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ESRI

**Petroleum User Group Meeting, April 2006**
**Houston, TX**

# *Leveraging Semantic Technology for Improved Enterprise Search and Knowledge Discovery*

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**Petroleum User Group Meeting, April 2006**
**Houston, TX**

*OR*

*GIS as a part of an Integrated, Dynamic Information Model*

# Why?

- Research, intelligence, life science, security, identity, energy (natural gas)

Selective and easy access to data, metadata and knowledge from anywhere, ability to annotate and relate, analyze and report

Use, share and re-process information assets

Collect project relevant data into application independent projects (shoeboxes)

Develop and test evolving models, pose hypothesis and analyze

Capture "recipes" for knowledge transfer and re-use

*..In dynamic (often spatially oriented) environments*

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# Expanding the Reach of GIS

- Dedicated users
- Periodic users – need familiar metaphors, integration with other applications/known environments and data and compelling reasons to use spatial data -

Google Earth

Google - Expectation that all information is searchable, transcends physical and application boundaries

Gmail – no explicit location for information. Flickr,.. Tagging metaphor gaining momentum

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# Search and Tag

*Limits of Web search today – lack semantics/meaningful tags:*

**Houston**
**- Houston, TX**
**- Whitney Houston**

**Refine search with synonyms – ranked by Google, author is often unknown, purpose for document often unknown**

**Semantic web – what it is (metadata) and what it means (semantics).**

**Houston – place**

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# Semantics

**Semantic approaches now in the enterprise –**

**Allow communities to describe their terms and relationships**

**Expand search capability**

**Allow the capture of context of information**

**Enable identification of evolving knowledge trends**

**Who uses them?**

Communities that want to eliminate and support ambiguity
Communities with evolving knowledge models
Communities who want to use their own language and relationships for accessing information

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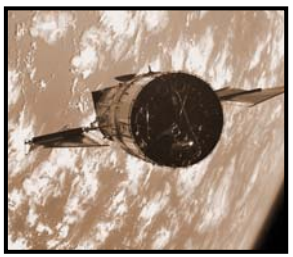
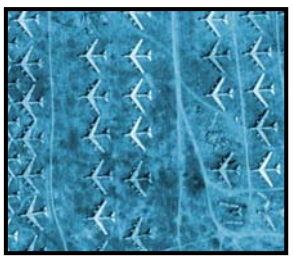
# Metadata

Data
Metadata
Knowledge
} aren't static

- Gain insight with time based views, filtering,..
  - Collecting more data and metadata isn't enough
    - DATA DEMANDS ATTENTION – DELIVERING MORE DATA CAN PREVENT USERS FROM DOING ANALYSIS
    - INFORMATION NEEDS TO BE TIMELY AND RELEVANT



- Communities will not agree on a single metadata/knowledge description
  - DIFFERENT PROBLEMS REQUIRE DIFFERENT DESCRIPTIONS and EVER CHANGING, PROBLEM SPECIFIC RELATIONSHIPS



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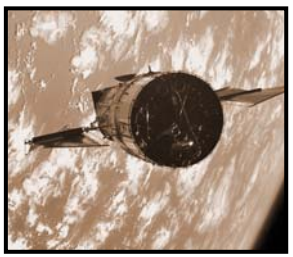
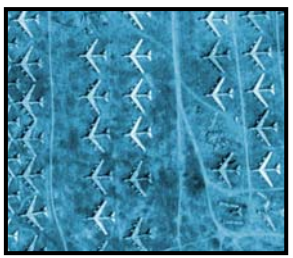
# Knowledge





## Need to capture, share and re-use knowledge

- Know more about data when it is captured or created
  - Automate metadata capture
  - Evolve through usage
  - Search and access using familiar terms
  - Easily find and relate information

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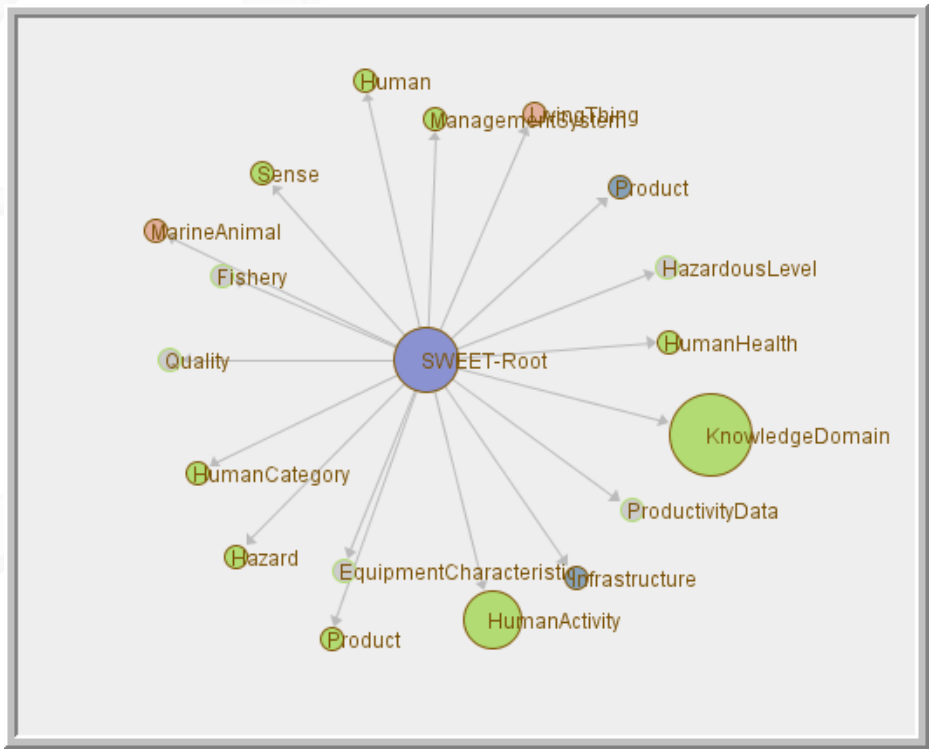
# Tags

## Semantic descriptions

- Dictionaries of categories, properties and relationships
  - Problem focused
    - Could have different dictionaries for different roles or activities
  - Interconnectable



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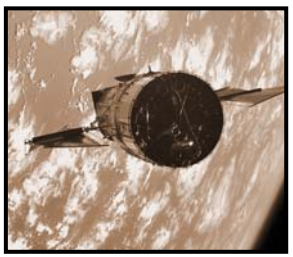

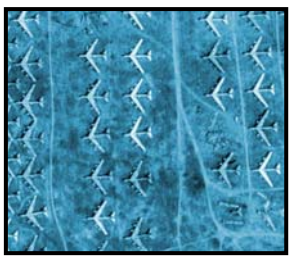

**Develops knowledge modeling and discovery infrastructure software for customers who:**

- **Have high-value data not easily structured using traditional database technology**
  - **Has evolving meaning**
  - **Has no single representation**
- **Need automated processing, notification and search**
- **Need recorded history of information**
- **Want to do predictive modeling**

**NEED to use a semantic approach**

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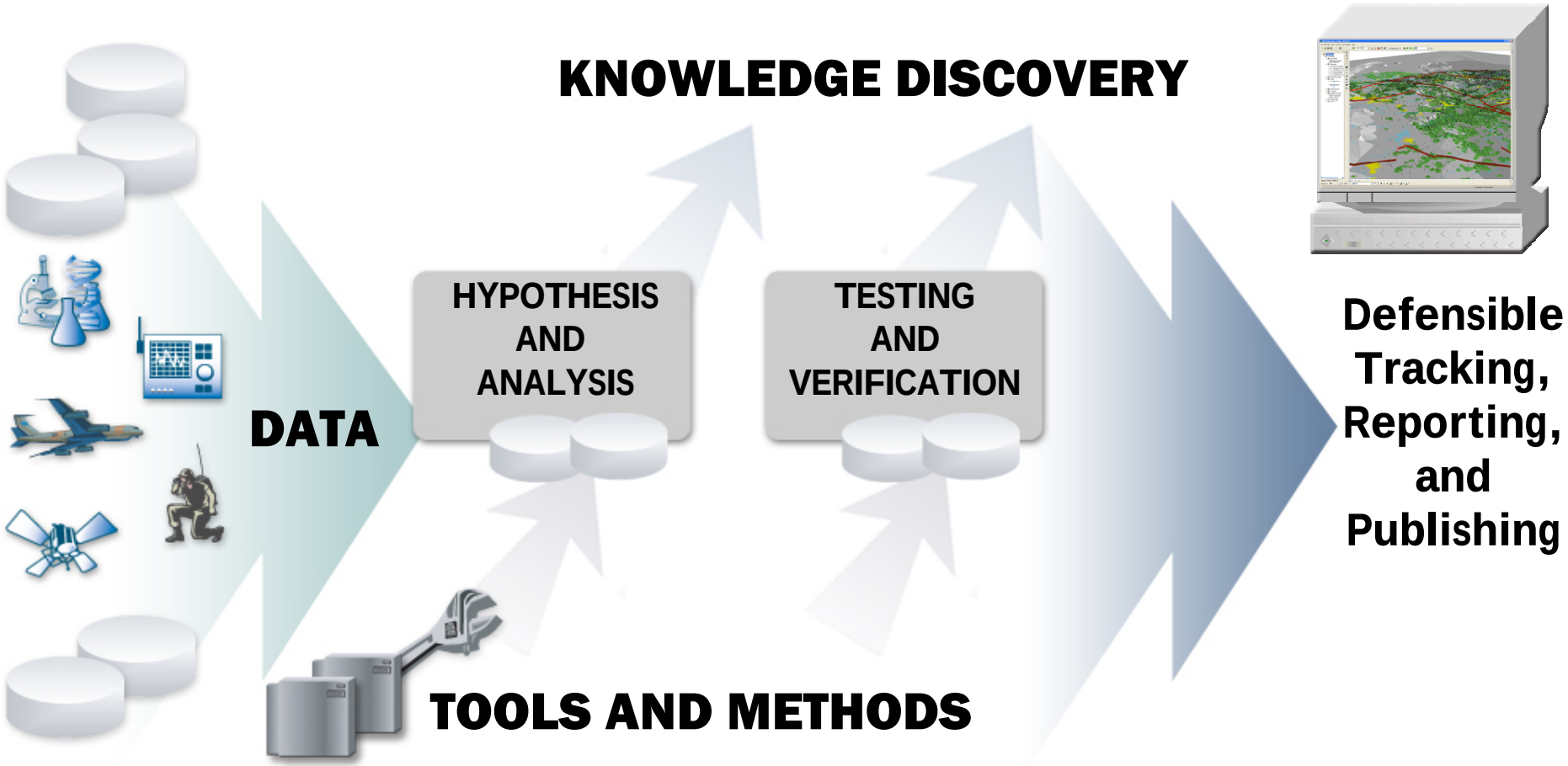
# Bridging the Knowledge Gap




OBSERVATION
MODELING
EXPERIMENTATION
STRUCTURED DATA

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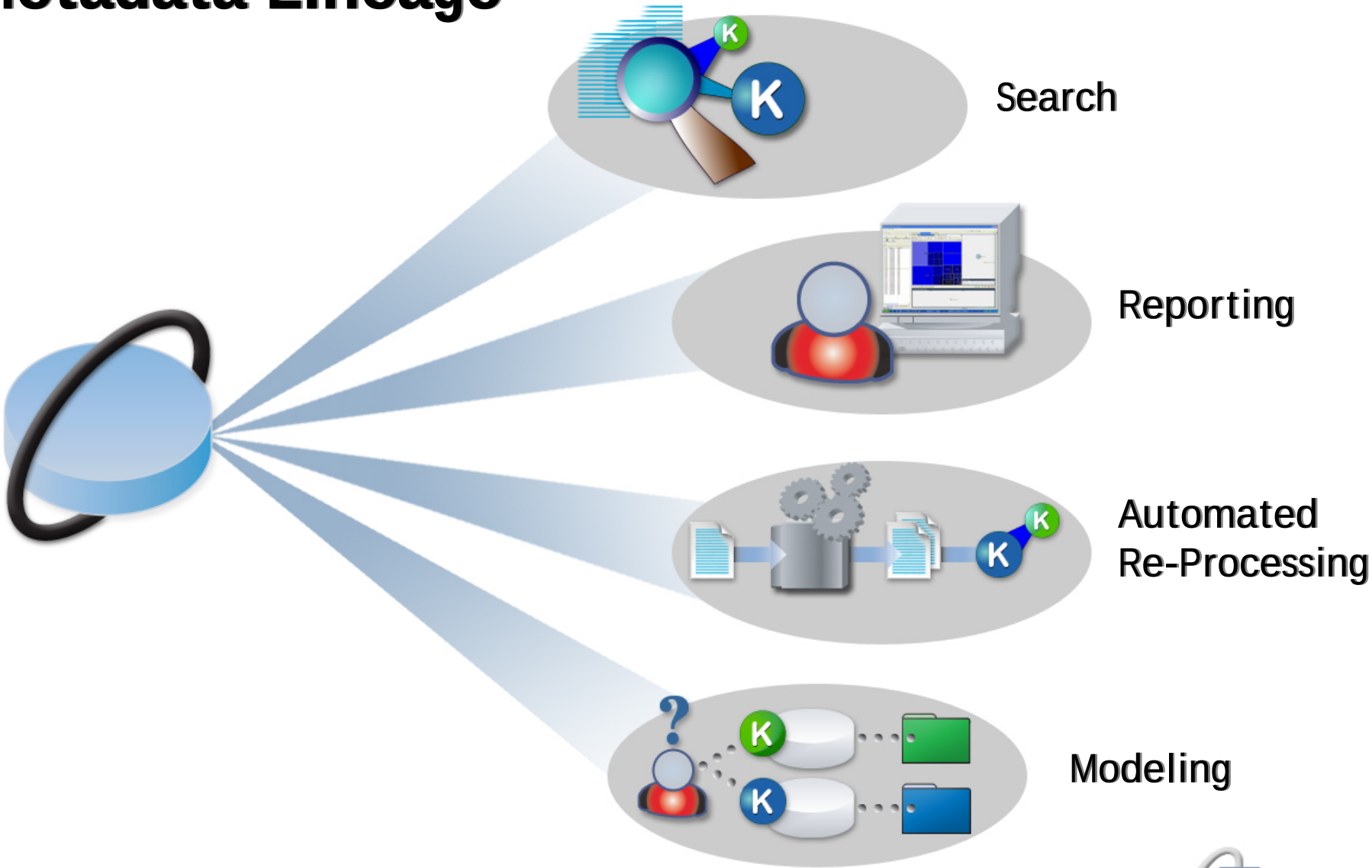
# Metadata Lineage

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# Knowledge Modeling Infrastructure Software


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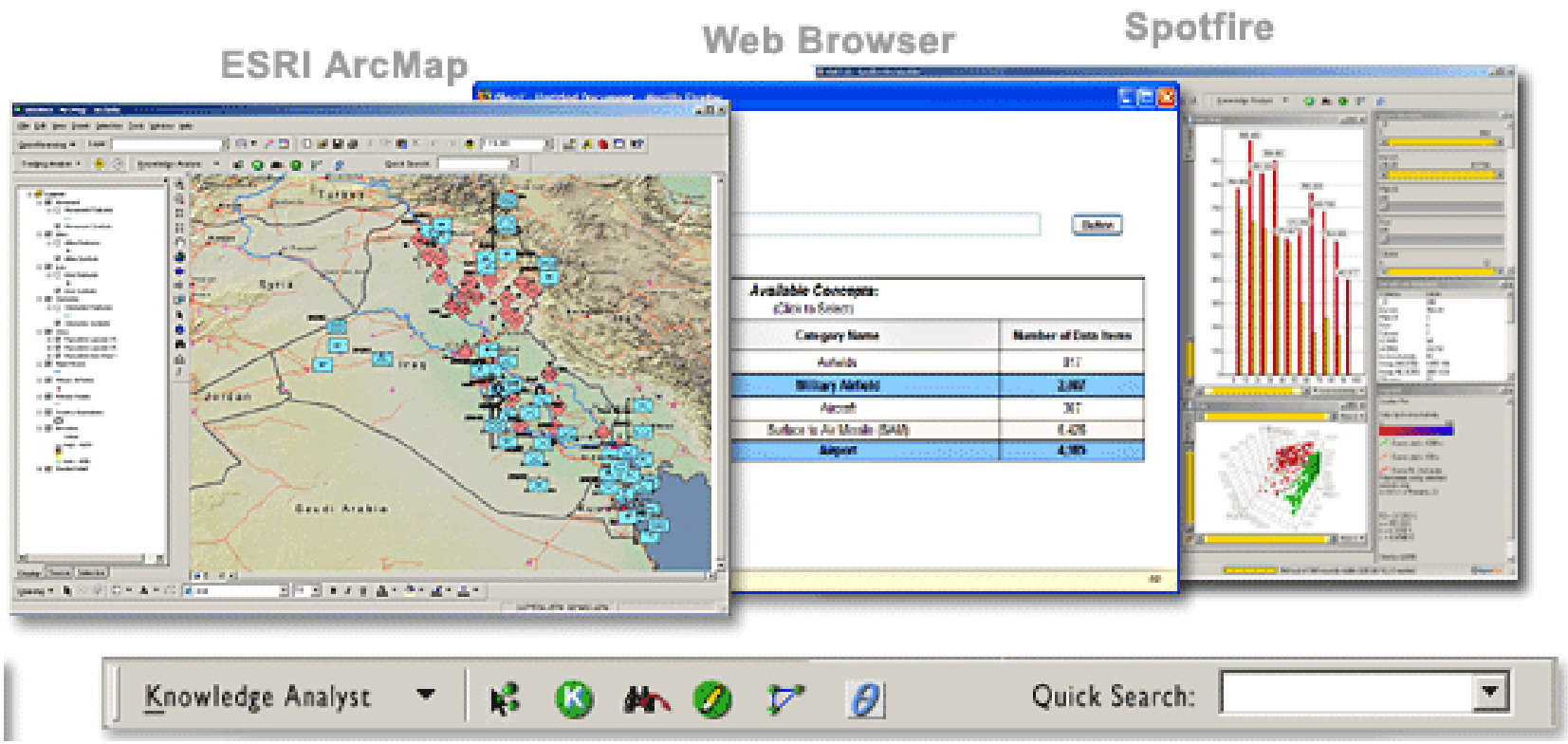
# Cross Application Knowledge

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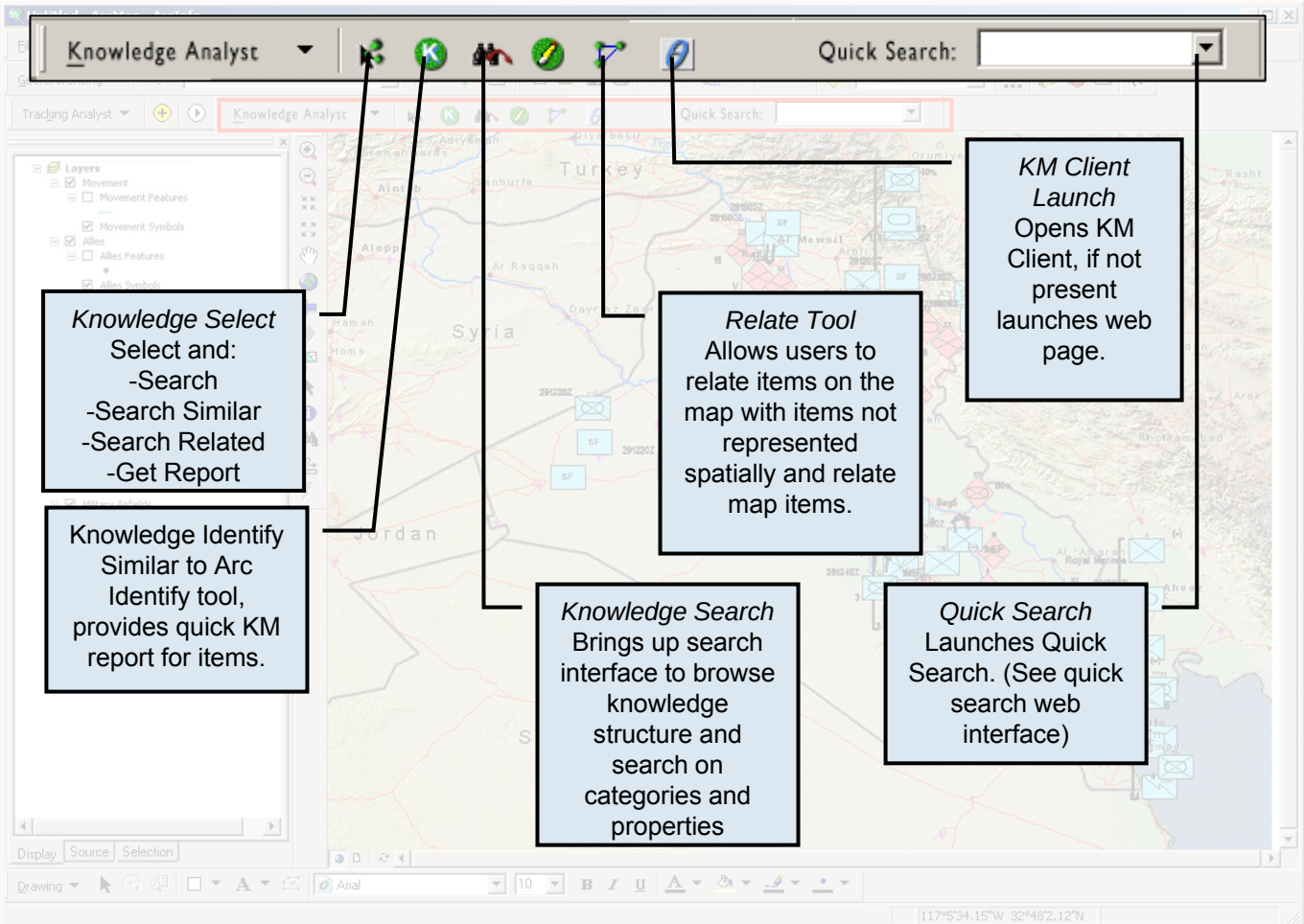
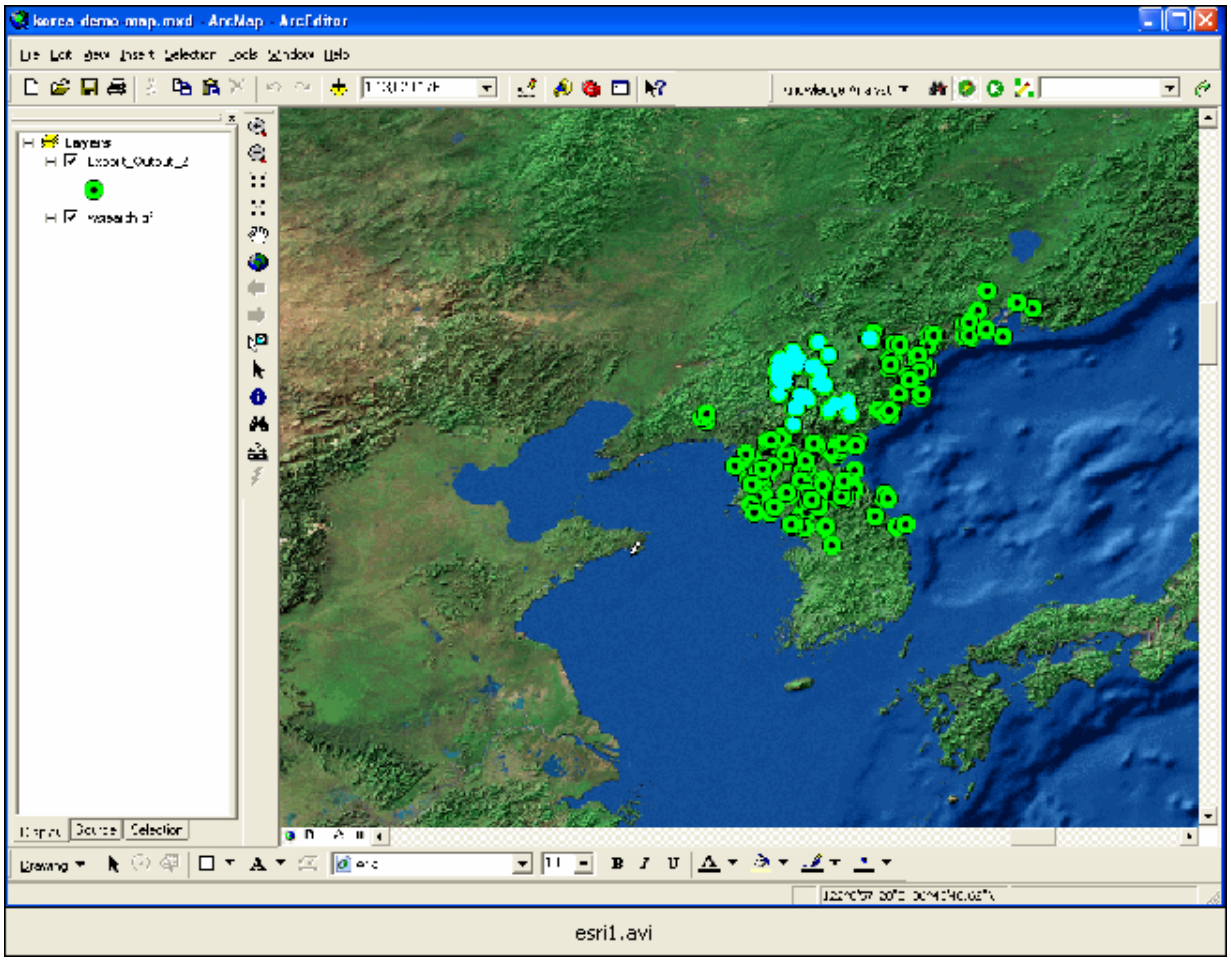
# GIS Connection: Knowledge Analyst



# Knowledge Sharing and Re-use

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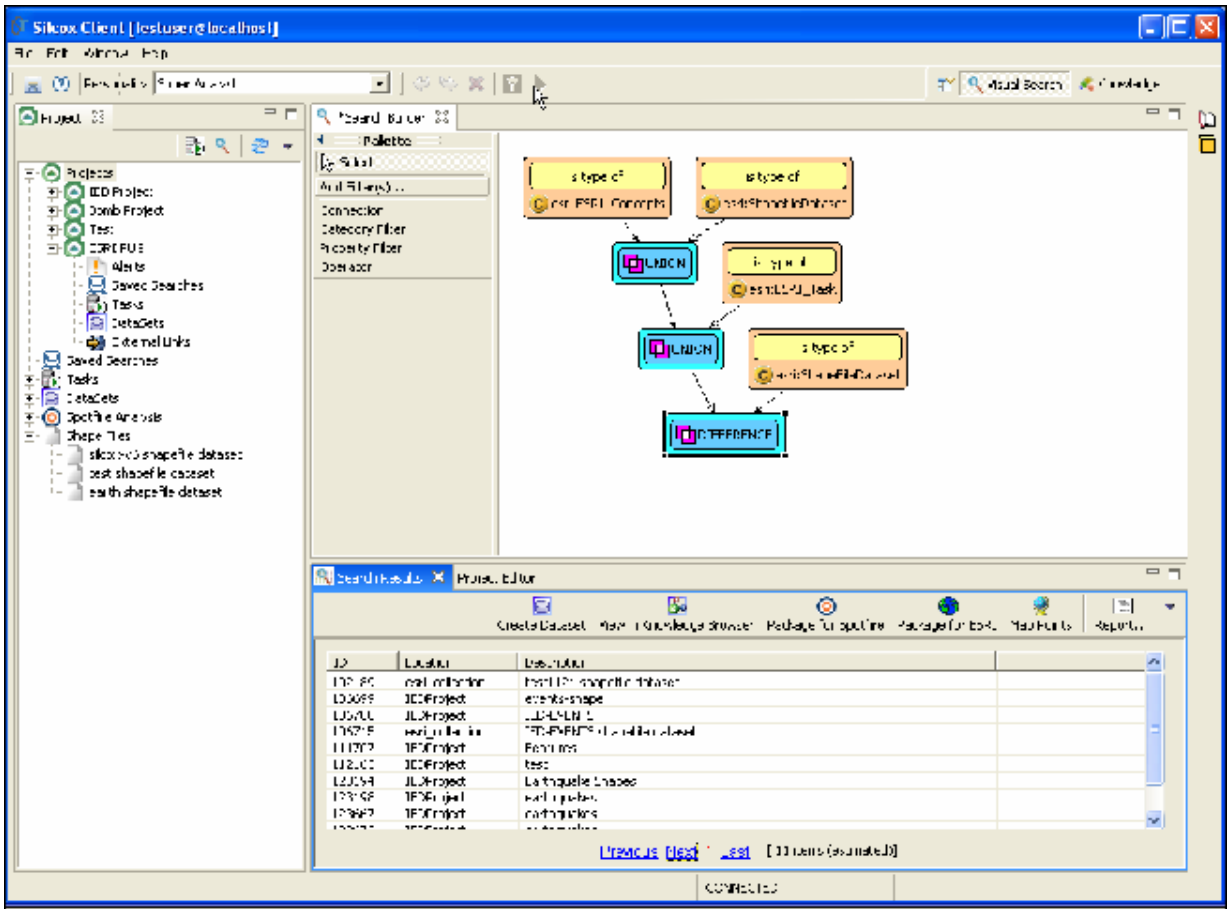
# Use Spatial Information

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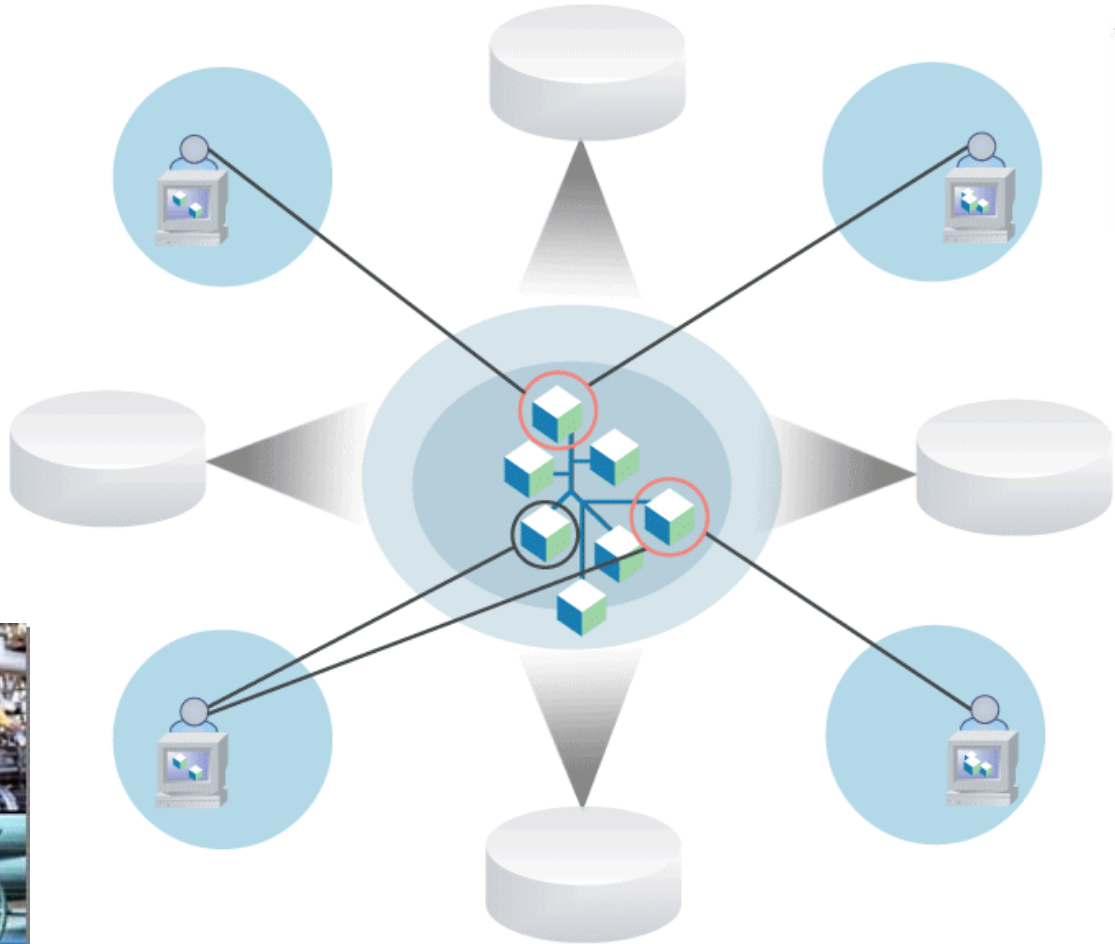
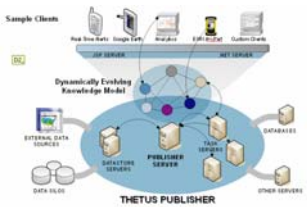
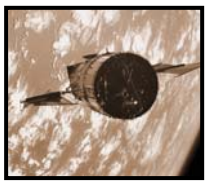
# Connecting Across Domains





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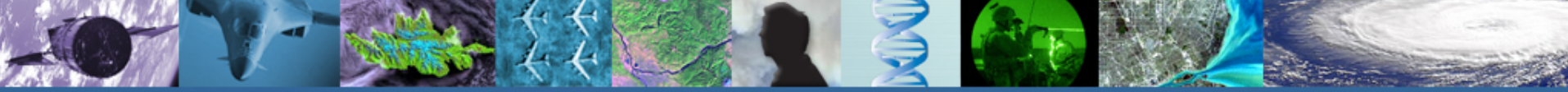
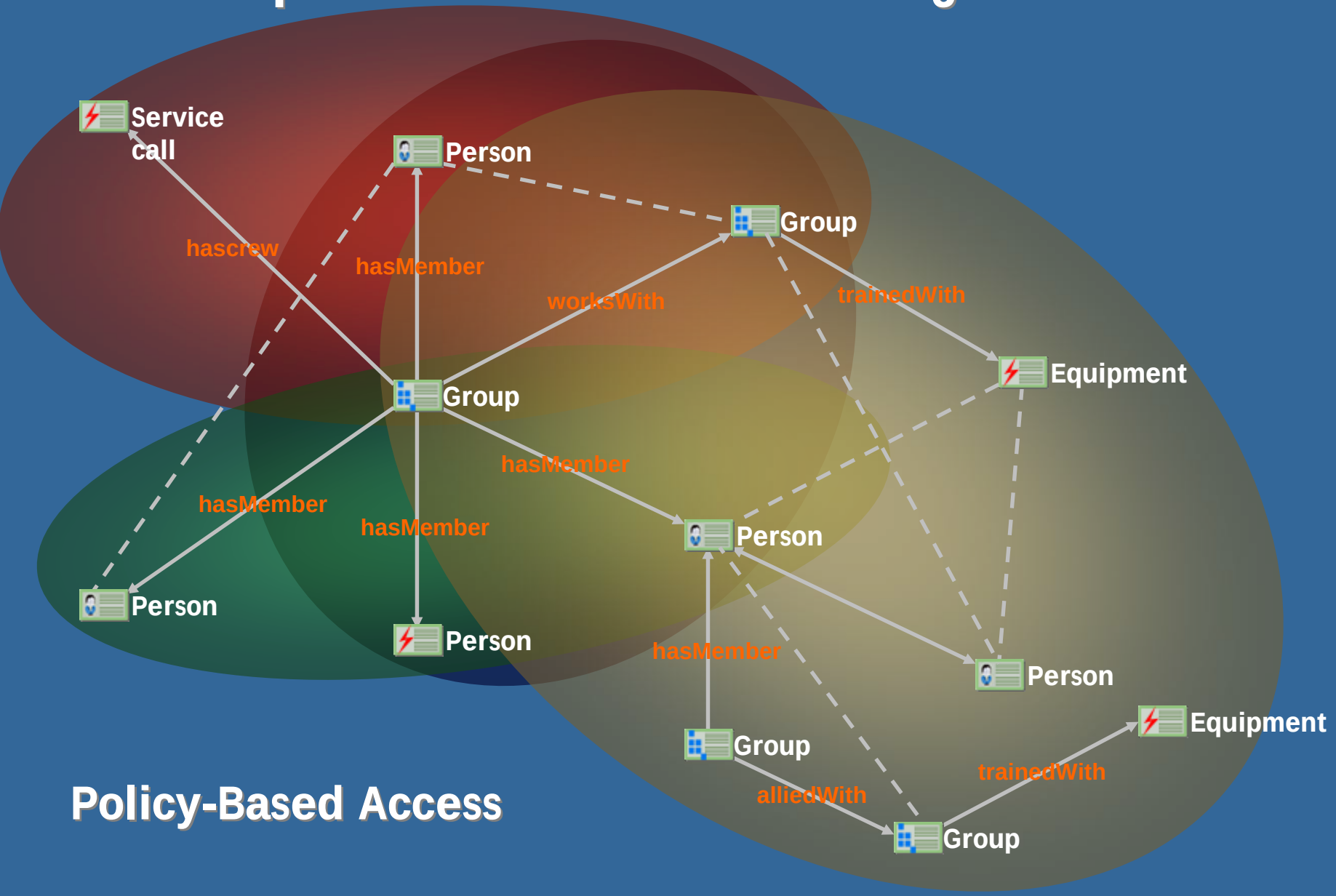
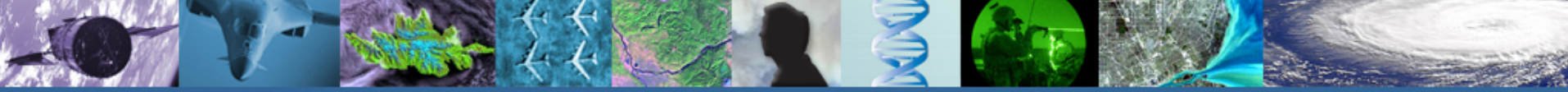


# Context-Specific Access to Knowledge



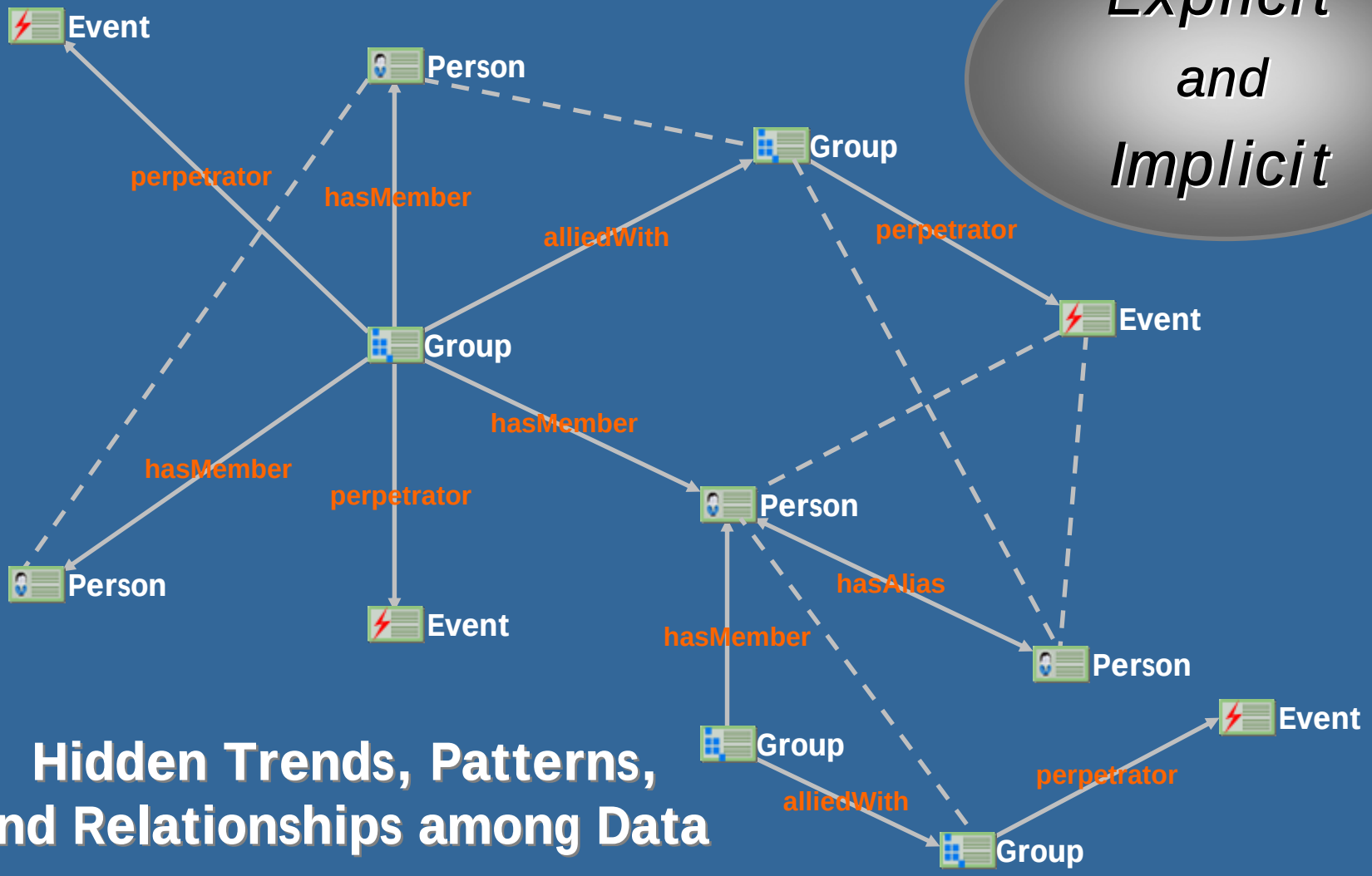

## Policy-Based Access



# Dynamically-Evolving Knowledge Bases

## Rich Networks of Relationships

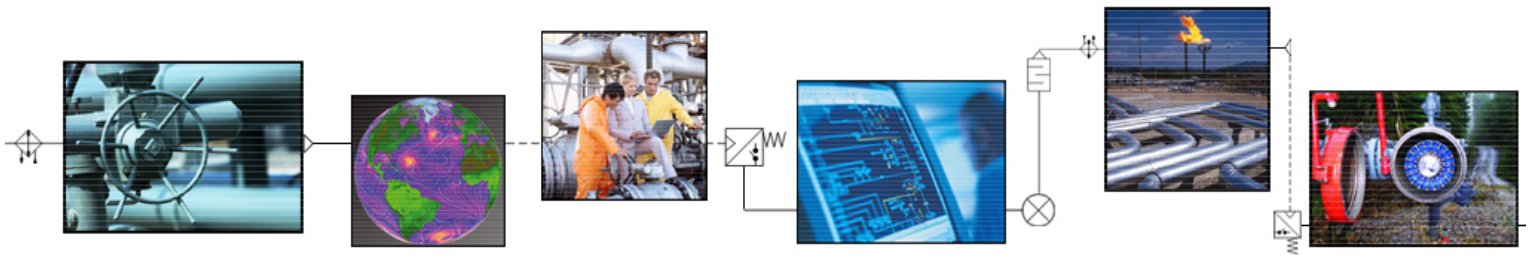
*Explicit and Implicit*




**Hidden Trends, Patterns, and Relationships among Data**

# Examples of Gas Utility Applications

- Damage Loss Prevention
- Gas Loss Identification
- Service Management
- Pipeline Integrity Management
- Asset Management



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# Damage Loss Problem

- Lots of Pipe – close to surface in high density areas
- Lots of Construction – not all permitted
- 50% of Damage caused when no Locate (call before you dig) request made
- No single source for information – inside and outside the enterprise
- Different views of information needed
- Need predictive model to prevent damage through education, inspection - not just penalties

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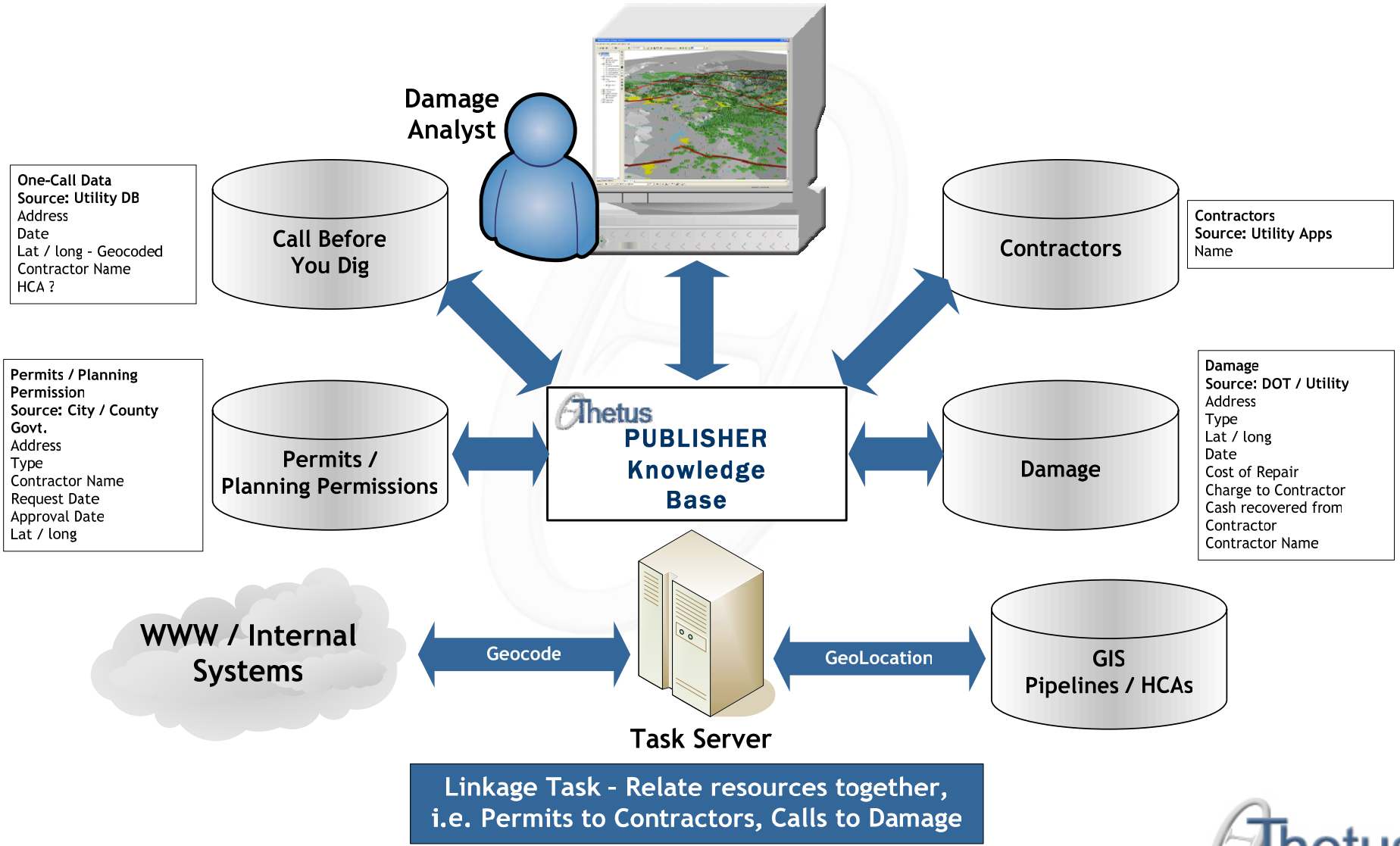
# Damage Loss Prevention




Linkage Task - Relate resources together, i.e. Permits to Contractors, Calls to Damage

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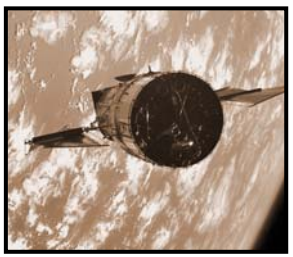
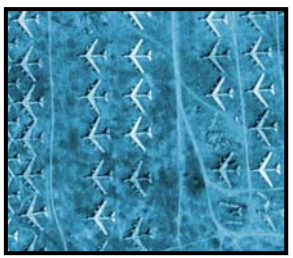
# Questions

- Are certain types of contractors more likely to cause damage?
  - How can we prevent?
  - Can I be notified when ‘at risk’ contractors are about to start work?



- Does damage happen more often under certain types of conditions
  - Economic
  - Weather



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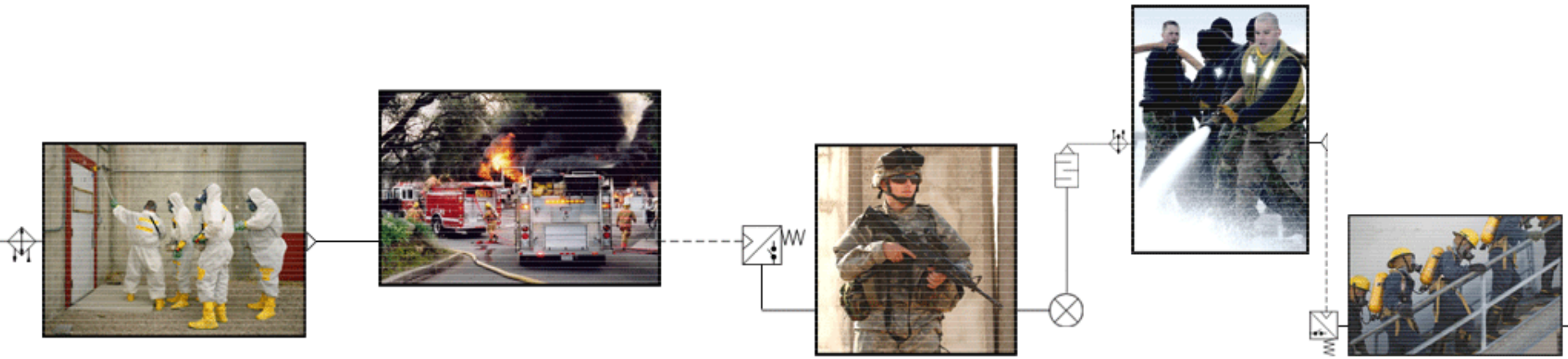
# Hazardous Condition Worker Monitoring



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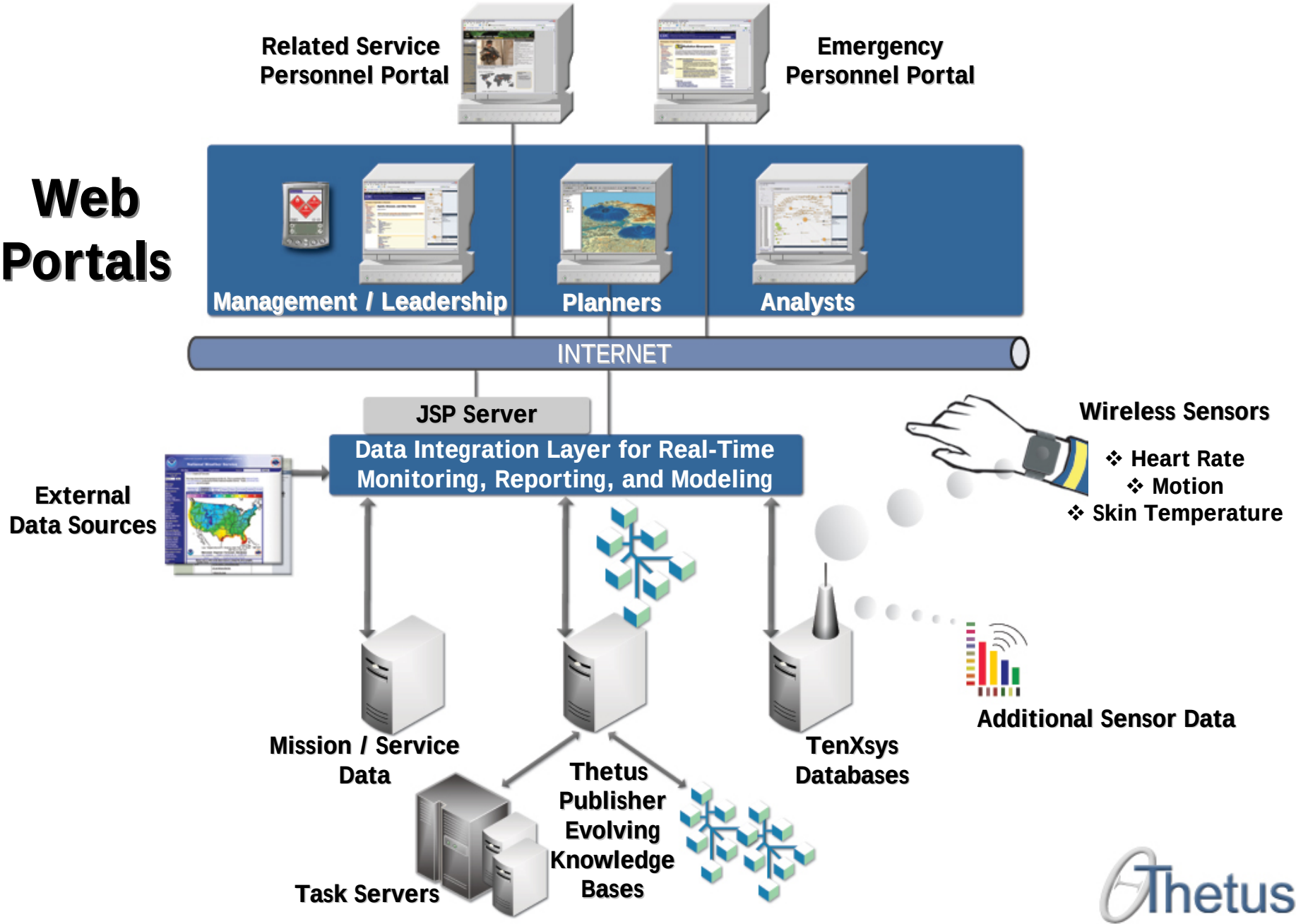
# Web Portals


Related Service Personnel Portal
Emergency Personnel Portal
Management / Leadership
Planners
Analysts
INTERNET
JSP Server
Data Integration Layer for Real-Time Monitoring, Reporting, and Modeling
External Data Sources
Wireless Sensors
❖ Heart Rate
❖ Motion
❖ Skin Temperature
Additional Sensor Data
Mission / Service Data
Thetus Publisher Evolving Knowledge Bases
TenXsys Databases
Task Servers

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