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1 Abstract

This work centers on the design and development of a web-based XML information representation (XIR) tool for the coupling/binding representation of data and metadata entities associated with physical sensors pertaining to environmental surveillance monitoring (ESM) applications. Metadata, defined in general as data that describe data, are associated with each sensor-signal-data through a binding/coupling registry process using extensible markup language (XML) format. The concept of sensor data availability in ESM is decomposed into three specific requirements for the XIR system: let users get to information in a remote manner, let users get access to data as soon as it is required, and enable a uniform interpretation of data among heterogeneous data sources and data destinations.

2 WALSAIP Conceptual Model

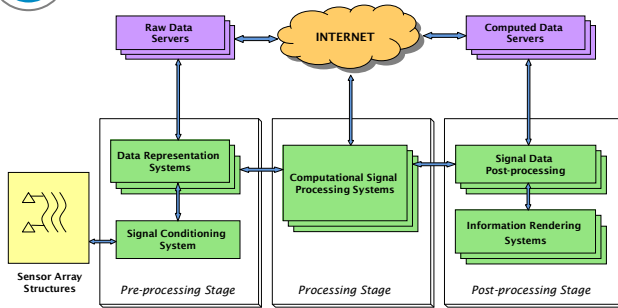


Figure 1. WALSAIP Conceptual Model

3 Problem Formulation

Data and Metadata

- Signal Data – all readings collected directly from sensors.
- Metadata – data that describes data. Metadata is crucial to provide researchers a concrete idea of the real conditions in which data was collected. Metadata is a determinant of how the environment influence the measurement in case of abnormal findings.

Data and Metadata Challenges

- There is a need for proper characterization of binding/coupling relationships between data and metadata files to improve information content analysis.
- Data should be interoperable across heterogeneous users with different data architectures, storage systems, and platforms.
- A mechanism should be design to make data readable and understandable across heterogeneous users in automated information processing systems.
- Lack of support for dynamic metadata management.
- Systems need to incorporate information from "human sensors".

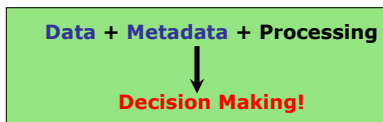


Figure 2. Decision Making Input

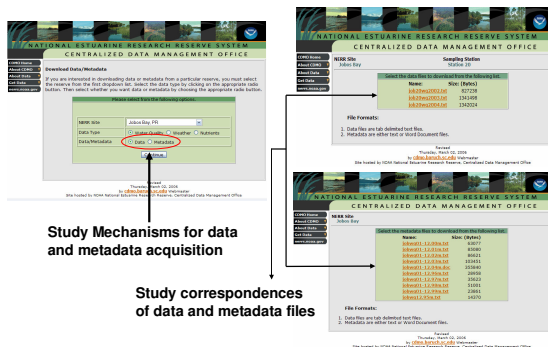


Figure 3. Example: NERR System Data/Metadata

4 Proposed Solution

- Using Java, XML, and FTP technologies for coupling or binding encapsulation of data and metadata files (proposed as format for information content exchange) in automated information processing systems.
- User may develop "stencils" in order to customize "XML tags" during encapsulation.
- Information theoretic measures are used to study how the extensible markup language (XML) may serve as a means for integrating symbols and meaning (semiotics and semantics parts), from metadata, with signals and structure (syntactic part) from sensor-based raw signal-data.

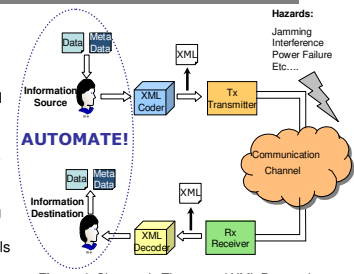


Figure 4. Shannon's Theory and XML Processing

- Proposed solution contemplates dynamic metadata management.
- Data and metadata can be enhanced with user observations.
- User can edit the obtained data by annotating additional comments and parameters.
- Context awareness aids in the detection, estimation, and classification of sensor-based signals acquired from ESM for the assessment and proper management of Earth's geophysical, environmental, and ecological issues.

Figure 5. Shannon's Theory Approach to Information Flow Study

5 Implementation Effort

- Develop a framework for sensor signal acquisition and server storage of raw data.
- Implement solution to force direct and specific relationship between data and metadata files.
- Analyze dynamic metadata management.

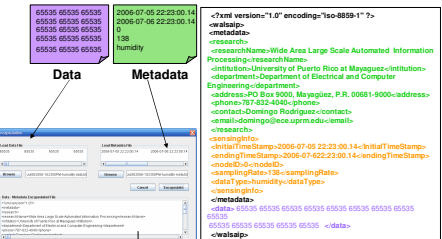


Figure 5. Data and Metadata Encapsulation Process

6 Ongoing Work

- Applying engineering techniques for solution design.
- Generating source code to implement a proposed solution instantiation.
- Identifying potential test cases to perform functional verification test after coding.
- Integrating a proposed solution to the WALSAIP architecture.

7 References

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