

US DOT SIS Team

IRSV System Architecture & Domain Knowledge Management

Software and Information Systems Department

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Group Objective:

- **To support bridge inspectors with the *knowledge-based approach***
 - Ontology provides formal description of concepts, properties, and their interdependencies.
 - A problem domain ontology (PDO) enables to solve a complex problem where the underlying domain concepts provide collective understanding of the data based on the domain knowledge from multi-dimensional resources
 - PDO provides a knowledge model for effective analytical problem solving
- **To provide a scalable and adaptable platform support solution for all other system components to share the common knowledge and the common understanding**
 - Support the interoperability, scalability and adaptability to facilitate heterogeneous data requirements, operational requirements and the overlapping functionalities
 - Compose meaningful set of services that support other system components' needs
 - Knowledge services can mediate between the various system components and the process services

System Functionality:

- Building Database Schema
 - Developing the Database schema
 - Developing the structure of Database Schema in SQL Server 2005
 - Import the data for 3 year cycle (2006, 2004, 2000)
 - Providing the heterogeneous data to other modules

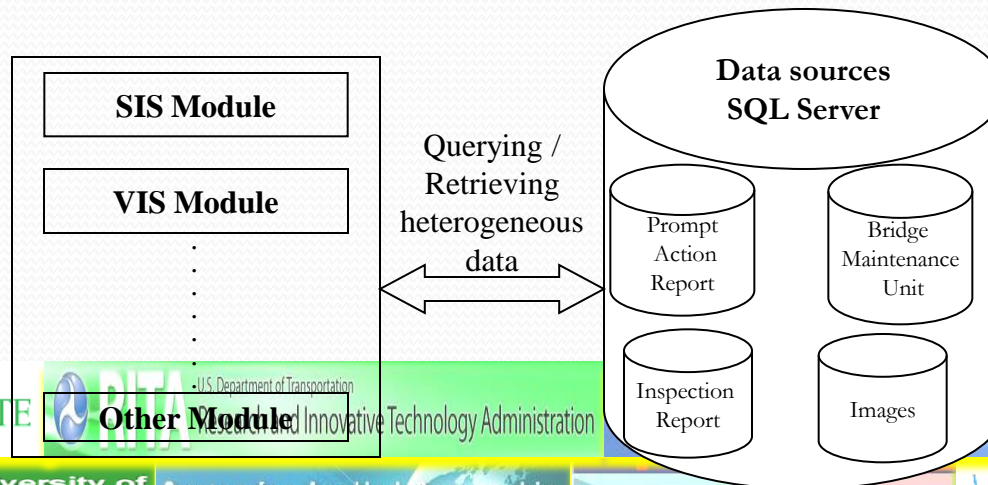


Fig: Querying / retrieving data from SQL Server



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Other Module

U.S. Department of Transportation

Research and Innovative Technology Administration

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Charlotte Department of Transportation



university of center for

Center for Applied Geographic

north carolina at charlotte transportation policy studies

Information Science



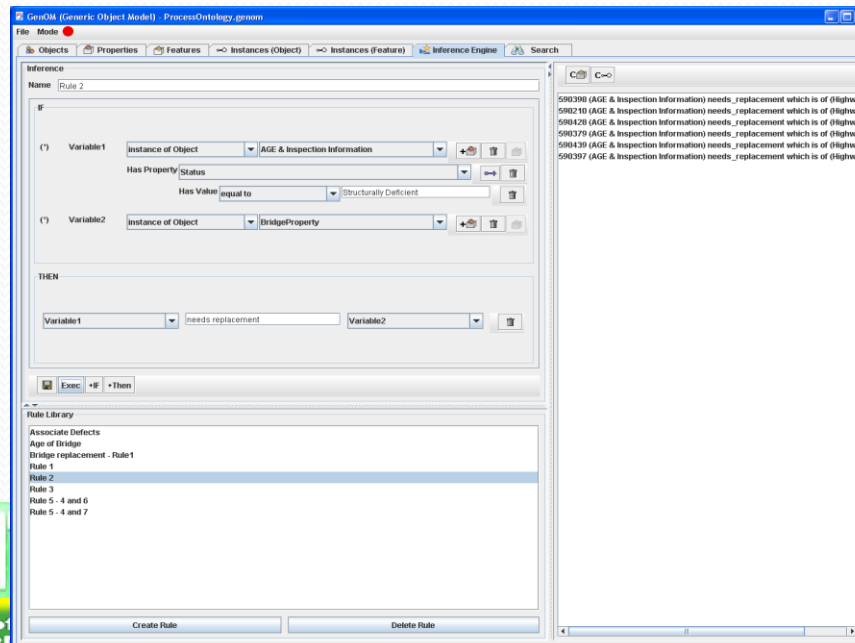
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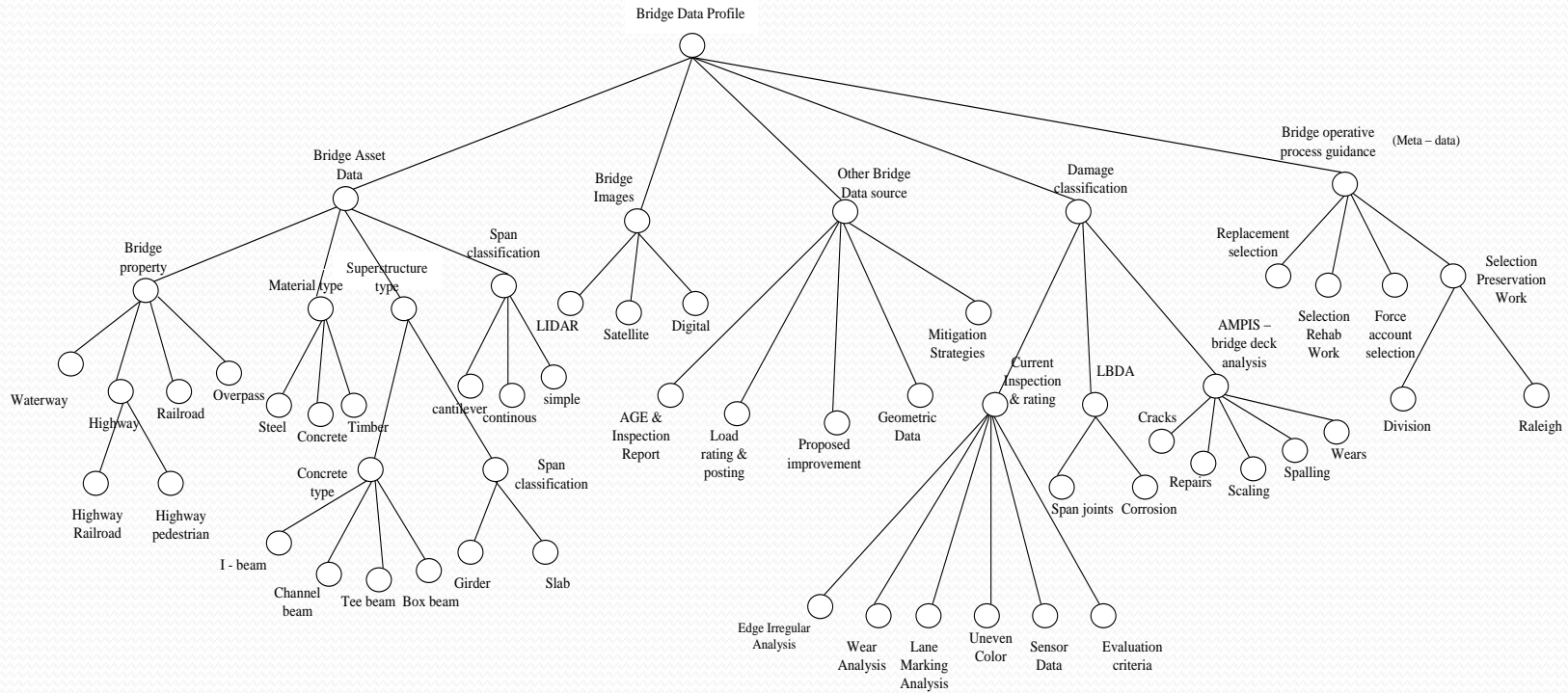
consulting engineers

System Functionality:

- Building the Knowledge Structure (Ontology)
 - The domain knowledge of bridge inspection process is captured and modeled by using the ontological engineering toolkit (GenOM).
 - GenOM provides functionalities to browse, access, query and reason about complex bridge inspection process.
 - It provides responses to “what-if” queries from system behaviors through matching various initial conditions and circumstances based on rules in domain model.



Knowledge Structure for Bridge Management



System Functionality:

- Creating a Web Service Framework

- A framework to compose services that serve other system components with knowledge and process services
- Support interoperability, scalability and adaptability to facilitate heterogeneous data requirements, operational requirements and overlapping functionalities

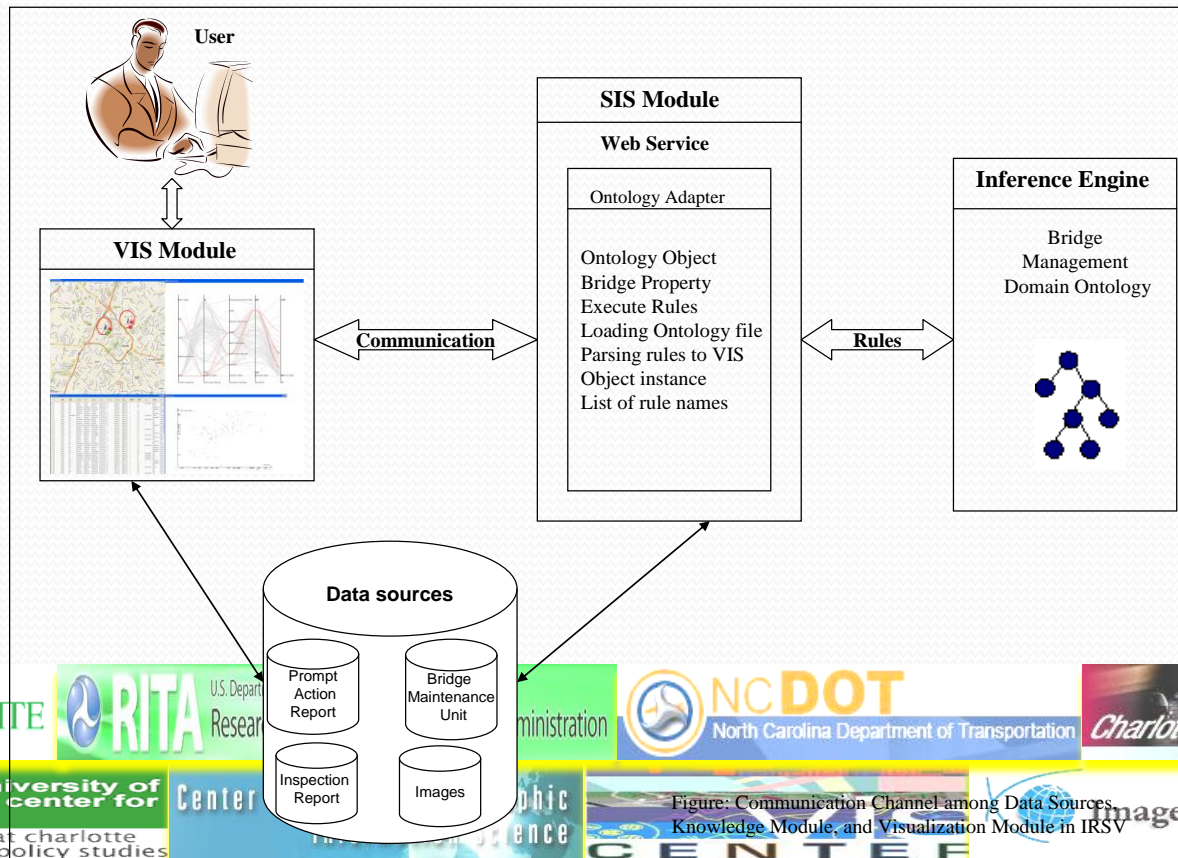


Figure: Communication Channel among Data Sources, Knowledge Module, and Visualization Module in IRSV

System Functionality:

- Developing IRSV Prototype User Interface
 - Primary focus of IRSV prototype user interface is to combine bridge inspection data and domain knowledge based on the knowledge representation and a goal-driven modeling technique.
 - Create data profile for the bridges
 - Correlate profiles to existing data sources
 - Use the correlation to locate relevant images and other sensor information/inspection reports
 - Analyze the available data sources with tools/processes provided by the AMPIS system.
 - Based on the evaluation criteria generated by AMPIS module, defects can be tagged with the help of knowledge structure (ontology) and recommend the bridge with the mitigation strategies.
 - Logical reasoning can be generated based on what – if conditions through the conceptual space (knowledge structure / Ontology)
 - Generate a report that includes the summary of analysis, mitigation strategies with the help of metrics and measures defined in the conceptual space.
 - Store this process as a customized process, which can be repeated in the future

Conclusion:

- IRSV system benefits from captured process knowledge and assessment knowledge for enhanced bridge evaluation.
 - Inference Engine with Ontology – Building rules with ontological concepts, properties and features that describe the problem scenario.
 - Capturing important knowledge and make it available for other modules.
- Integrated web service framework can be scaled and adapted to evolving processes and technologies
 - Service framework can mediate between various system components, knowledge and process services and can provide right information at the right time