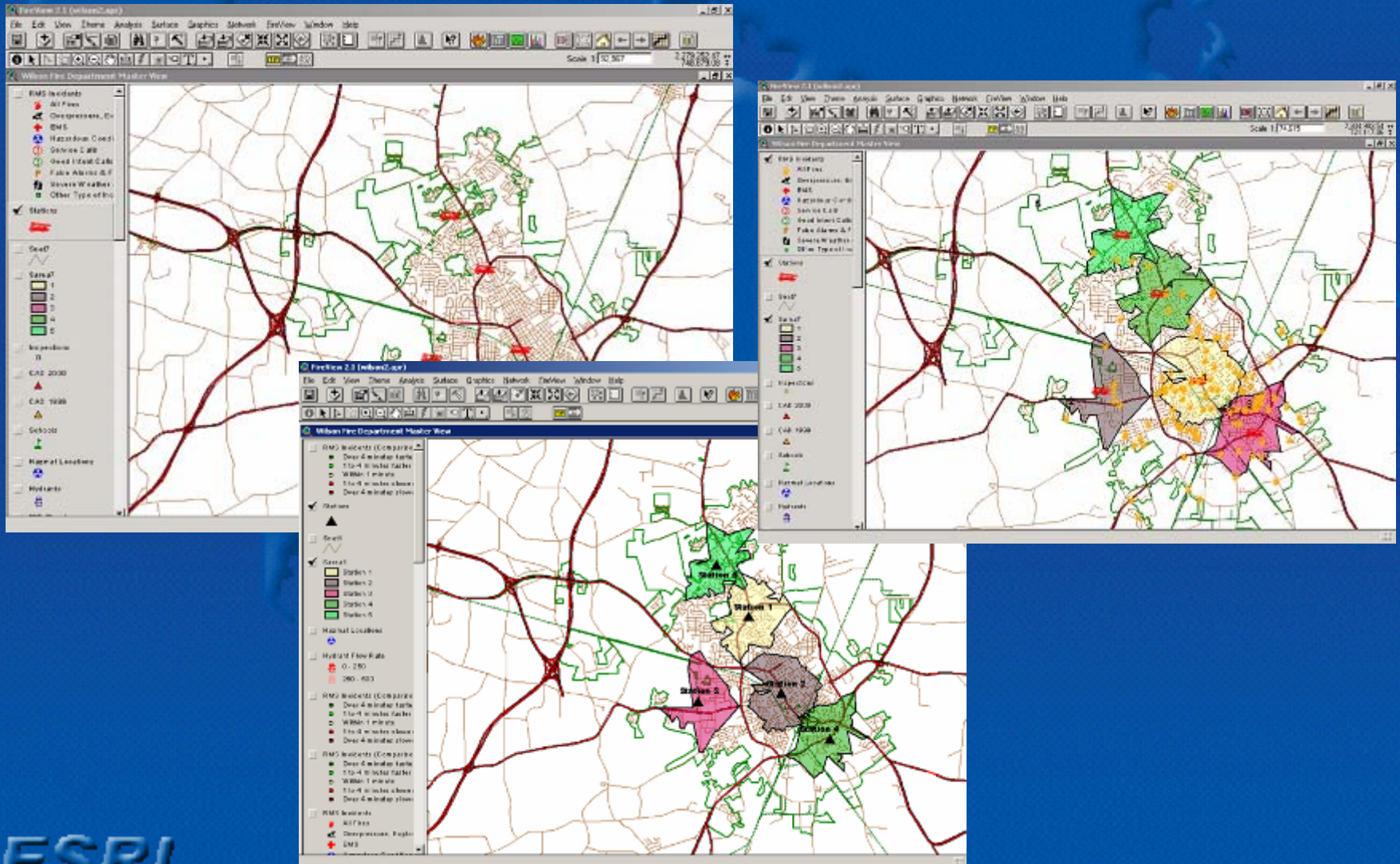


HAZUS - FEMA

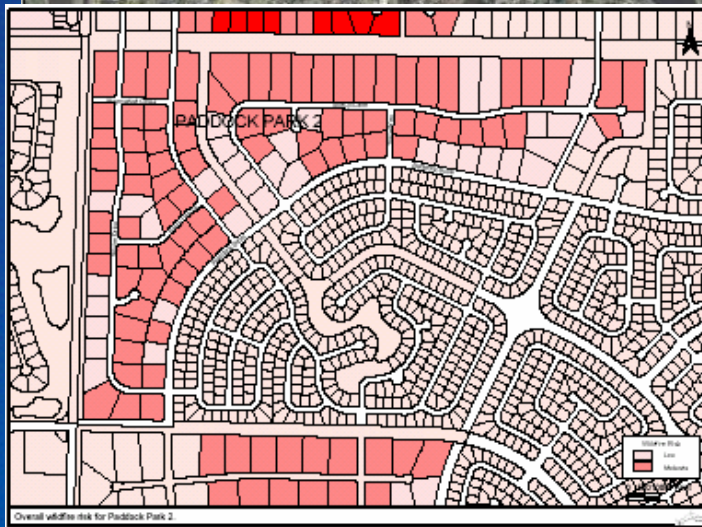
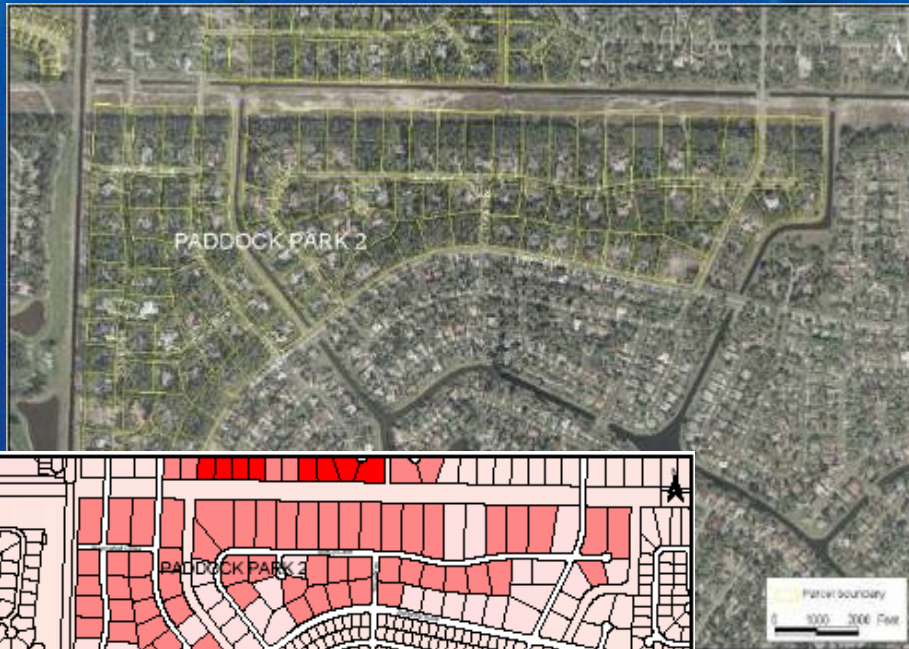


Incident Command System Tools _USFS

Structural Fire Planning FireView – GIS Desktop Application



Wildfire - Mitigation Planning Tools

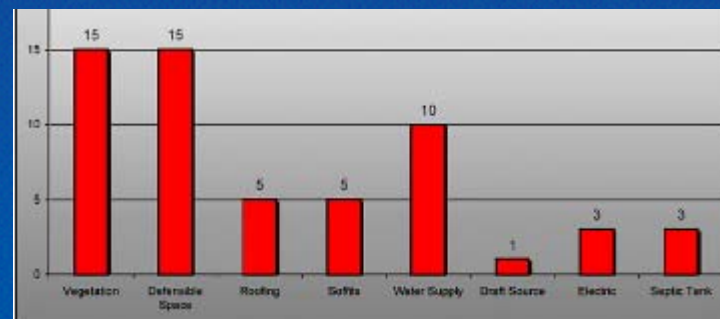


VILLAGE OF WELLINGTON
WILDFIRE MITIGATION PLAN

30 September 2002

Prepared by:
Wellington Wildfire Mitigation Technical Advisory Committee

Village of Wellington
14000 Greenbriar Boulevard
Wellington, Florida 33414



Wildfire - Server-Based Planning Applications Browser-Based Interfaces

Firewise Mapping System - Powered by EOS Education Project

Scale 1: 1,142,621

Layers Legend Search

State: Montana

County: [Select]

Watershed: [Select]

Fire District: [Select]

Address: [Text]

Street Name: [Text]

Latitude (NAD): [Text]

Longitude (NAD): [Text]

PLEASE FIRE

Map Region Center

Center of Map: Latitude 47°34'N, Longitude 111°27'W

Firewise Mapping System - Powered by EOS Education Project

Scale 1: 94,162

Layers Legend Search

State: Montana

County: [Select]

Watershed: [Select]

Fire District: [Select]

Address: [Text]

Street Name: [Text]

Latitude (NAD): [Text]

Longitude (NAD): [Text]

PLEASE FIRE

Map Region Center

Center of Map: Latitude 47°34'N, Longitude 111°27'W

Firewise Reporting System - Microsoft Internet Explorer

Firewise Property Rating Reports

Report 1 of 1 Reports

VIEW OWNER

Property Information

County: 340200000000

3003 PARK LAKES RD

Missoula County, Montana

Legal: B1 S 10 N 10 W P4 N1 PLATS P4, P4 & P3 20-15-21 30-0

Owner Name

Structure Information

Location: [Text] Latitude: 47.000000

Longitude: -114.200000

Building Date: [Text]

Description: single story attached garage detached w/ building

Other Info: [Text]

Firewise Rating

QUALIFIED COLLECTED DATA! [Click Here for Data](#) (Login Required)

Measure of Access	Subcategory	Description	Score
Measure of Access	A1: Access and Egress	Over road and On	7
	A2: Road Width	Less than 20 feet wide	4
	A3: Access Road Condition	Deteriorated, grade > 7%	2
	A4: Fire Service Access	Dead End Roads > 200 feet	5
	A5: Street Signage	Present (4 in., reflective)	8
Vegetation (Fuel Loads)	B1: Fire Resistant Vegetation	Heavy	20
	B2: Defensible Space	Less than 30 feet	20
Topography within 300 ft	C1: Slope	Between 21% and 35%	7
Additional Rating Factors (B)	D1: Topography that adversely affects wildland fire behavior...		8
	D2: Areas with history of higher fire occurrence...		3
	D3: Areas of seasonally severe fire weather and winds...		4
	D4: Orientation of adjacent structures		8

Firewise Reporting System - Microsoft Internet Explorer

Firewise Mapping System - Powered by EOS Education Project

Scale 1: 11,932

Layers Legend Search

State: Montana

County: [Select]

Watershed: [Select]

Fire District: [Select]

Address: [Text]

Street Name: [Text]

Latitude (NAD): [Text]

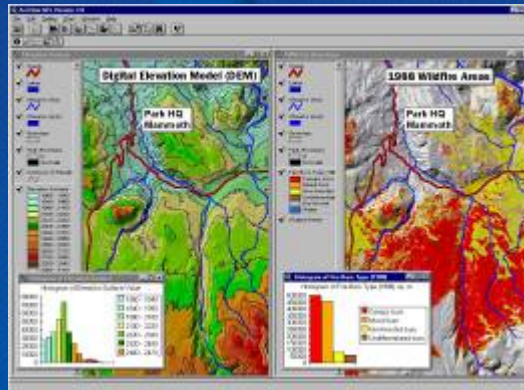
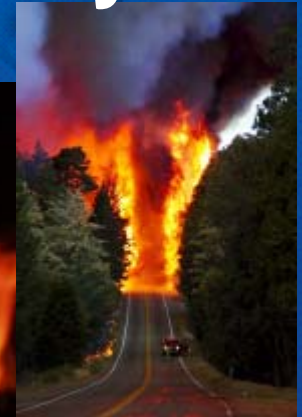
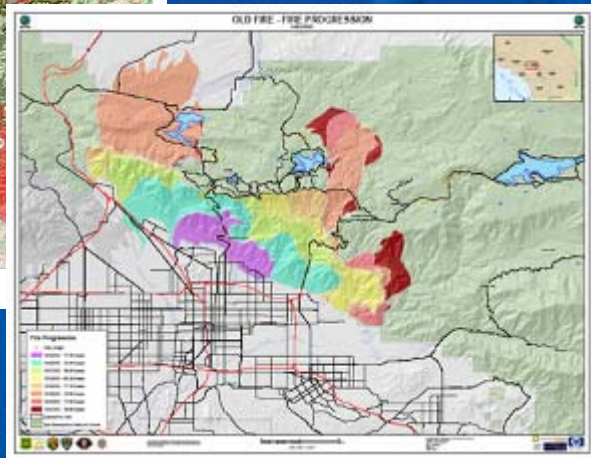
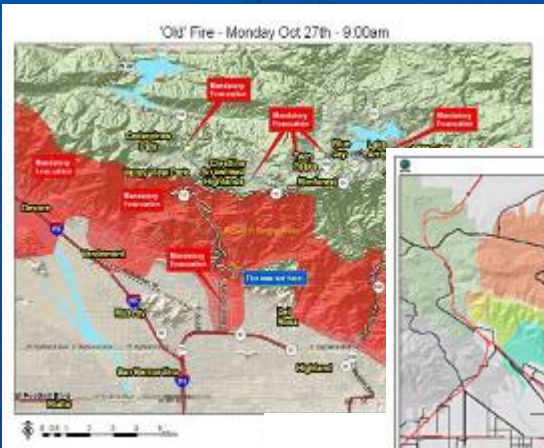
Longitude (NAD): [Text]

PLEASE FIRE

Map Region Center

Center of Map: Latitude 47°34'N, Longitude 111°27'W

Wildfire – Response and Recovery



ESRI



GIS for Disaster Management – Planning, Response & Recovery

- **Planning is a very important component of Disaster Preparedness**
- **The Cost and Effectiveness of the Disaster Response and Recovery are Tied to the Extent and Appropriateness of the Planning!**

GIS for Disaster Management – Planning, Response & Recovery

- Floods
- Earthquakes
- Tsunamis
- Hurricanes
- Hail Storms
- Wind Storms
- Special Events

GIS Was Used Extensively in Response to Hurricane Katrina

Hundreds Of Separate Mission Focused Efforts



Great Demand for Maps and Geospatial Analysis

Many Examples Of Powerful GIS Applications

Forecasting and Tracking

Demographic Analysis

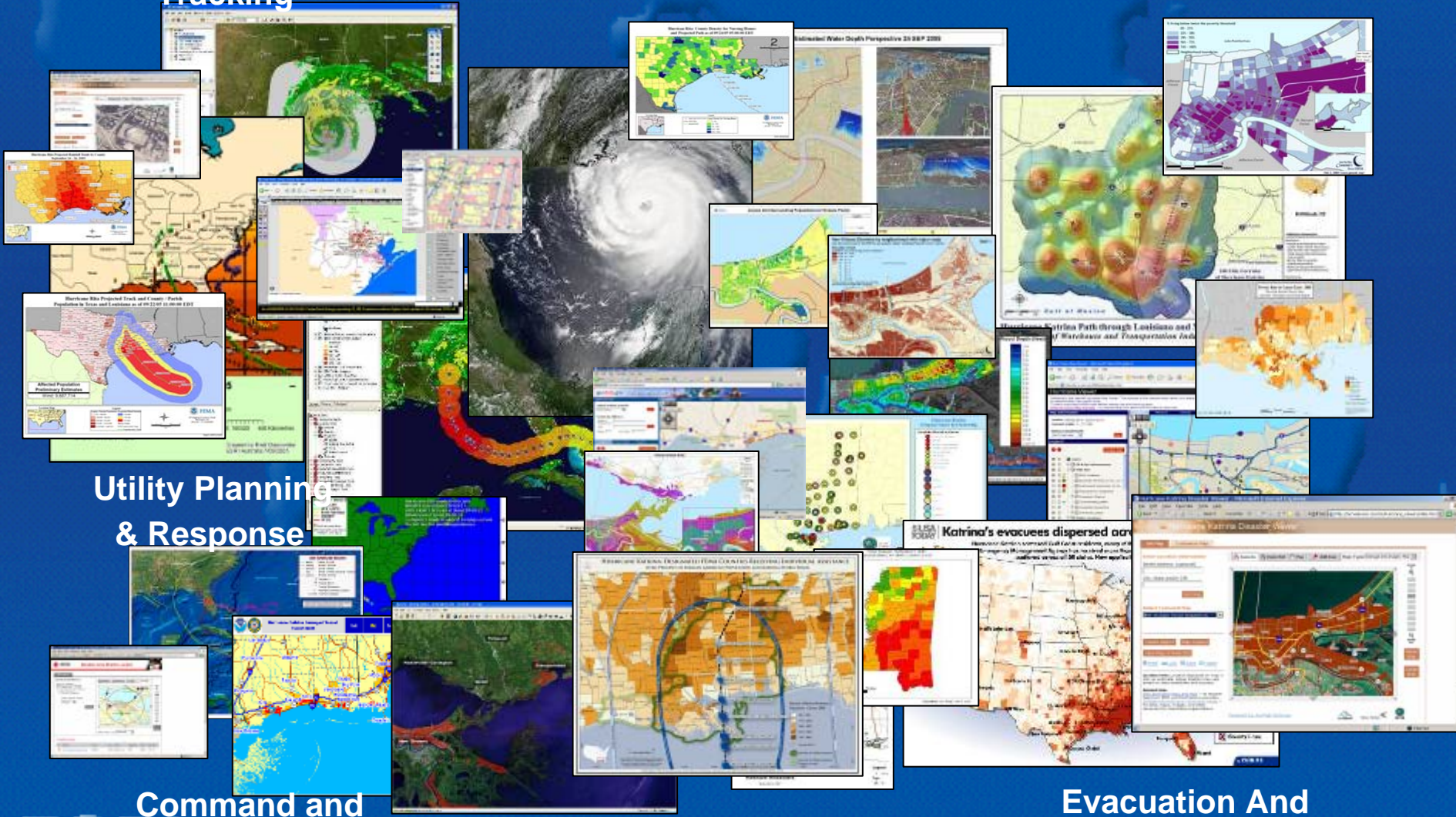
Flood Status Visualization

Utility Planning & Response

Command and Control

Damage Assessment

Evacuation And Rescue



There Was Very Little Preparedness of Geospatial Infrastructure

... Required A Lot of Heroic Efforts

- Metadata on Web
- Data Discover Acquisition
- Processing
- Data Modeling
- Application Development
- System Acquisition/Installation
- Training

... Done Repetitively, Inconsistently, and with Considerable Cost

They Envisioned and Began to Create a “GIS for the Gulf”

- Extended Database
- Integrated Data Model
- Distributed via Web and Media
- Consistent/Responsible Application

... Datasets Assembled and Distributed in 14 Days

ESRI

... A Model for GIS for the Nation

Responding To The Crisis – *A Multi Agency Effort Created An Integrated Database for the Gulf*

*Priority Areas Of
Louisiana, Alabama, Mississippi and Texas*

- Integration Of Existing Data
- Standard Data Model
- Consistent Applications
- Dissemination Via Web and Media



New Orleans



Houston

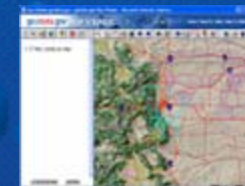
An ETL Interoperability Process Was Used

Integrating And Disseminating Existing Local, State And Federal Data

**National
Data Model**



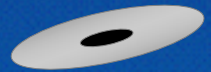
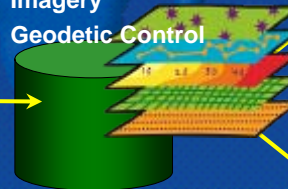
- Emergency Operations
- Structures/Critical Infrastructure
- Governmental Units
- Utilities
- Addresses
- Transportation
- Ownership Parcels
- Hydrography
- Environmental
- Land Use/Land Cover
- Base Map
- Geodetic Control
- Elevation
- Imagery
- Geodetic Control



**Data
Model**

**Data &
Services**

Data Bricks



- Data Sets**
- Local Gov
 - State Gov
 - Federal Gov
 - Commercial

- Spatial ETL**
- Transformation
 - Conversion
 - Integration

**Database
And Server**

DVD Data Sets

GIS for the Nation (State and City)

data themes

Emergency Operations

Structures/Critical Infrastructure

Governmental Units

Utilities

Addresses and Names

Transportation

Cadastral

Hydrography

Environmental

Land Use/Land Cover

Base Map

Elevation

Imagery

Geodetic Control

scales of use

national/state regional/country city neighborhood

GIS FOR THE HOUSTON COMMUNITY

AN INFORMATION MODEL FOR LOCAL, COUNTY, REGIONAL, STATE, AND NATIONAL GIS

data themes and strategies

Emergency Operations

Structures/Critical Infrastructure

Government Units

Utilities

Addresses and Names

Transportation

scales of use

national/state regional/country city neighborhood

GIS FOR TEXAS

AN INFORMATION MODEL FOR LOCAL, COUNTY, REGIONAL, STATE, AND NATIONAL GIS

data themes and strategies

Emergency Operations

Structures/Critical Infrastructure

Government Units

Utilities

Addresses and Names

Transportation

Cadastral

Hydrography

Environmental

Land Use/Land Cover

Base Map

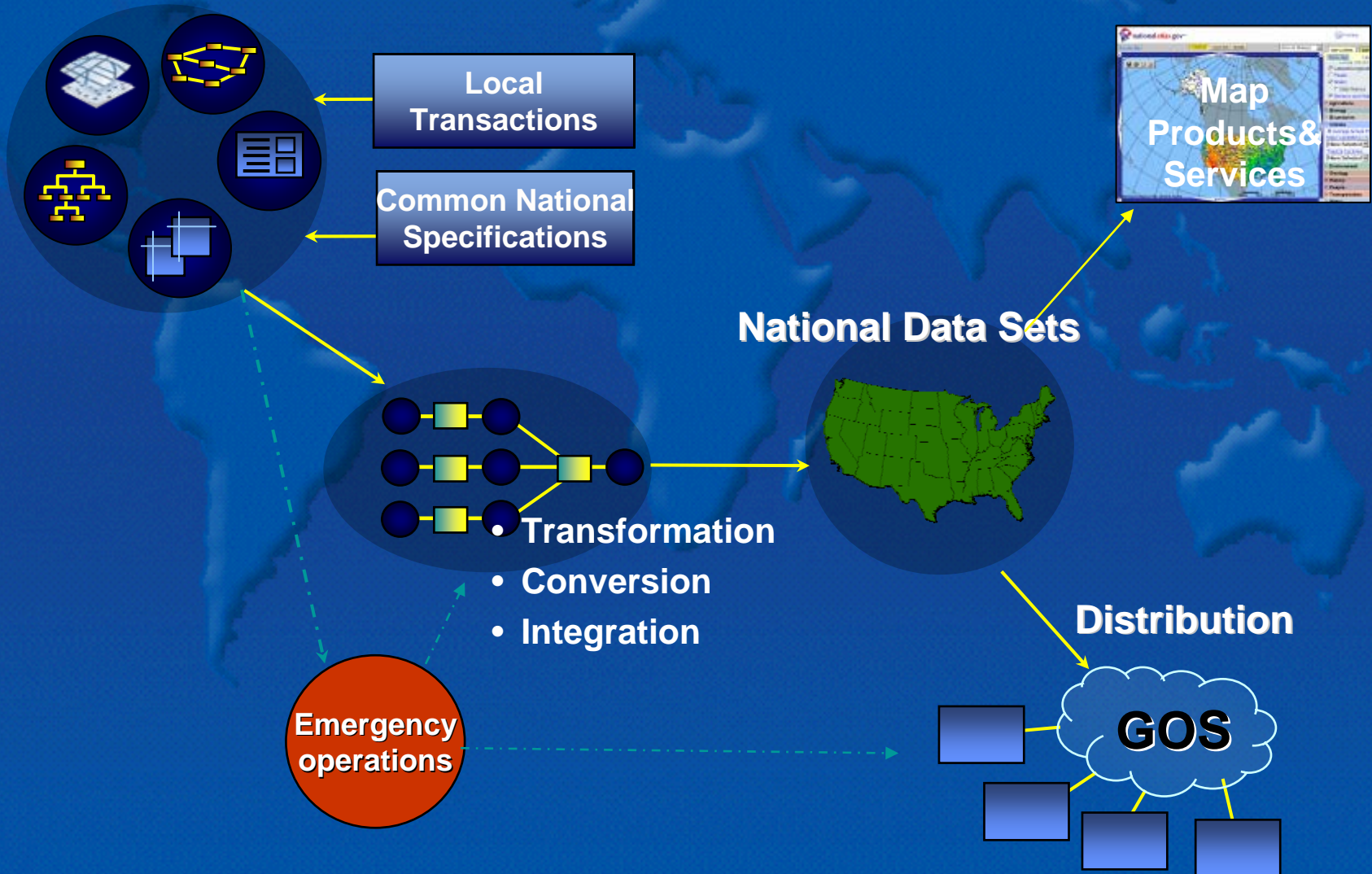
Elevation

Imagery

Geodetic Control

Emerging Geospatial Community Vision

Local Data Sets



ESRI High-Quality Data Compiled from Local Sources

This Event Is Full Of Lessons For The Geospatial Community

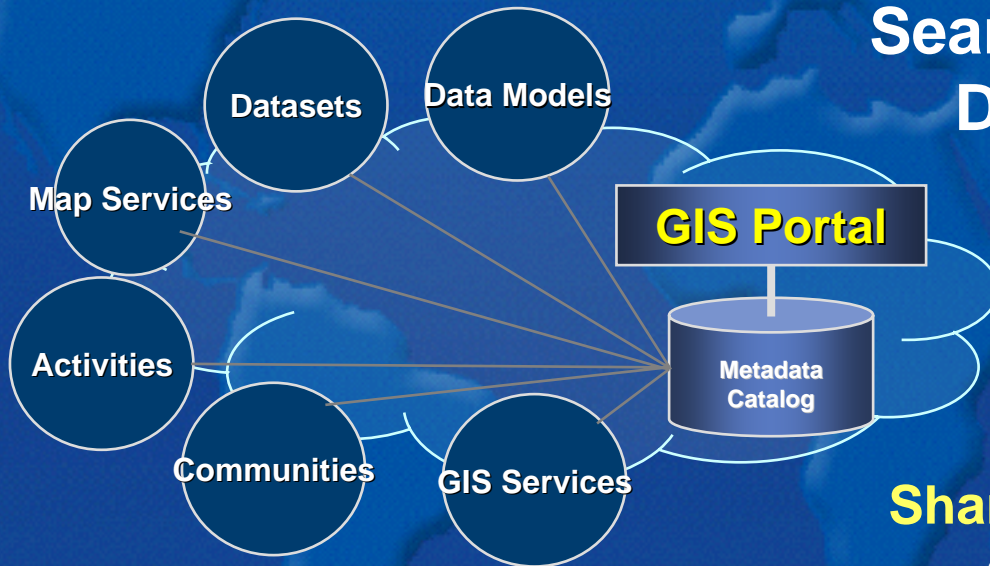
- Planning
- Data
- Organization
- Methodology
- Collaboration
- Infrastructure



- ***Significant work was done . . . but not efficient***
- ***Success required heroic efforts***
- ***Many data collection efforts were repetitive, inconsistent, & costly – consuming time and resources***
- ***No integrated Situational Awareness existed***
- ***A multi-purpose database was needed***
- ***Data sharing needs to be part of future emergency response plans***

The Important Role of GIS Portals

Search for and Access GIS
Data and Web Services



Shared Catalog that References

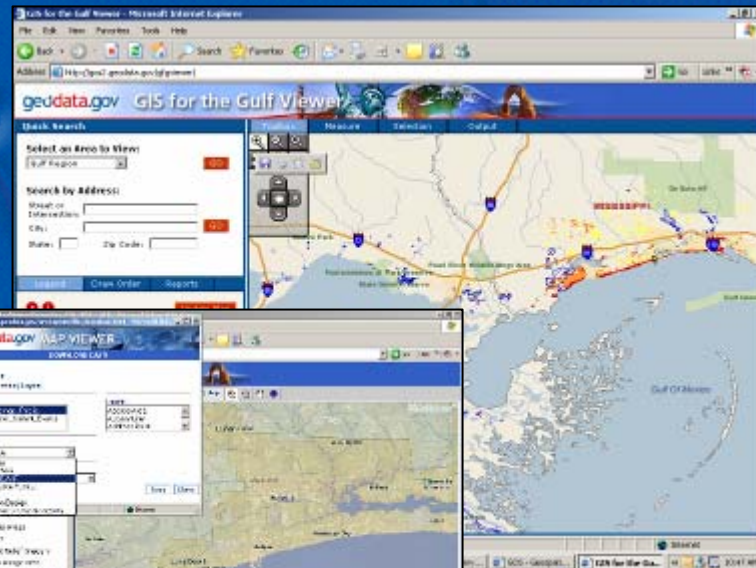
- Datasets
- Maps
- Map Services
- Models
- GeoServices
- Data Models
- Communities
- GIS Activities

Key Role of GeoSpatial Portal

GeoSpatial One-Stop (Phase 2)



Special Channel



Fusion of Data & Services



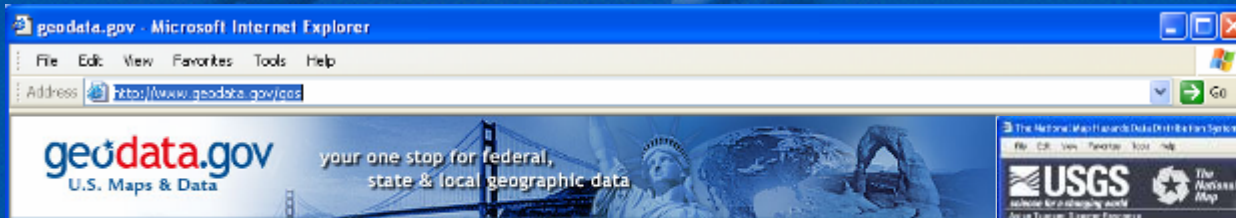
Communities



Marketplace

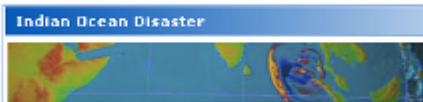


GeoSpatial One-Stop – Tsunami Response



Geodata.gov is part of the [Geospatial One-Stop E-Gov initiative](#) providing access to geospatial data and information. For help use the [Quick Start Guide](#).

To find geospatial data that meets your specific criteria:
 Select "Search all data in this site", in left column,
 -- OR --
 For quick access to featured geospatial resources by subject:
 Click on one of the Categories or Sub-Categories below.
 Click "+" sign to see sub-categories.



Data Categories

- ➔ Administrative and Political Boundaries
- ➔ Agriculture and Farming
- ➔ Atmosphere and Climatic
- ➔ Biology and Ecology
- ➔ Business and Economic



GIS for Nation

The Role of the Lead Agency

- **Setting the Data Standards**
- **Digital Data Compilation**
 - “Intermediate” Data Products
 - Ortho-imagery
 - DEM’s
 - Map Series as Imagery (e.g., Historical)
- **Map Production**
- **GIS Web Services**
- **Hosting the GIS Catalog Portal**
- **Leading role in a federated “GIS for each Nation”**



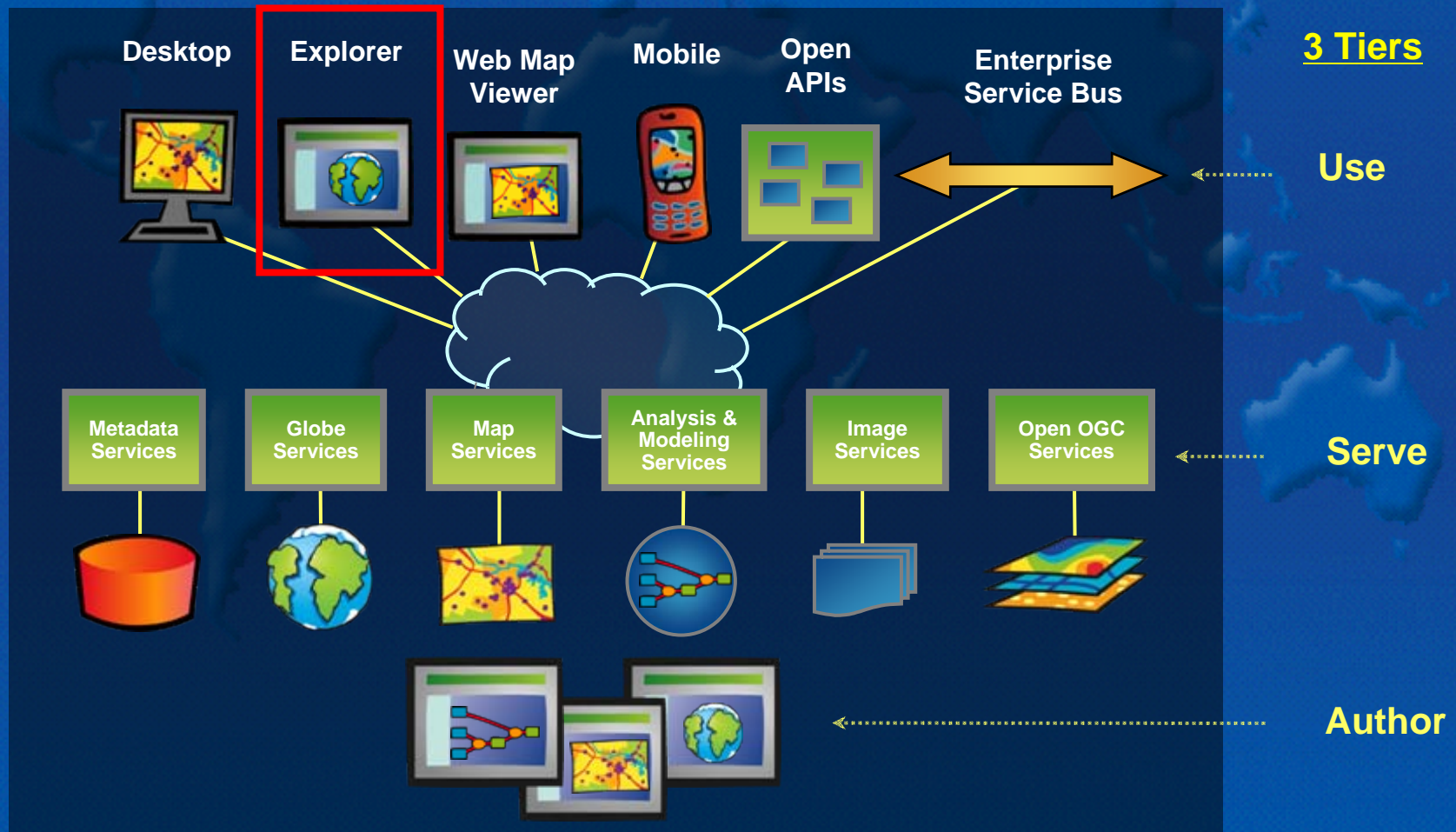
ESRI

New Developments – New Opportunities



The Geographic Information System

For Authoring, Serving and Using GIS Knowledge



ArcGIS Explorer – An Introduction

- A No-Cost, General Purpose GIS Viewer and Application
 - ArcGIS Server
 - 2D Maps, 3D Globes, Tasks
 - ArcIMS
 - ArcWeb Services
 - WMS
 - Other Web Services
- And More
 - Swipe and Transparency Tools. Identify, etc...
 - Task-Based GIS Analysis

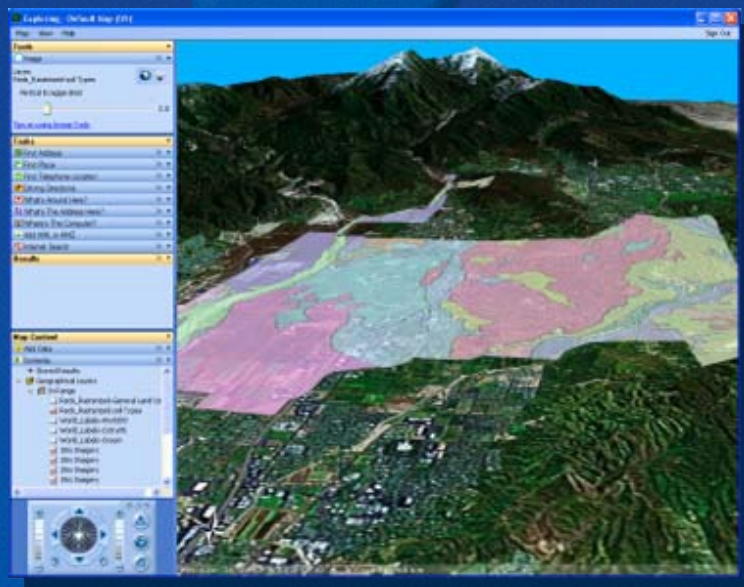




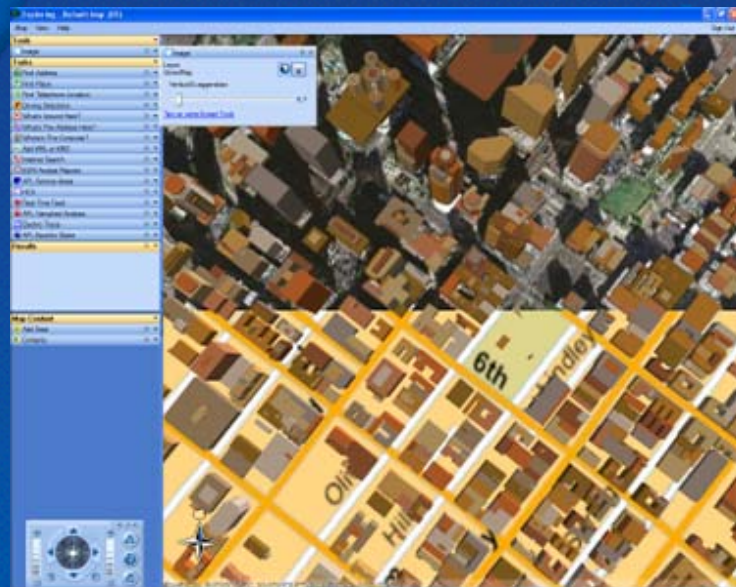
ArcGIS Cartography



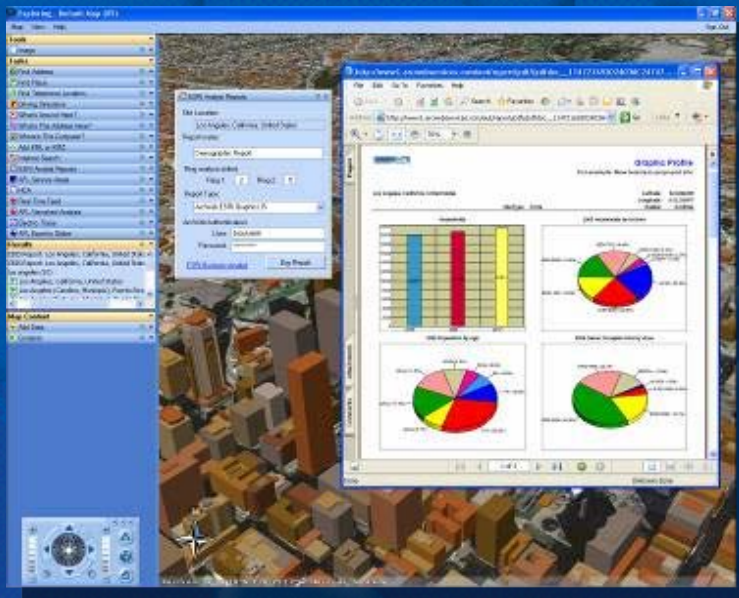
3D Visualization



Local Data



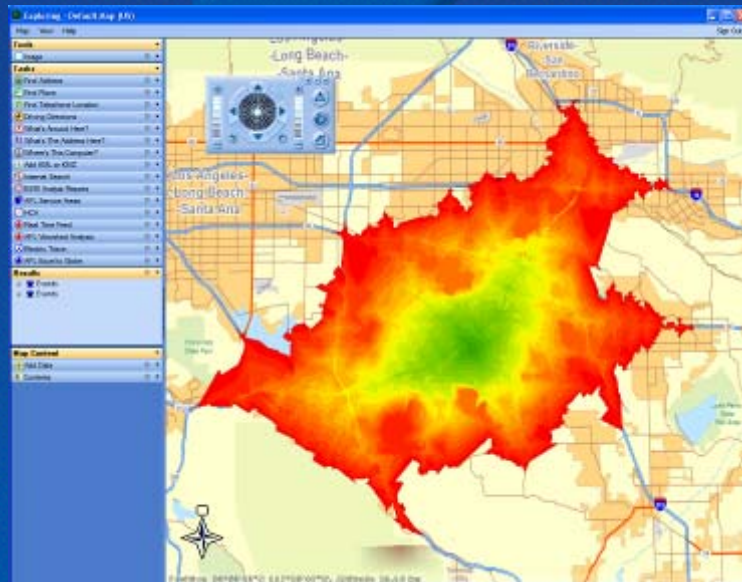
Swipe / Transparency



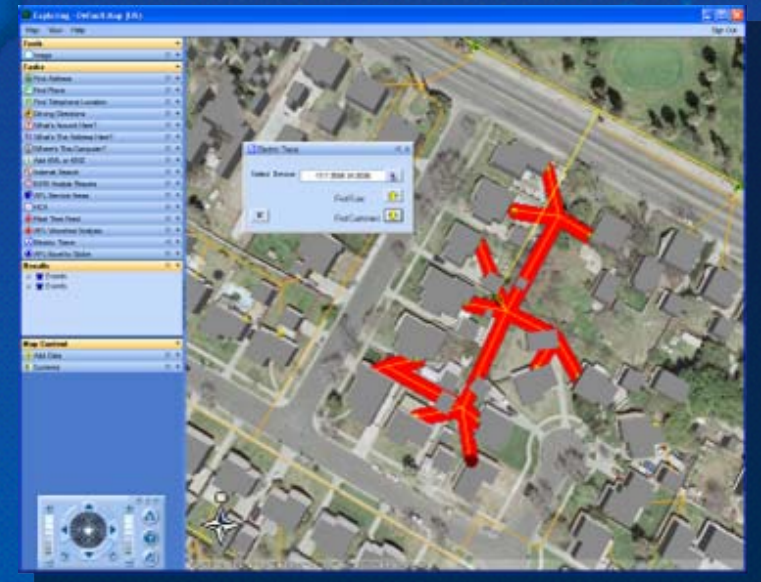
Business Analysis



HCA Analysis



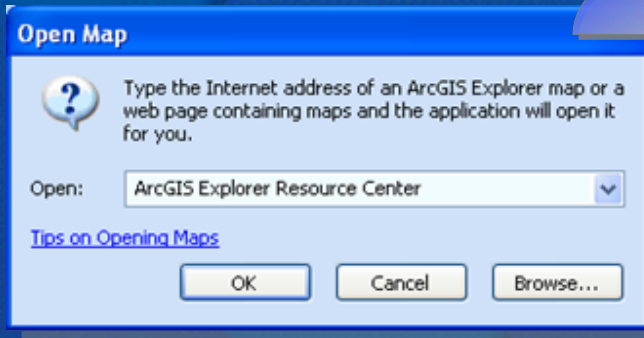
ESRI Service Area Analysis



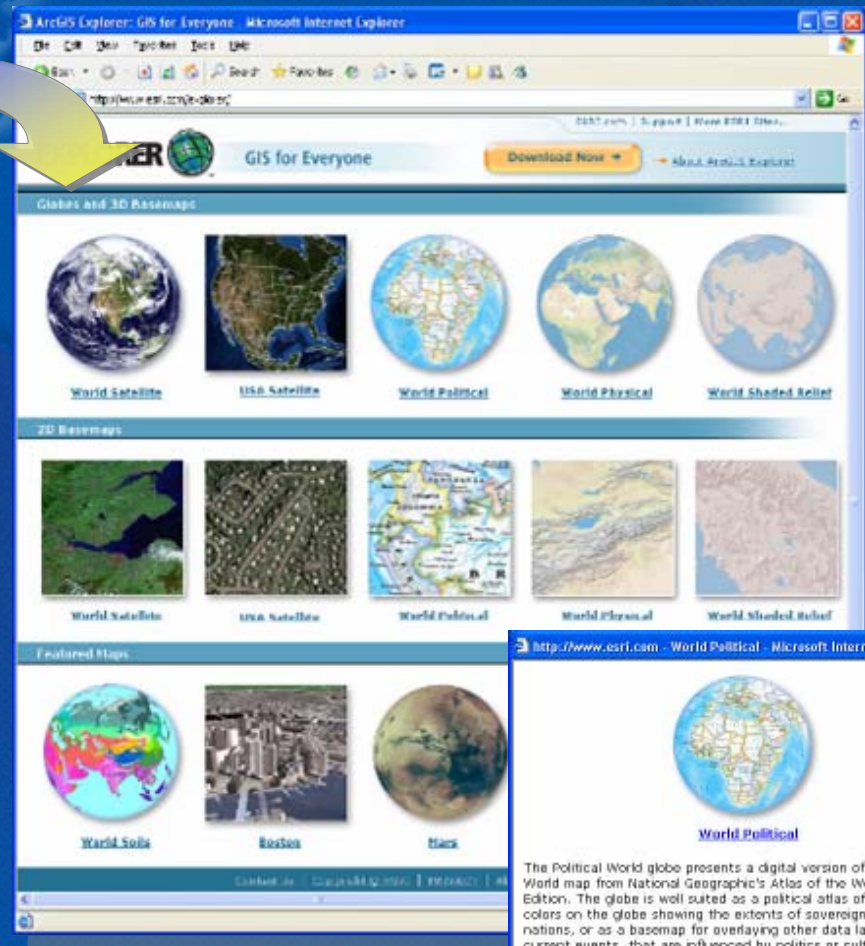
Electric Utility Trace

Easy Access to Content

ArcGIS Explorer Resource Center



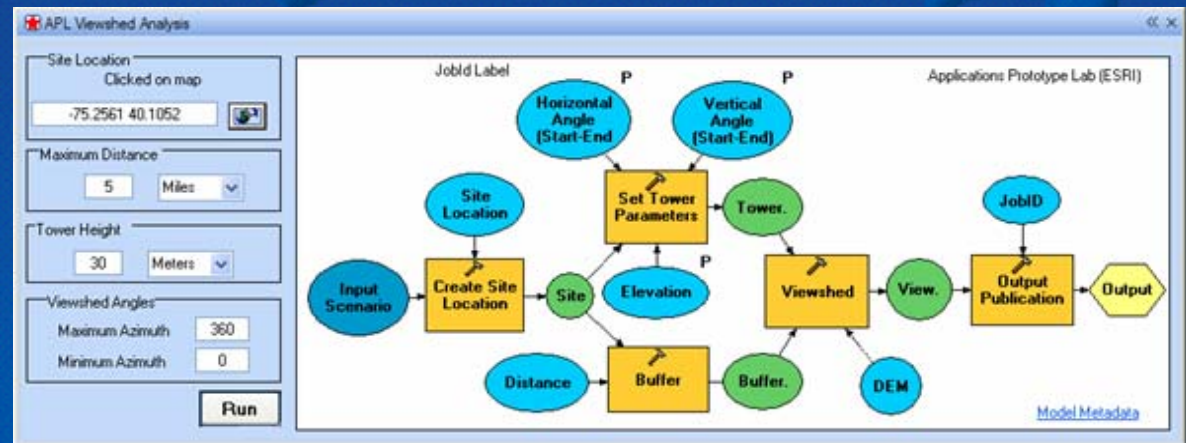
- Direct connect from Explorer
- Base Maps
- Featured Maps
- User Community



ArcGIS Explorer - Tasks

ArcGIS Server-based Functions

- Default Tasks
- Custom Tasks
 - Authored using ArcGIS Desktop & Published using ArcGIS Server
- No programming necessary
- SDK for extending tasks, or building new tasks



A Customizable Application

ArcGIS Explorer - SDK

- Visual Studio 2005 (.NET)

```
TaskContext  
Class  
  
Properties  
ParametersVersion { get; } : int  
ResultVersion { get; } : int  
Status { get; set; } : esriE2TaskStatus  
TaskName { get; set; } : string  
TaskUIName { get; set; } : string  
  
Methods  
GetParameters() : ParameterSet  
GetResult(ref Result pResult) : void  
UpdateParameters(ParameterSet parameters)  
UpdateResult(Result result) : void
```

```
esriE2ServerType  
Enum  
  
esriE2ServerTypeGlobe  
esriE2ServerTypeMap  
esriE2ServerTypeIMS  
esriE2ServerTypeIMSFeature  
esriE2ServerTypeWMS
```

```
esriE2ResultSortOrder  
Enum  
  
esriE2ResultSortOrderExecution  
esriE2ResultSortOrderType  
esriE2ResultSortOrderCategory  
esriE2ResultSortOrderDateSimple  
esriE2ResultSortOrderDateGrouped
```

```
esriE2GeometryAction  
Enum  
  
esriE2GeometryActionFlash  
esriE2GeometryActionPan  
esriE2GeometryActionZoom  
esriE2GeometryActionMarker  
esriE2GeometryActionGraphicLabel  
esriE2GeometryActionCallout  
esriE2GeometryActionBookmark  
esriE2GeometryActionIdentify  
esriE2GeometryActionSelect  
esriE2GeometryActionUnselect  
esriE2GeometryActionFly
```



Simple, Yet Everything You Need

In Summary

- **GIS is an Important Platform for Disaster Management – Planning, Response and Recovery**
- **Many Lessons To Be Learned from Past Events – What Worked and What Didn't**
- **New Technology Creates New Opportunities - For**
 - **Collaboration**
 - **Coordination**
 - **Enhanced Effectiveness**
- **Technology is Important, But Institutional and Organizational Issues are More Important**



ESRI