

# A Data Model for Distributed Data Management

Matt Erker, Phil Lidov



# Problem Statement

---

- Transportation planning, from statewide long range planning through environmental assessment of individual improvements, requires access to extensive amounts of high-quality data from jurisdictions at the federal, state, regional and local levels

# Outline

---

- Describe the Need
- Parts of the Solution
- Envision a Client

# Typical Data Requirements – Long Range Planning

---

- Development Corridors (State)
- Proposed improvements (State/MPOs)
- Land Use plans (local governments)
- Environmental streamlining will require both the NEPA data and the long range planning data

# Typical Data Requirements - EIS

- Right-of-Entry & Permits
- Field Surveys
- Global Positioning Surveys
- Monumentation
- Photogrammetric Mapping
- Drainage
- Aerial Photography
- Topography (Contours)
- Planimetric (Topo)
- Accident Data
- Traffic Counts
- Existing Traffic Control
- Speed Limits
- Noise Study
- Air Quality
- Travel Demand Data
- RTP Travel Forecasts
- Travel Demand Modeling
- Travel Demand Model Output
- Operating Plan Reviews
- Transit Ridership
- Rail Alignment Road Crossings
- Bicycle & Pedestrian Facilities
- Public Transit Operations
- Archaeology
- Paleontology
- Initial Geology Investigation
- Water Quality
- Ecological Assessment
- Historical
- Floodplain & Drainage Assessment
- Right-of-Way (ROW)
- 4f Activity
- 6f Activity
- Threatened and/or Endangered Species
- Wetlands
- Hazardous Materials
- Existing Roadway/Structures
- Farmlands
- Land Use
- Vegetation/Noxious Weeds
- Preliminary Soils Investigation
- Pavement Rehabilitation
- New Pavement Structure
- Existing Bridge Condition Investigation
- Foundation Investigation
- Hydrology
- Utility Location Maps

# Typical Solution

---

## Big Pile O' Data

- Compile data sets
  - Data transfer
  - Metadata
- Improve/Customize data sets
  - Analysis

# Typical Solution

---

## Advantages

- Single point
- Controlled access

## Disadvantages

- Cost
- Data sharing restrictions
- Disconnected updates
- Delivery of improved/customized data
- Time consuming



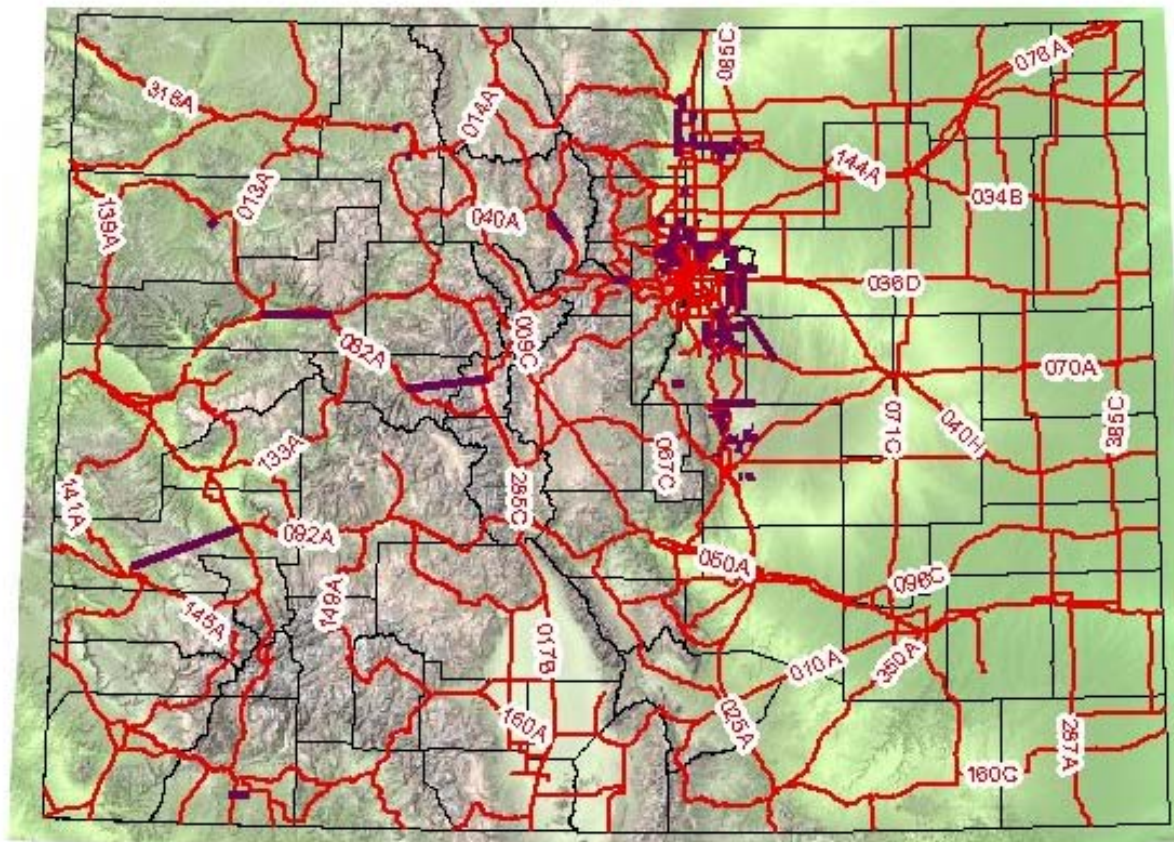
Quick Link (Click to Navigate)

Home > Interactive Map

Logout | Help



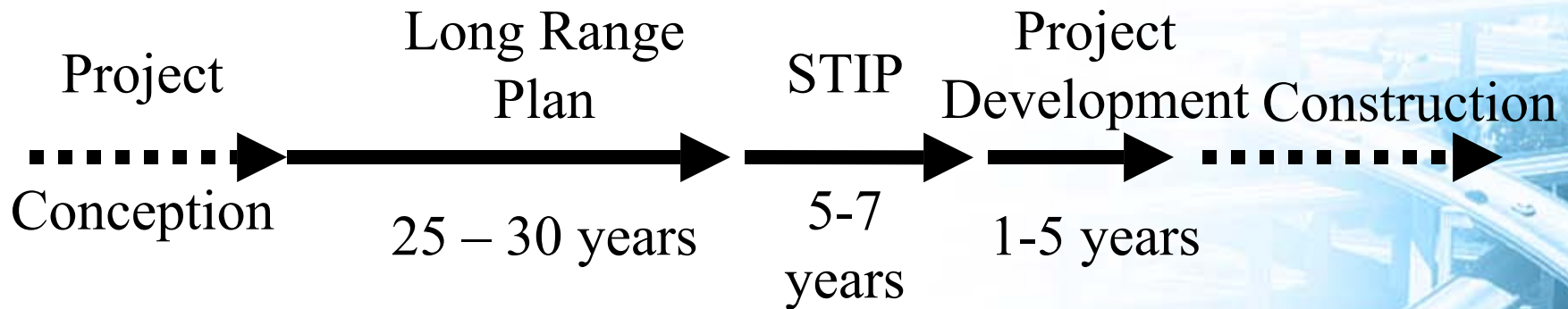
Zoom To: None Selected



(Show Legend)



# Data Timeline



# One Solution

---

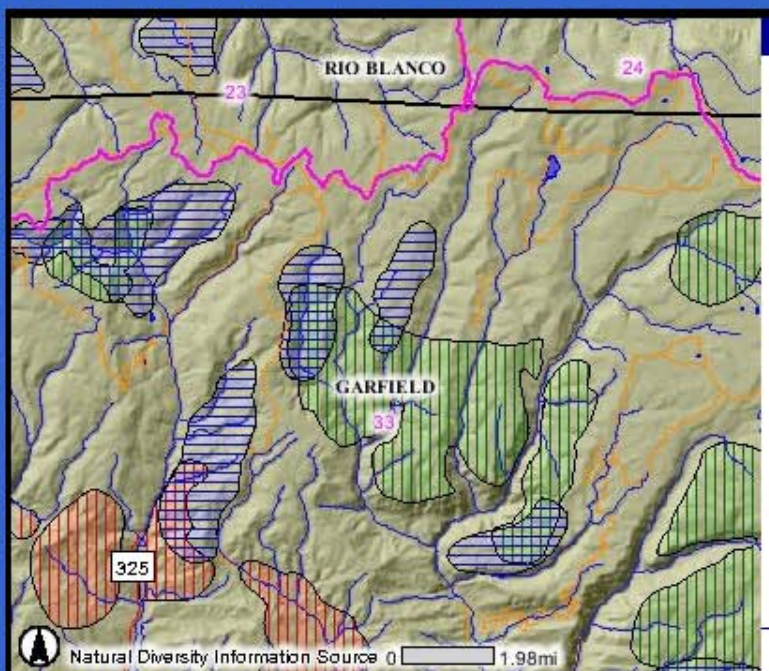
- Presentation layer
- Web – based access to data
- Customized data export tools
  - Query data set and download results

### MapIt! Interactive Mapping Application

Tool Mode: zoom in



Click for GAME maps!



#### Legend

- American Elk Highway Crossings
- American Elk Limited Use Area
- American Elk Migration Corridors
- American Elk Production Areas
- American Elk Resident Population
- American Elk Severe Winter Range
- American Elk Summer Concentration

Layer List

### MapIt!

#### Find a Place:

Feature Type:

Search String:

#### Zoom to GPS Coordinate:

GPS Coordinate Format:

Example: Lat. N: 39° 50.089'

Example: Long. W: 104° 59.021'

(Lat.) N:  °

(Long.) W:  °

Label:

#### Set Identify Feature:

#### Set Map Size:

#### Did you know?

Township and Range information can be viewed by making the Township Range layer visible and then clicking Refresh Map.

#### Contact Us

Hunting Related Links: Previous Page · CDOW Big Game · CDOW Hunting Page · CDOW Small Game · USNO Sunrise Sunset

# NDIS Website Case Study

---

- Benefits:
  - Easy access to location specific data
- Limitations
  - Requires expert user to integrate into larger project
  - Snapshot of data becomes outdated
  - Incompatible projections

# Existing IT Solutions

---

- SOAP – Simple Object Access Protocol
  - XML-based protocol
- WSDL – Service Description
  - Description of web service interface
- UDDI – Universal Description, Directory and Integration
  - Registry of web services

# Limitations of IT Solutions

---

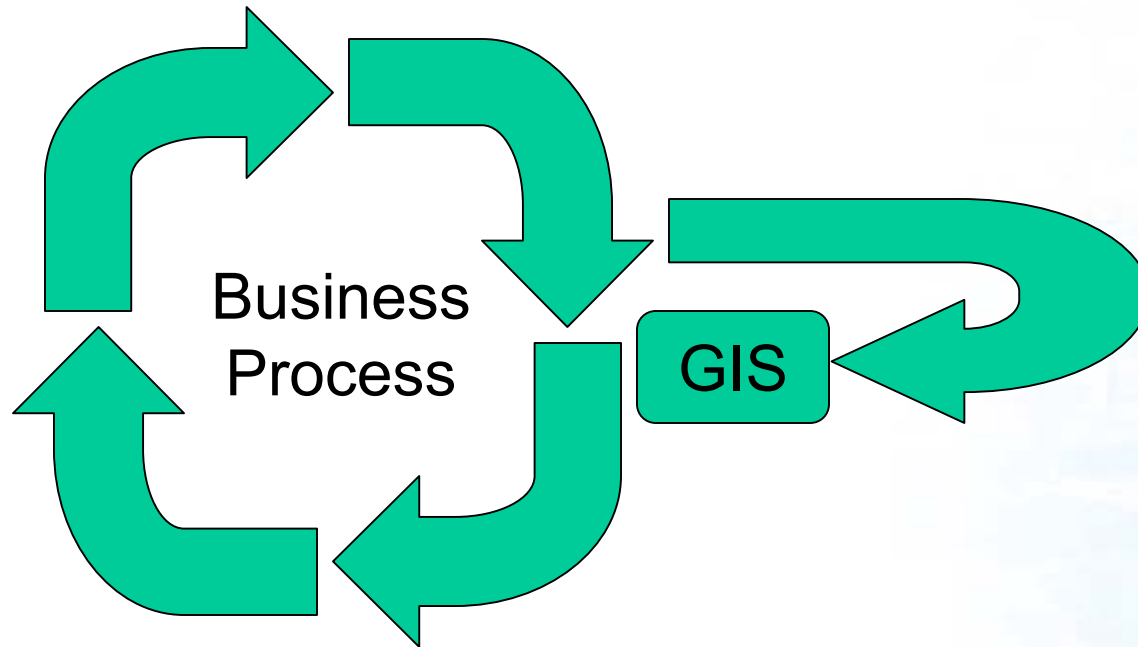
- Doesn't meet special needs of GIS
- Current state of technology is varied
- Future is bright, but still in the future

# Solution - Distributed Data Management

---

- Keep data in it's native domain
- Provide live, secure access to data
- Provide directory of available data sources
- Develop client that can consume data
- Each organization creates and maintains data relevant to their mission
- Scale/coverage of data should be appropriate to the mission
- In a distributed repository, this data should be both stewarded and actively served.

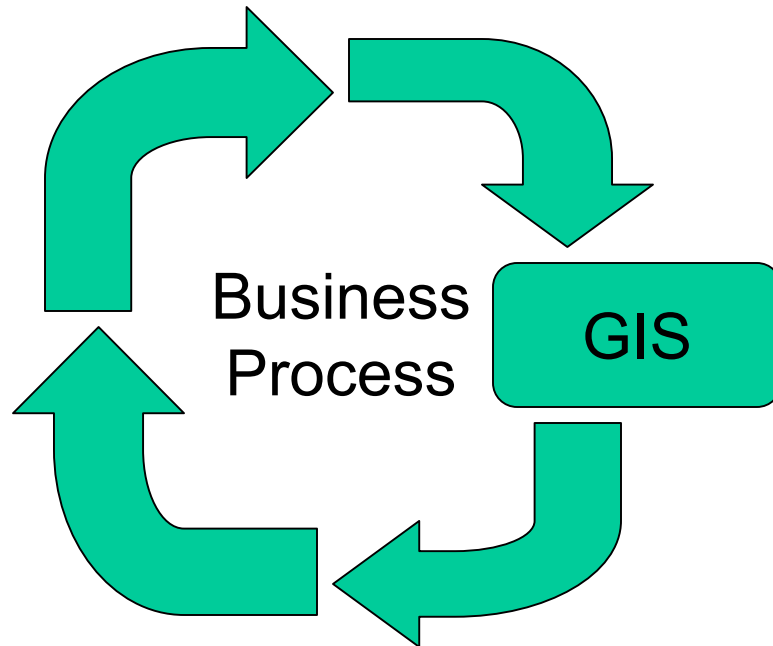
# Typical Solution





# Distributed Data Management

---



# Requirements

---

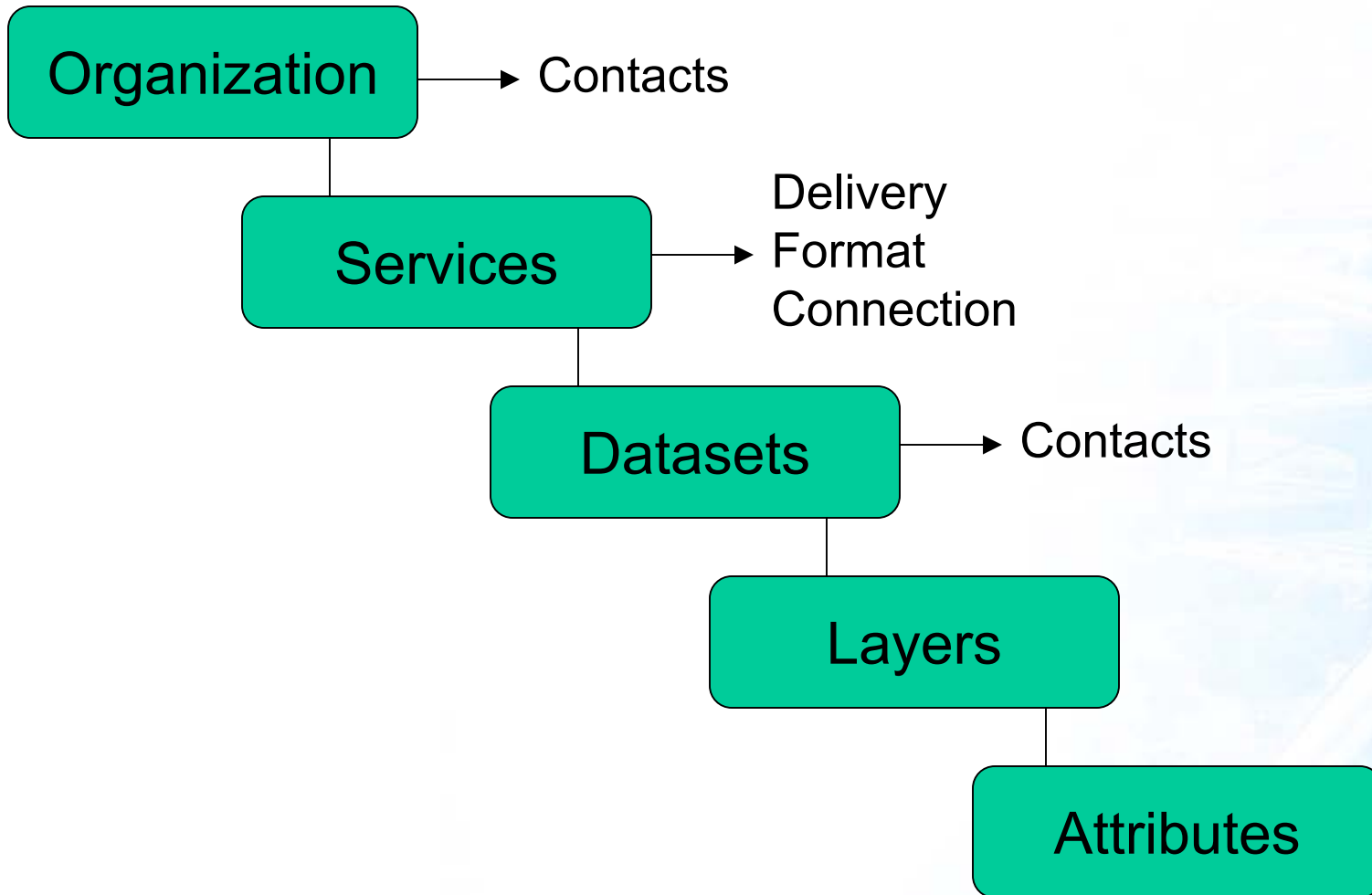
- Publish
  - Describe the data that is provided by organizations through a web service
  - Identify security constraints
  - Metadata
  - Format
- Search
  - Client searches the registry for the required data
  - Fulfills requirements for accessing data
- Discover
  - Registry provides a list of registered data brokers and the requirements for access
- Consume

# Solution

---

- Similar to Web Services and UDDI
  - Managed within an enterprise (e.g., State or DOT)
  - Provides pointers to data
    - Type of access
    - Use restrictions/security
    - Content description and metadata
- Different from Web Services and UDDI
  - Heterogeneous data services
  - Doesn't require consistent format of web services before registering

# Data Model



# Typology of Data Services

---

- Sneaker Net
- FTP
- Interactive Data Download
- Mapping Services – Images
- Mapping Services – Features
- Database Connection
- Replication/Mirror
- Web Services

# Potential Implementations

---

- Ad-hoc map – Just in Time mapping
- Spanning Organizations
  - Security Constraints
  - Networking

# Next Steps

---

- Further develop data model
- Build prototype
- Assist organizations in developing web services that facilitates use in GIS
- Begin creating registry of data sets and organizations