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 describes 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

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 influences 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".

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.

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.

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

Figure 1. WALSAIP Conceptual Model
Figure 2. Decision Making Input
Figure 3. Example: NERR System Data/Metadata
Figure 4. Shannon's Theory and XML Processing
Figure 5. Shannon's Theory Approach to Information Flow Study
Figure 6. Data and Metadata Encapsulation Process