Student Research under WALSAIP Project (NSF-CISE-CNS Grant No. 0424546)

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WALSAIP

Institute for Computing and Informatics Studies (ICIS)
University of Puerto Rico at Mayaguez (UPRM)

May 2007

AIP Group 2
Automated Information Processing

Outline

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- **Information Flow Infrastructure Concept**
  - **Signal-based Information Flow**
  - **Basic vs. Net-Centric Information Processing System**
  - **Computational and Information Processing (CIP)**
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WALSAIP Project Description

Wide Area Large Scale Automated Information Processing (WALSAIP)

- ***Developing a new conceptual framework for the automated processing of information arriving from physical sensors in a generalized wide-area, large-scale distributed network infrastructure.***

- ***Focusing on water-related ecological and environmental applications, and it is addressing issues such as scalability, modularity, signal representation, data coherence, data integration, distributed query processing, scheduling, computer performance, network performance, and usability.***

WALSAIP Research Application

*From: ***sur-*** 'over' + ***veiller-*** 'watch'

Environmental Surveillance* Monitoring (ESM)

It deals with the gathering and processing of appropriate environmental information to aid in the process of effective decision making!

http://www.walsaip.uprm.edu

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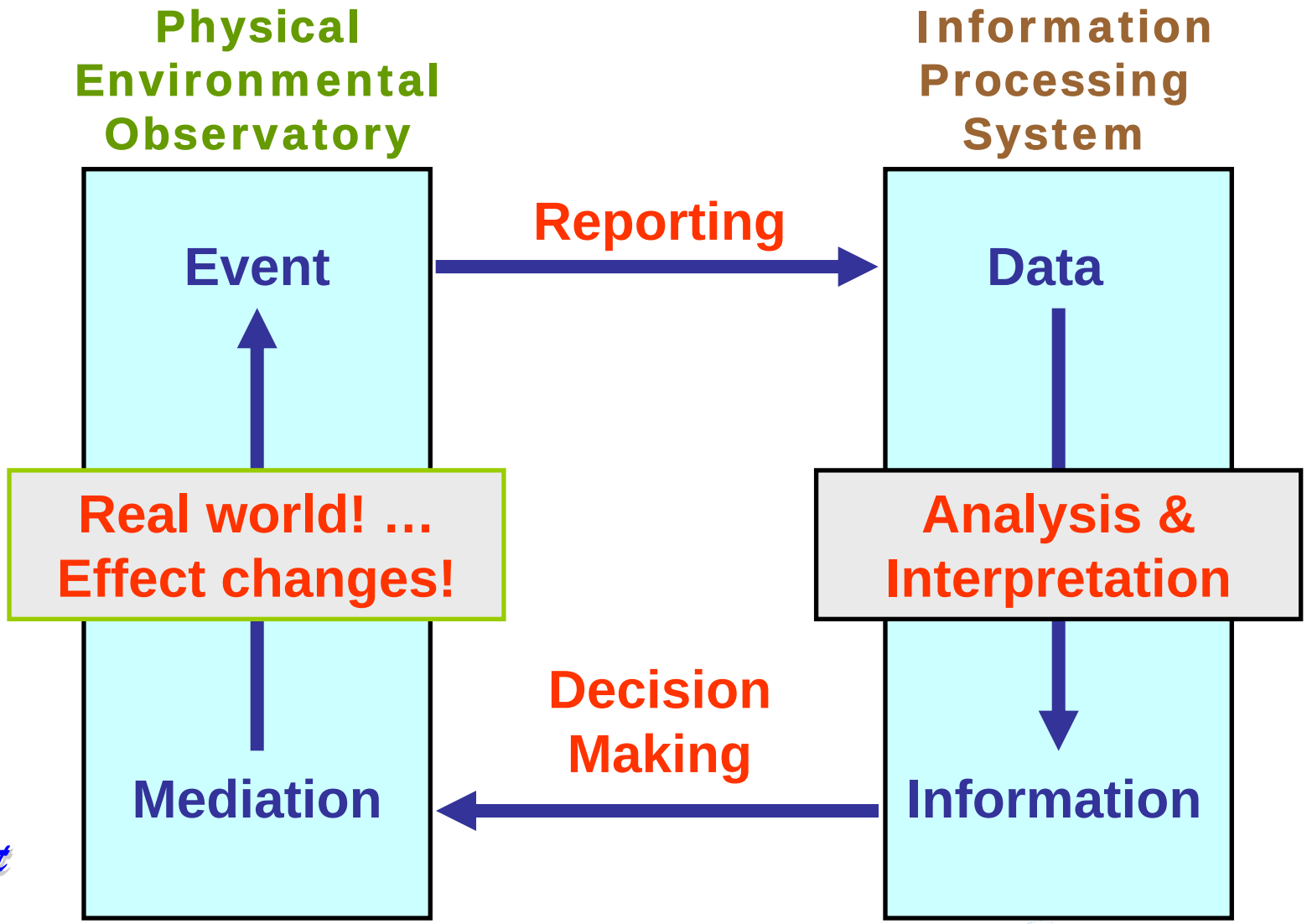
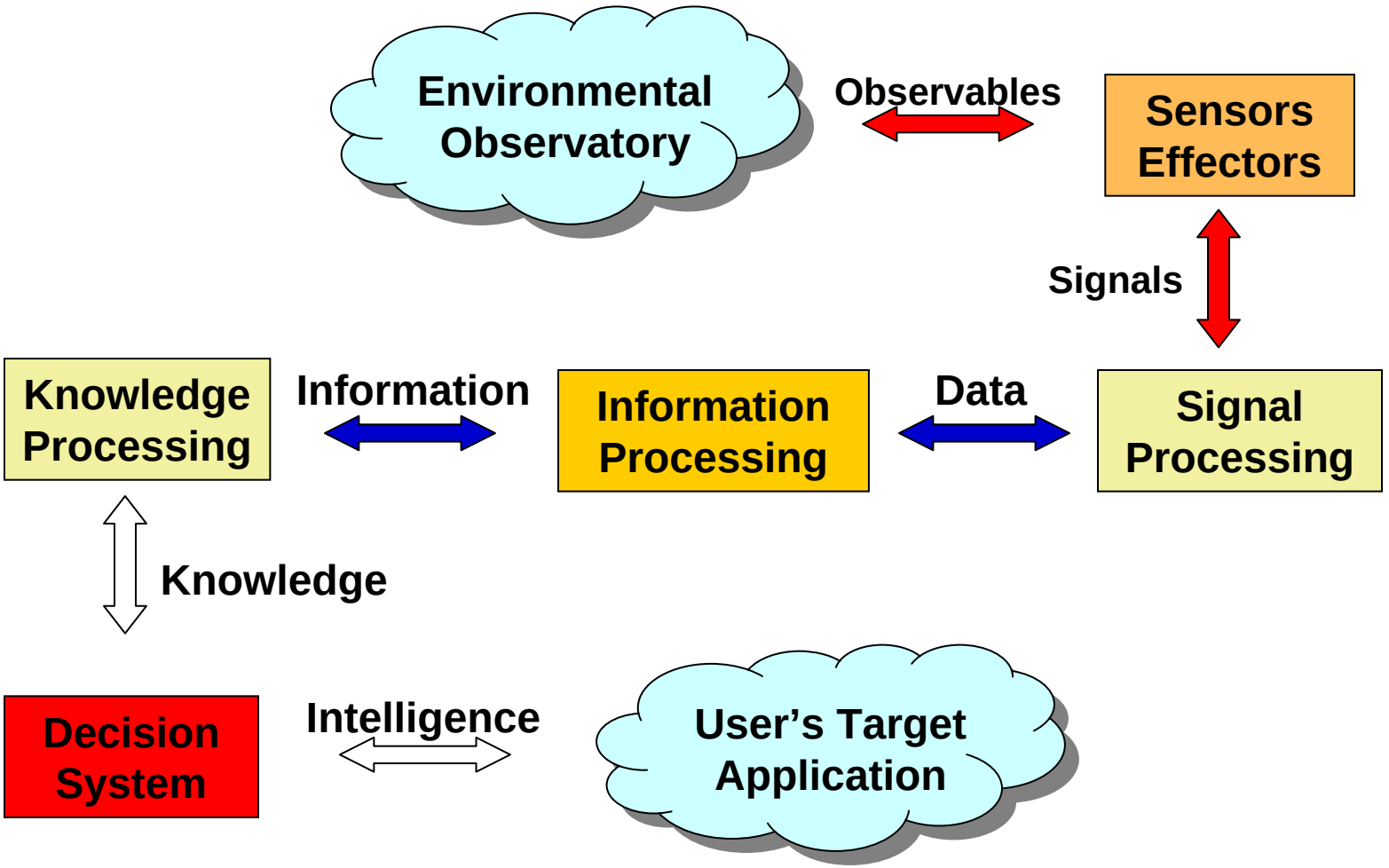
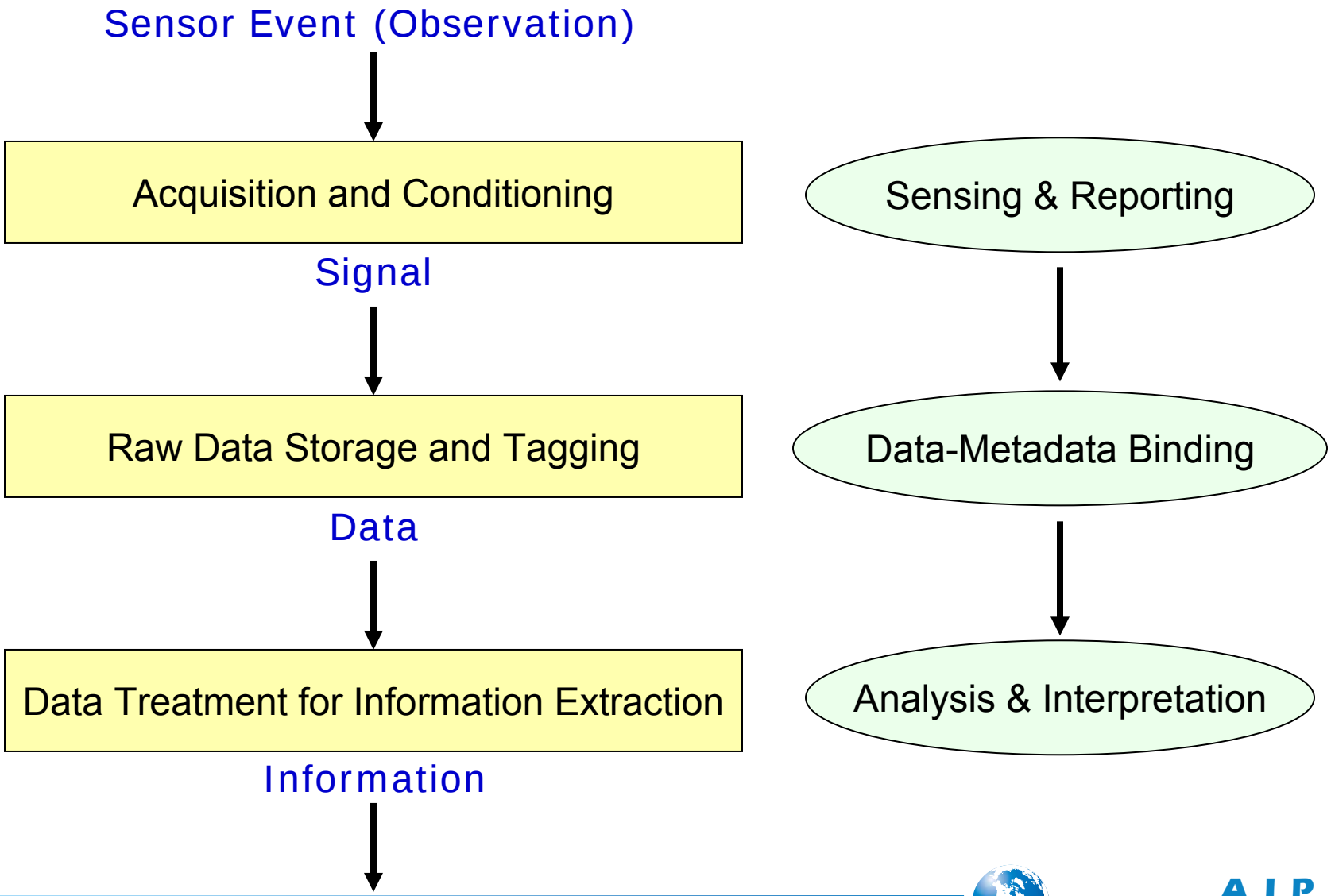
ESM-Adaptive Management Concept



Information Flow Infrastructure Concept

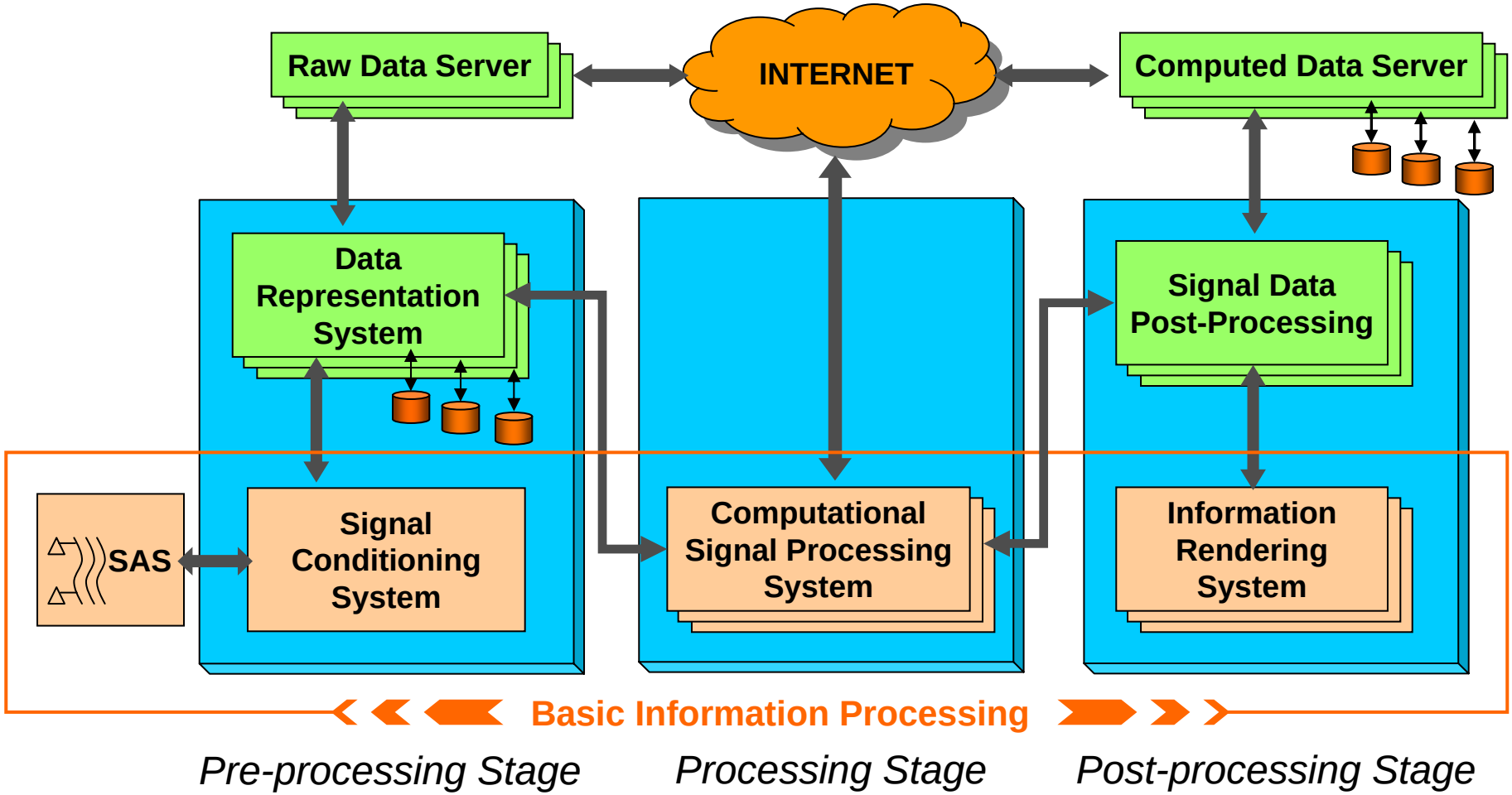


Signal-based Information Flow



Basic vs. Net-Centric Information Processing

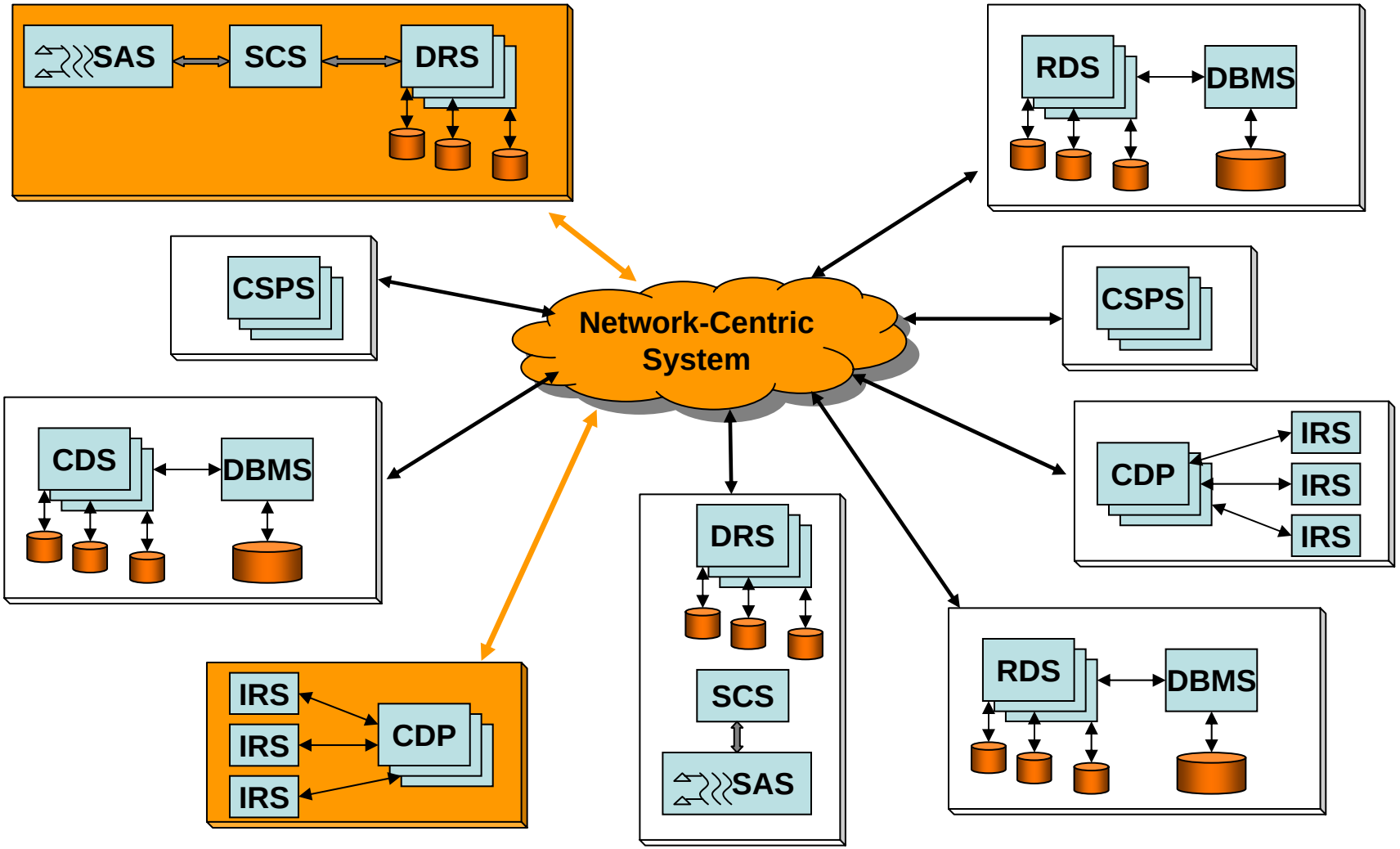
Computational and Information Processing (CIP) Environment



Definition of a CIP Environment

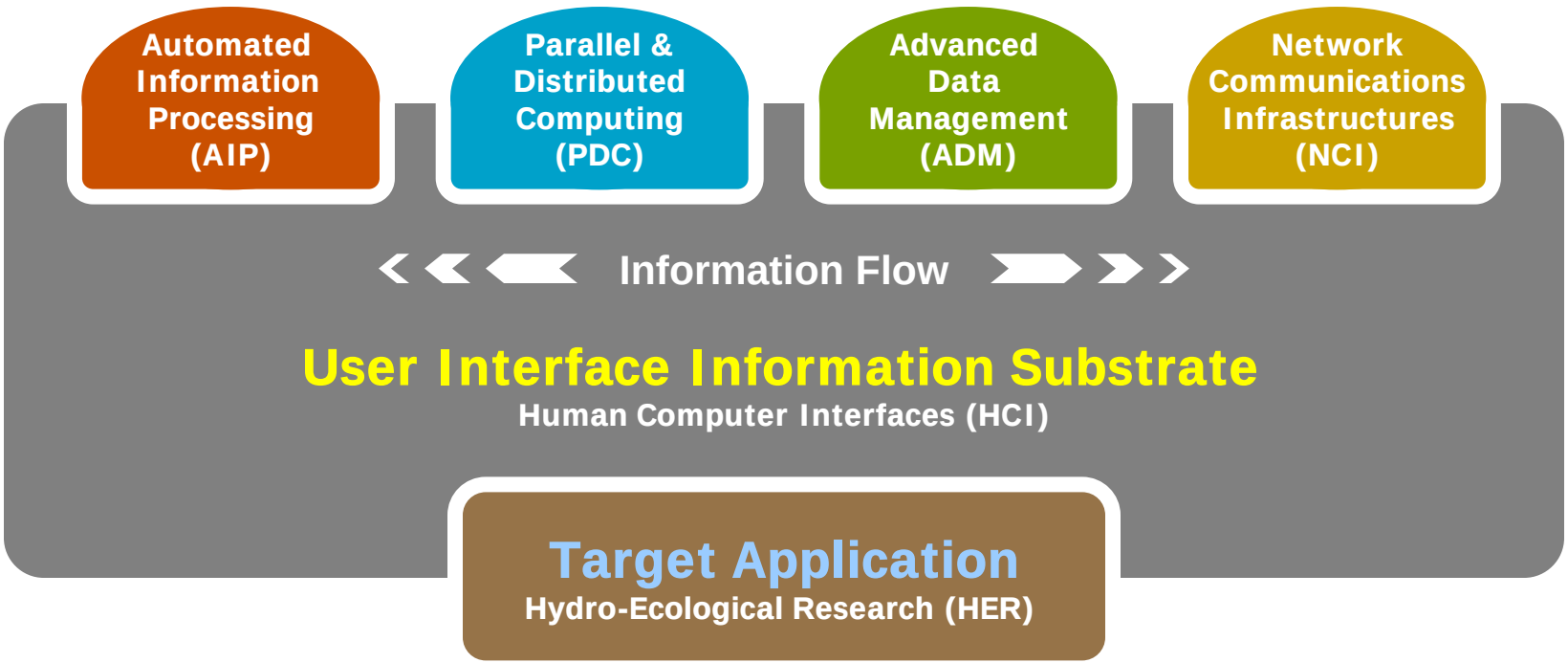
- A Set of Input Entities
- A Data Storage Infrastructure
- A Set of Generalized Operators
- A Set of Composition Rules
- A Set of Action Rules
- A Set of Output Entities
- A User Interface

Distributed CIP Conceptual Framework



WALSAIP's Research Framework

A Framework for Computational and Information Processing



WALSAIP's Students Layered Research

Information Flow

Application Services Layer

- XML Schema Developer
- GIS Viewer
- Computational Image Developer
- Image Mapper
- Visual Terrain Explorer
- Net-Centric Signal Analyzer

Students

- Luz Acaba MS
- Viky Arnedo MS
- Lola Bautista MS
- Omar Valenzuela MS
- Ricardo Veguilla MS

Distributed Systems and Middleware Layer

- Scheduling
- Operating Systems
- Fault Tolerance
- Virtualizator
- Distributed Computing Systems
- Composition Operator Grid Portlet
- Web Services
- Grid Services
- Data Bases
- Adaptivity
- Provisioning

Students

- Cesar Aceros PhD
- John Sanabria PhD
- Jaime Ballesteros PhD
- Mariana Mendoza MS
- Angel Villalain MS

Physical Layer

- Sensor Networks
- Signal Processing Units
- Signal Analysis and Design
- Multicore Embedded Systems
- Hardware Implementations
- MAC Wireless
- WSN Security

Students

- Rafael Arce PhD
- Miguel Erazo PhD
- Yuji Yunes MS

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Analysis and Design of a MAC protocol for Wireless Sensor Networks with Periodic Monitoring Applications

By: Miguel Erazo, PhD Student

Advisors:
Prof. Yi Qian
Prof. Kejie Lu

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Network and Communications and Infrastructure Group
University of Puerto Rico at Mayaguez (UPRM)
May 2007

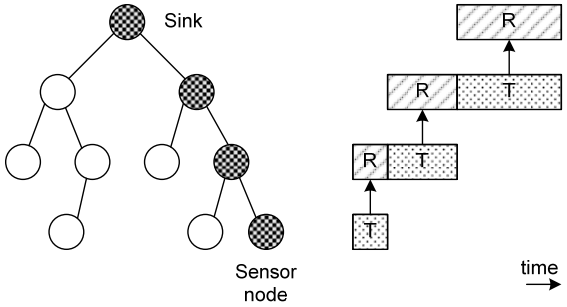
Problem formulation

How to efficiently manage scarce energy resources in WSN

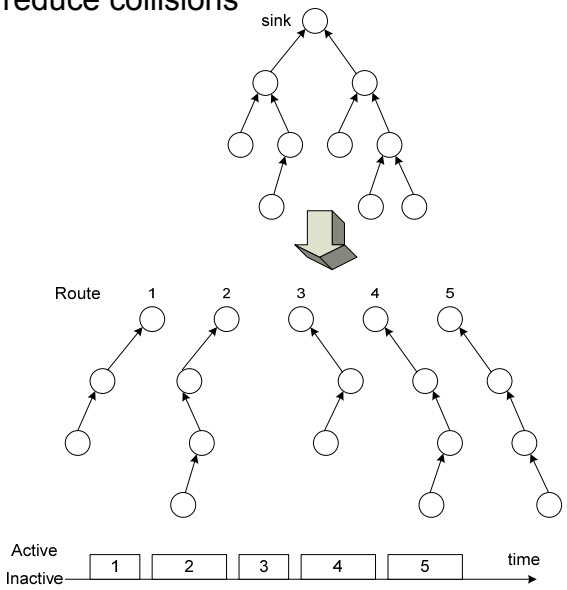
for wide area large scale environmental monitoring applications.

Methodology

A. Proposed Time Schedule



B. *Route Partition* mechanism proposed to reduce collisions

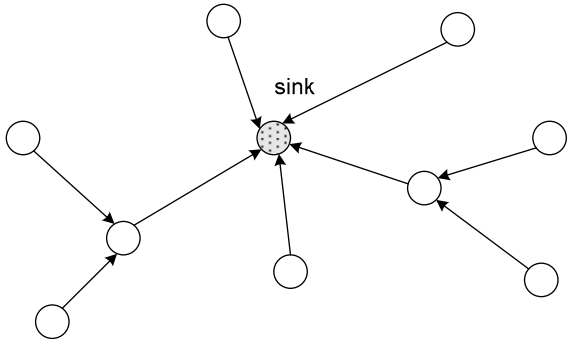


C. **Algorithm to find a subset of paths** to be disseminated through RDP packets

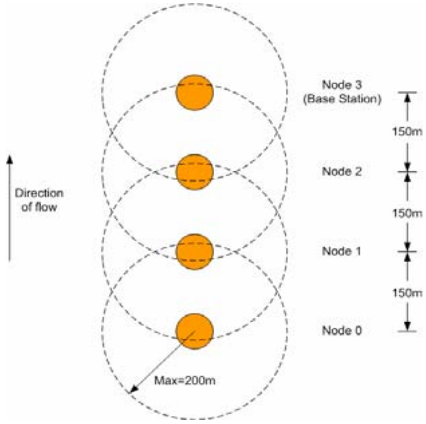
```
Create used                                   //object of a data structure
Create subpaths                               //object of a data structure
for i=1 to N                                  //for all original paths
    (if used.find (Ri)!){                     //path has not been used
        subpaths = findSubpaths(Ri, R)        //find subpaths
        R',add(Ri)                            //route is added to R'
        used.add(Ri)                          //path has been used and now can be discarded for future use
        for j=1 to sizeof(subpaths)
            used.add(subpaths .returnNextSubpath)          //discard subpaths for future use
}


findSubpaths(Ri, R){
    Create subpaths
    for j=1 to N
        if(|R.Rj| < |R.Ri|)                   //possible subpath
            for k=1 to |R.Rj|
                equalElements = 0
                for l=1 to |R.Ri|                          //compare all elements of Ri with all those of Rj
                    if rk,j == rl,i
                        equalElements =1
                if(equalElements ==0)
                    goto label 1
                subpaths.insert(R.Rj)
        label 1
return subpaths
}
```

Application Tools

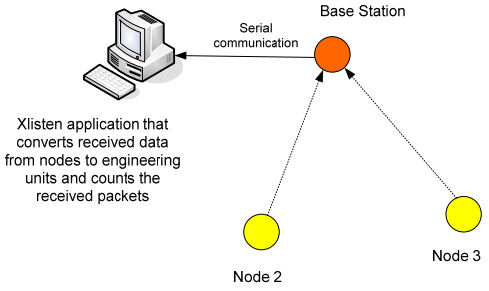
Network configuration for simulations using ns-2



Network configuration used in simulation using ns-2 for previous work (SEA-MAC)



Network configuration used in implementations in mica2 motes for previous work (SEA-MAC)

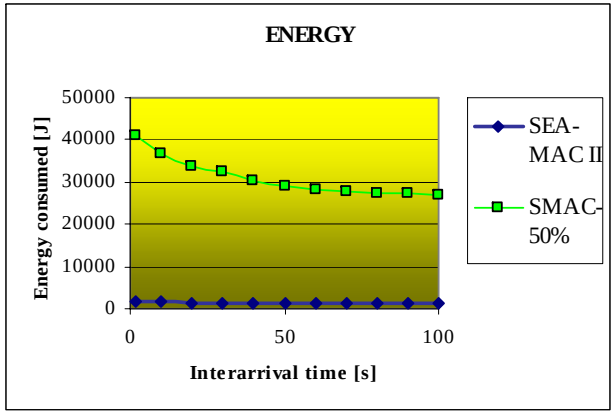


Each node transmits environmental data together with batt voltage every 60 seconds

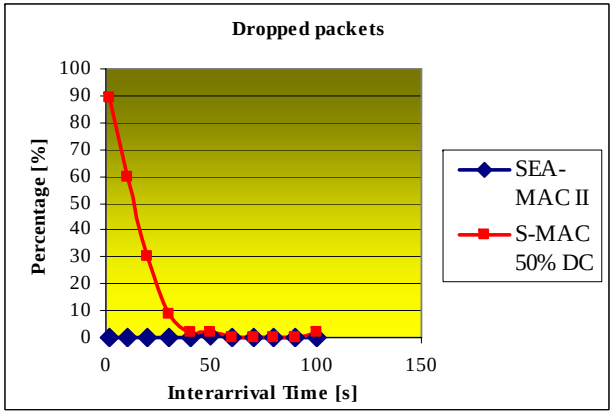
Research Results

Protocols SEA-MAC II and S-MAC

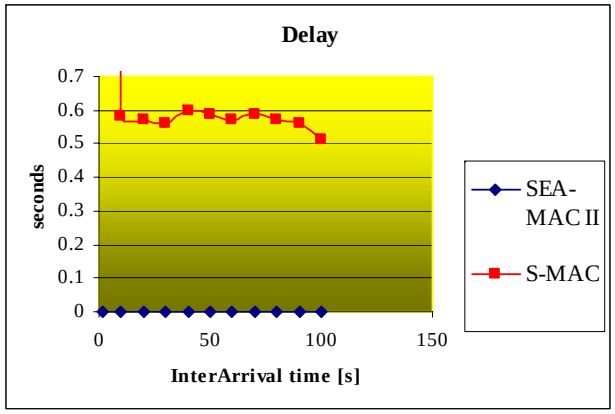
Energy



Packet Loss



Delay



Publications:

M. Erazo, Y. Qian, “SEA-MAC: Simple Energy Aware MAC Protocol for Wireless Sensor Networks for Environmental Monitoring”, Proceedings of ISWPC’2007, San Juan, PR, February 2007.

High-level Partitioning Of Discrete Signal Transforms For Distributed Hardware Architectures

By: Rafael Arce-Nazario, PhD Student

Advisor:

Prof. Manuel Jiménez

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Automated Information Processing Laboratory (AIP)

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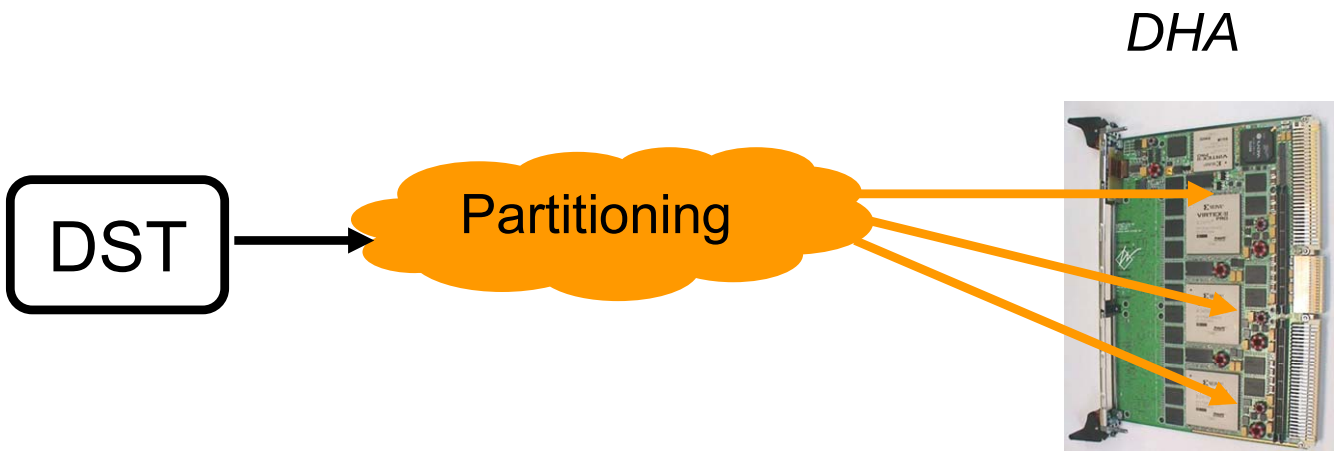
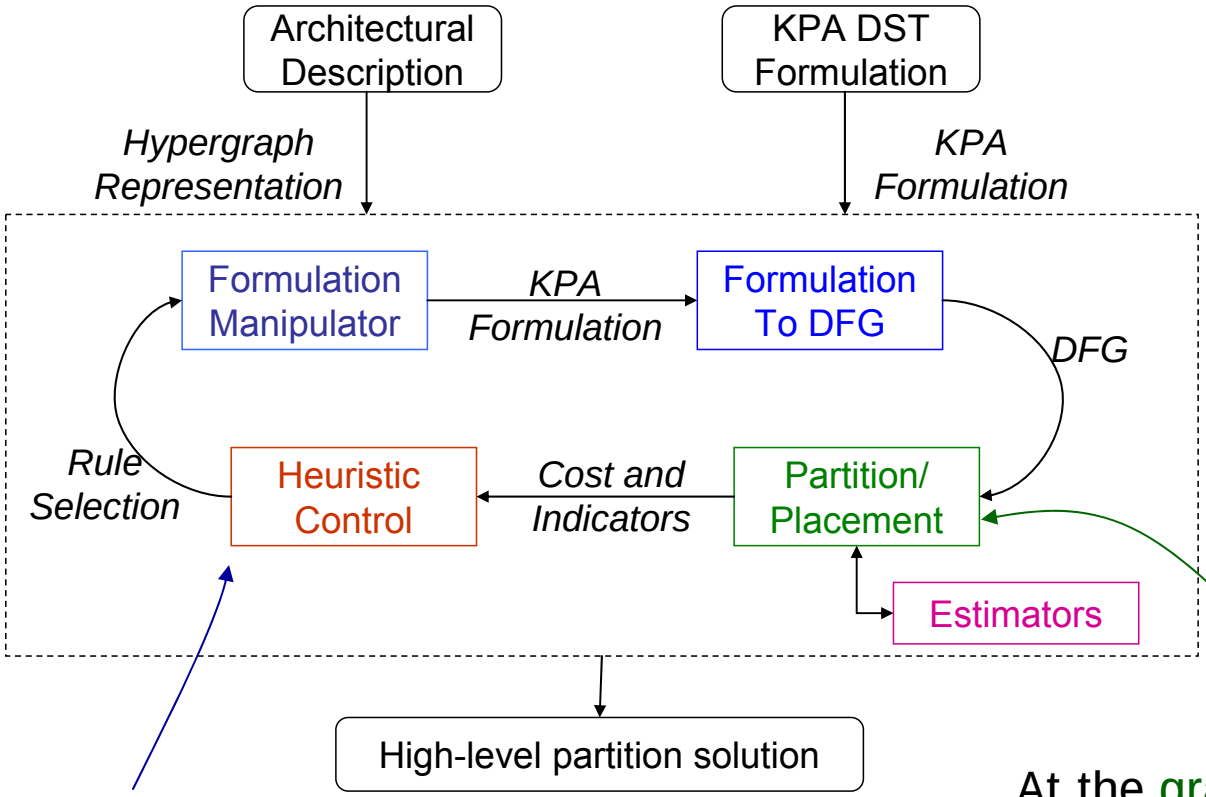
May 2007

Problem Formulation

Given a Discrete Signal Transform and a description of a distributed hardware architecture, partition the DST by taking advantage of its algorithmic and graphic properties.



Methodology



DST-features are introduced in two abstraction levels as part of our methodology: at the **graph level** and the **algorithmic-level**.

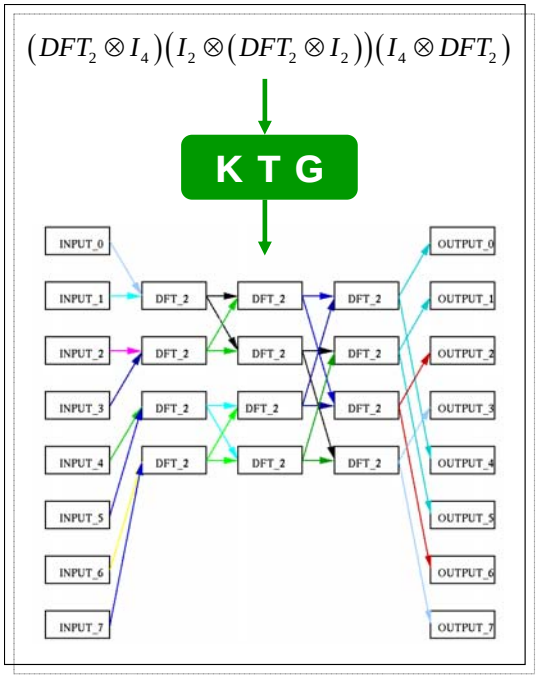
At the algorithm-level, an exploration is conducted in search of equivalent transform formulations that are more suitable for the target topology.

At the graph partitioning level, a series of DST-specific structural considerations have been taken to improve the graph partitioning heuristic.

Application Tools

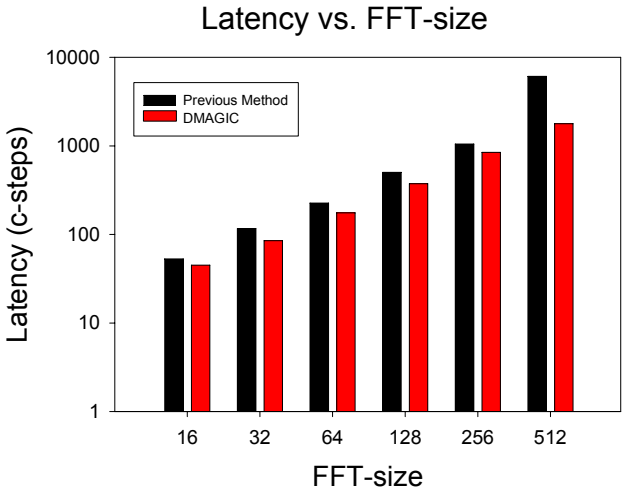
- Conceptual tool - Kronecker Products Algebra (KPA):
  - Compact framework for formulation of DSTs
  - Governed by well known rules and properties
  - Commonly used to explore alternate formulations which better exploit architectural features
  - Formulation 'implies' structure

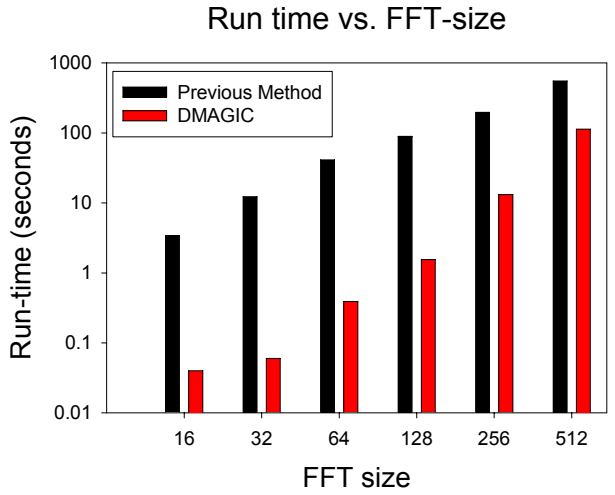
- Software tools
  - KPA to dataflow graph tool
    Partitioning/placement, resource and latency estimation heuristics adapted to the DST problem
  - Experiments to assess reformulation impact on partition quality



Research Results

- Assessment of algorithmic level transformations effect on partition solution quality.
- Greedy strategy for formulation exploration based on DST factorization.
- Comparison against DFG-based generic HL partitioning tool [Srinivasan01]





- New factorization algorithm for regular fast DCTs.
- Tool for KPA to dataflow graph conversion

Publications

Published & accepted articles in peer-reviewed forums

1. R. Arce Nazario, M. Jiménez, D. Rodríguez. “Partitioning Exploration for Automated Mapping of Discrete Cosine Transforms onto Distributed Hardware Architectures”. Accepted to the 50th IEEE Midwest Symposium on Circuits and Systems. August 2007. Montreal, Canada.
2. R.. Arce Nazario, M. Jiménez, D. Rodriguez. “Algorithmic-level Exploration of Discrete Signal Transforms for Partitioning to Distributed Hardware Architectures”. Accepted for publication on Journal of IET Computers & Digital Techniques. April 2007.
3. R. Arce Nazario, M. Jiménez, D. Rodríguez. “High-level Partitioning of Discrete Signal Transforms for Multi-FPGA Architectures”. 16th IEEE International Conference on Field Programmable Logic and Applications. August 2006. Madrid, Spain.
4. R. Arce Nazario, M. Jiménez, D. Rodríguez. “Functionally-aware Partitioning of Discrete Signal Transforms for Distributed Hardware Architectures”. 49th IEEE Midwest Symposium on Circuits and Systems. August 2006. San Juan, PR.
5. R. Arce Nazario, M. Jiménez, D. Rodríguez. “Effects of High-Level Discrete Signal Transform Formulations on Partitioning for Distributed Hardware Architectures”. IEEE on Symposium Field-Programmable Custom Computing Machines. April 2006. Napa, CA

Submitted article

1. R. Arce Nazario, M. Jiménez, D. Rodríguez. “Mapping of Discrete Cosine Transforms onto Distributed Hardware Architectures”. Submitted to Journal of VLSI Signal Processing. April 2007. Springer.

Signal operator algebras framework over distributed signal processing systems

By: Cesar Aceros-Moreno, PhD Student

Advisor:
Prof. Domingo Rodriguez

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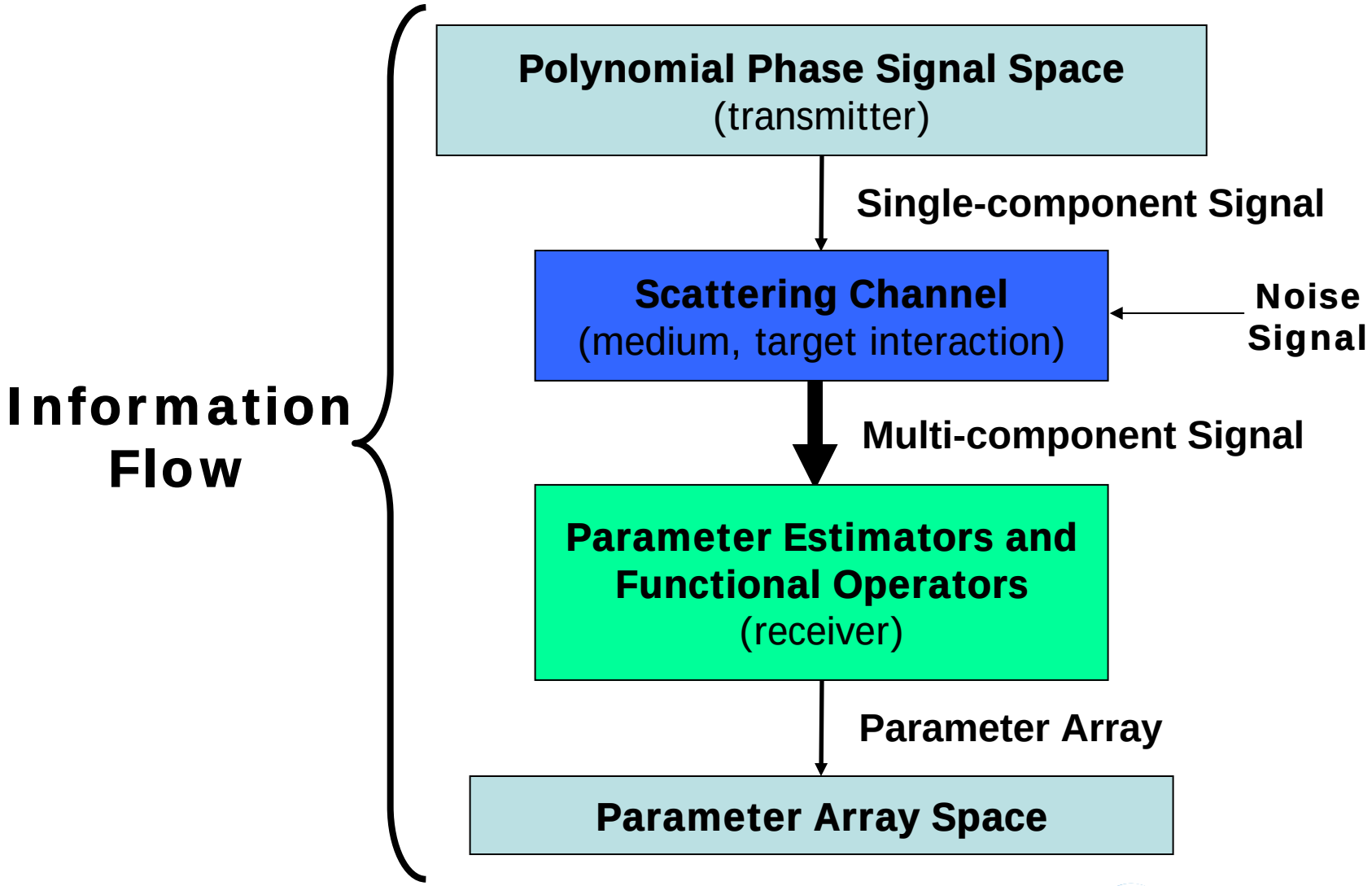
Automated Information Processing Laboratory (AIP)
University of Puerto Rico, Mayagüez Campus (UPRM)
May 2007

Problem Formulation

- How to characterize parameter estimators for multicomponent polynomial phase signals used as active sensing waveforms to study information processing aspects associated with the spatio-temporal dynamics of finite dimensional systems.

$$x[n] = \sum_{n=0}^{K-1} A_K e^{j \sum_{m=0}^{M-1} \alpha_{k,m} n^m} \quad , \quad n \in \mathbf{Z}_N$$

Methodology (Operator Algebras)



Application Tools

C

MPI

FFTW

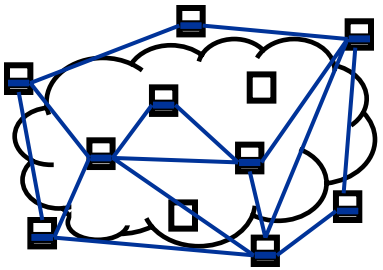
Matlab®

Parallel implementation

MPI Cluster (Komolongma)

Distributed implementation

PlanetLab



PLANETLAB
An open platform for developing, deploying, and accessing planetary-scale services

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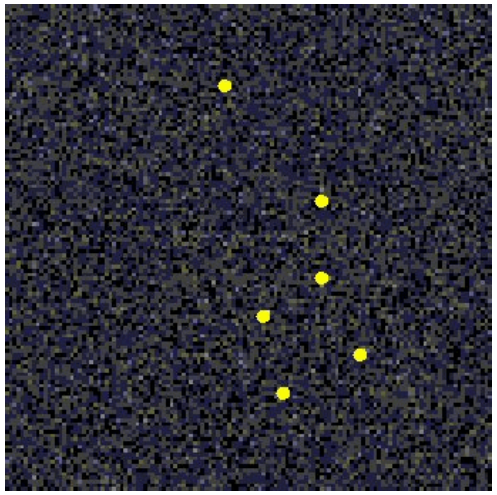
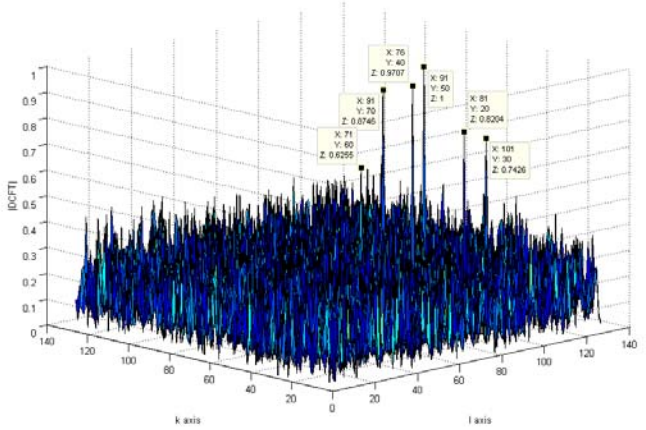
Research Results

UNSUCCESSFUL EST.

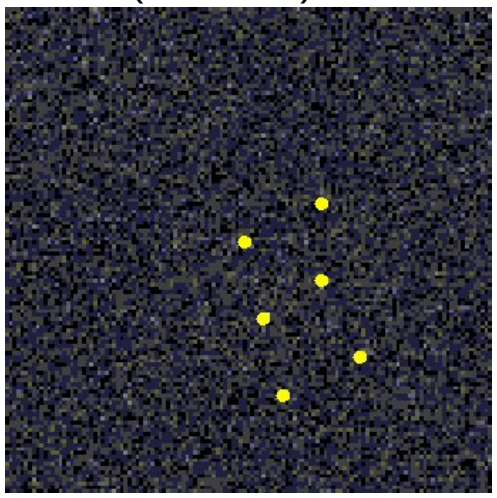


6-component chirp signal estimation
(3 dB SNR)

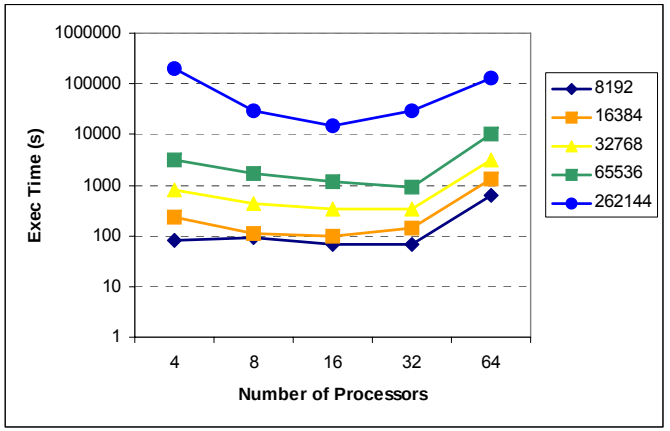


DCFT estimator output
6-component chirp signal

SUCCESSFUL EST.



6-component chirp signal estimation
(6 dB SNR)



DCFT Multi-processor Implementation

Publications

[1] D. Rodriguez, Y. Yunes, C. A. Aceros-Moreno, J. Jimenez, and Y. Mendez, "Beamforming characterization of acoustic signals in wireless sensor networks," Submitted to IEEE Global Telecommunications Conference, Nov 2007.

[2] C. A. Aceros-Moreno, D. Rodriguez, and N. Santiago, "Performance measures for parameter extraction of sensor array point targets using operator group algebra and signal transforms," Submitted to Supercomputing 2007 Conference, Nov 2007.

[3] D. Rodriguez, C. A. Aceros-Moreno, and A. B. Ramirez, "Operator group algebra methods in chirp Fourier implementations for multi-component radar signal analysis," Submitted to IEEE Transactions on Aerospace and Electronic Systems.

[4] D. Rodriguez, C. A. Aceros-Moreno, and H. Parsiani, "A theoretical formulation for subsurface radar waveform design using harmonic analysis on the Heisenberg group," Submitted to Military Communications Conference 2007, Oct 2007.

A Java-based tool for accurate, interactive 3D terrain visualization: Visual Terrain

By: Ricardo Veguilla, MS Student

Advisor:
Prof. Nayda Santiago

WALSAIP

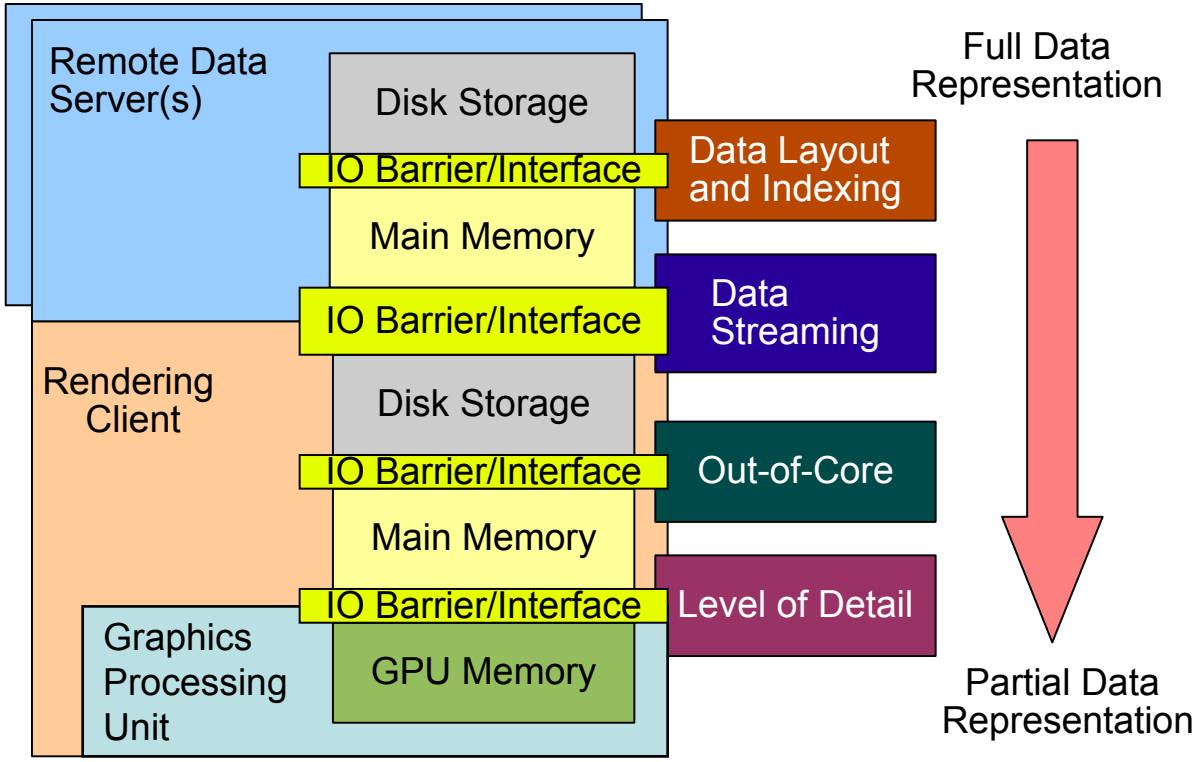
Automated and Information Processing Laboratory
University of Puerto Rico at Mayaguez (UPRM)
May 2007

Problem Formulation

- How to characterize the relation between visual quality and hardware resources in terrain visualization to estimate the tradeoffs associated with:
  - Visual quality
    - Responsiveness
    - Accuracy
  - Hardware
    - Memory

Methodology

- Solution taking into consideration all levels
- Explore issues affecting each level



Application Tools

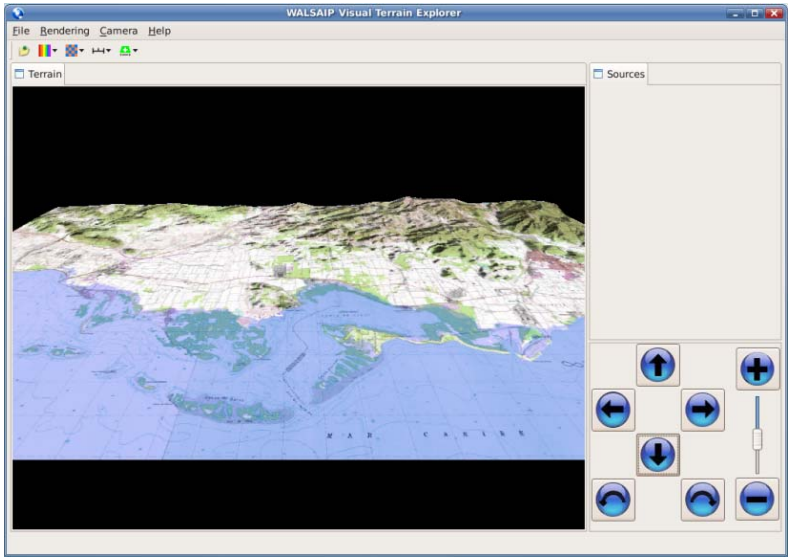
Java Platform 1.5
Cross-platform development and deployment.

OpenGL 2.0
Cross-platform hardware-accelerated 3D rendering.

Eclipse Rich-Client Platform
Modular application development.

Research Results

- Implementation
  - Modular and extensible cross-platform application
  - Multiple data formats support
  - Level-of-Detail management
  - Out-of-core operation and data streaming support currently in development



- Publications
  - Veguilla, R., Santiago, N. G., and Rodríguez, D., "Issues in Terrain Visualization for Environmental Monitoring Applications", Fourth Latin American and Caribbean Conference for Engineering and Technology LACCEI 2006, Mayagüez, Puerto Rico, June 21-23, 2006

Distributed Sensor Signal Acquisition, Analysis, and Representation for Environmental Surveillance Monitoring Applications (ESM)

By: Yuji Yunes, MS Student

Advisor:

Prof. Domingo Rodriguez

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Automated Information Processing Laboratory (AIP)

University of Puerto Rico, Mayagüez Campus (UPRM)

May 2007

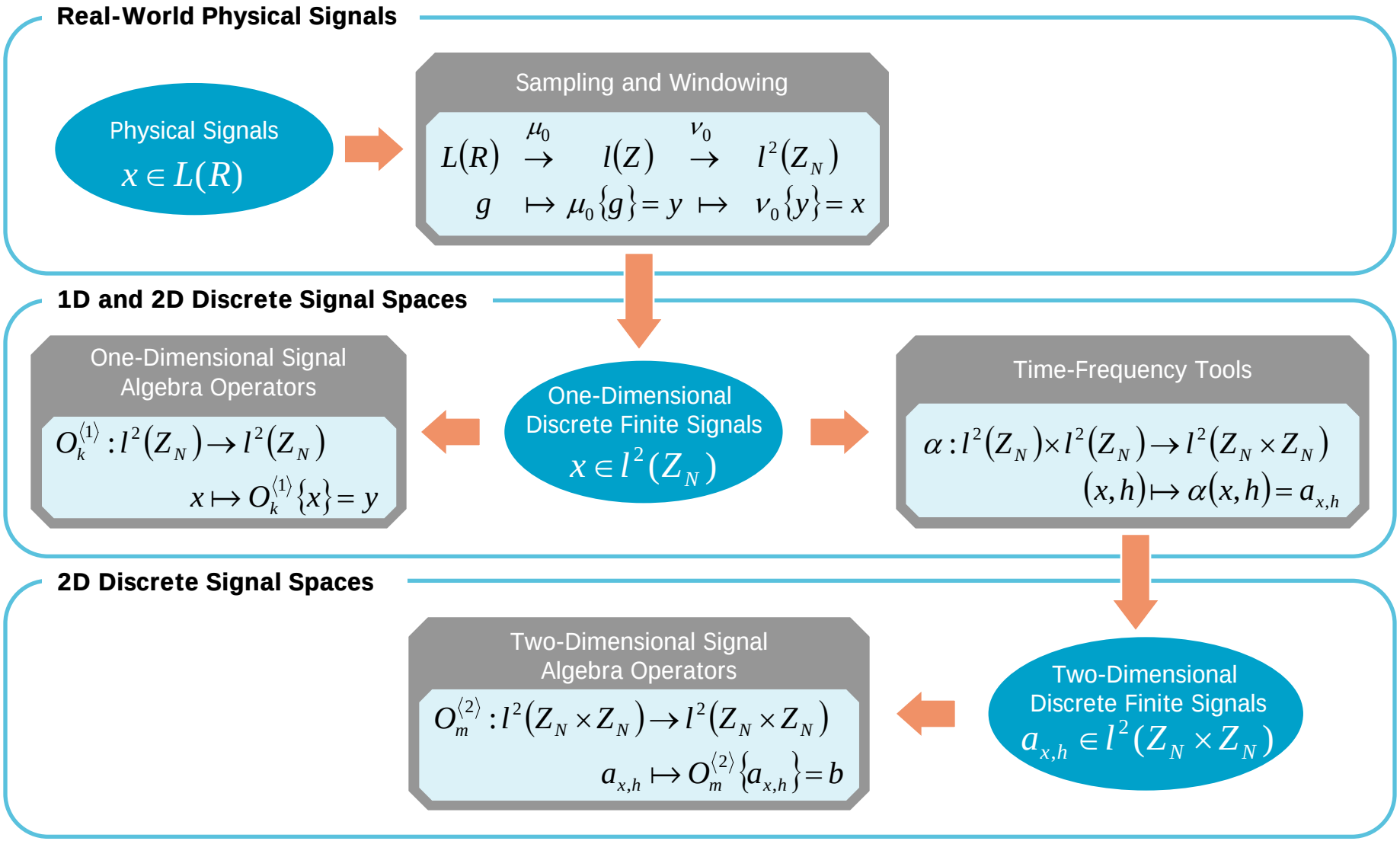
Problem Formulation

1. How to develop high-resolution, efficient, time-frequency representations of acoustic signals.
2. How to design DFT beamforming algorithms to detect direction of arrival (DoA) of acoustic sources.

Justification:

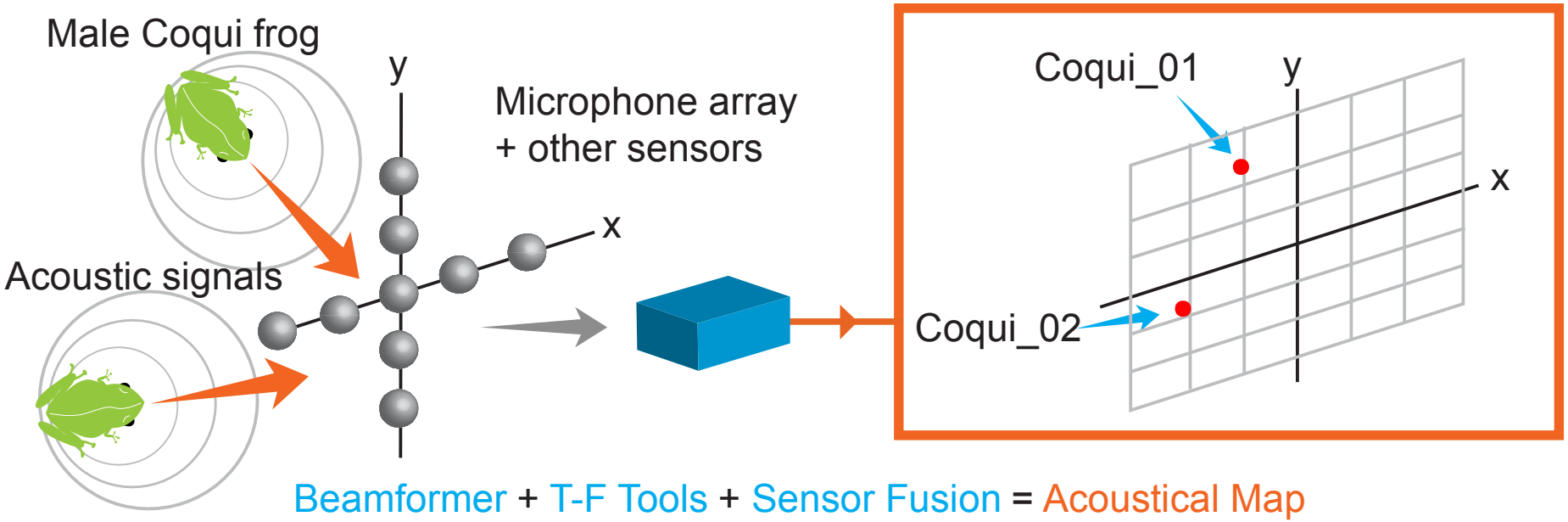
- There is a need to explore new and efficient ways for the monitoring and surveillance of the environment.
- There is also a need to map spatial coordinates of acoustic sources (A-MAP).

Methodology (Operator Approach to Signal Analysis)



Application Tools

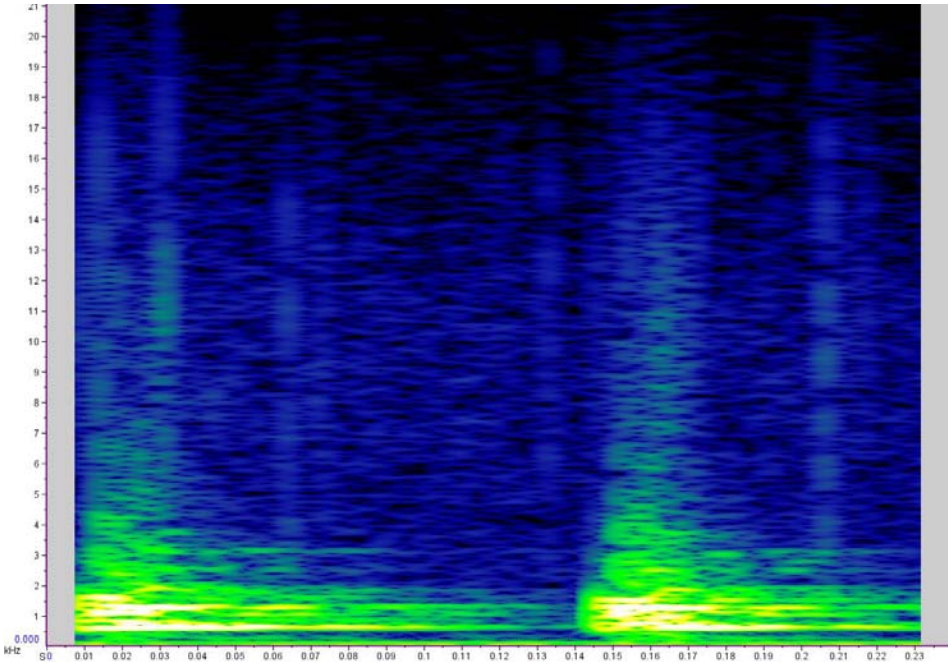
- MATLAB is being used for development and testing of the algorithms.
- Raven is a time-frequency (T-F) tool product developed by Cornell University.
- TI 6713 (floating point) DSPs with Code Composer Studio IDE.
- Xilinx Virtex 4 and Virtex II-Pro FPGAs with ISE and System Generator v8.1.
- Crossbows mica2, mica2dot, and micaZ motes (WSN).
- Tmote Invent and Sky motes (WSN).
- Gumstix Embedded PCs.
- AOpen i945GTt-VFA Core 2 Duo Mobile Embedded PC.
- Data Translation DT-9816 Data acquisition boards.

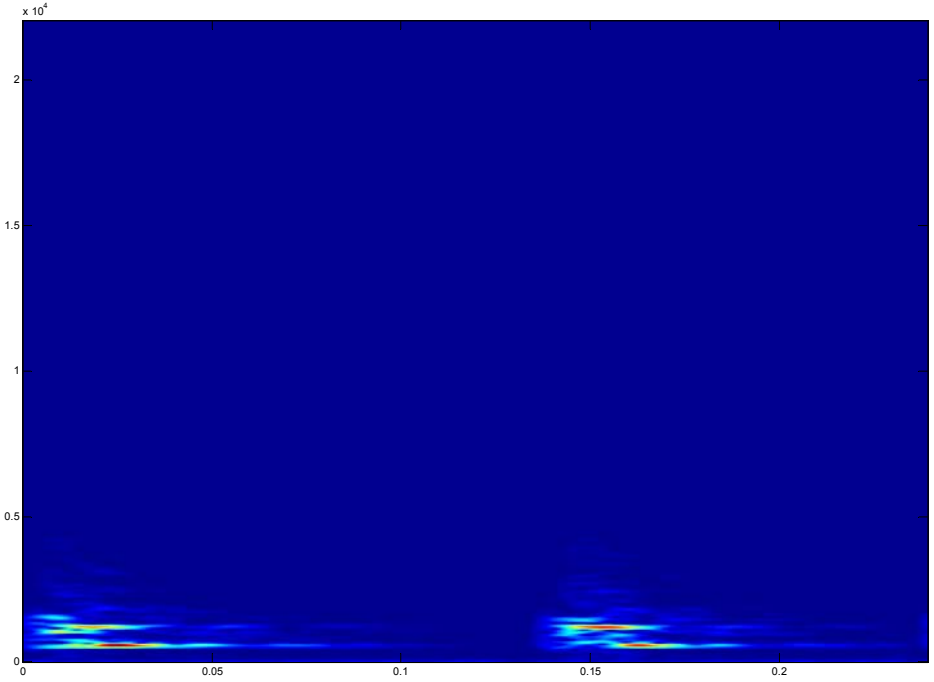


Beamformer + T-F Tools + Sensor Fusion = Acoustical Map

Research Results

Raven vs. Cyclic Short Time Fourier Transform (CSTFT) of a Bufo Lemur frog calling





- Raven's Spectrogram
- CSTFT's Spectrogram

XIR: XML Information Representation Module for Sensor-based Information Processing Systems

By: Luz Acaba, MS Student

Advisor:

Prof. Domingo Rodriguez

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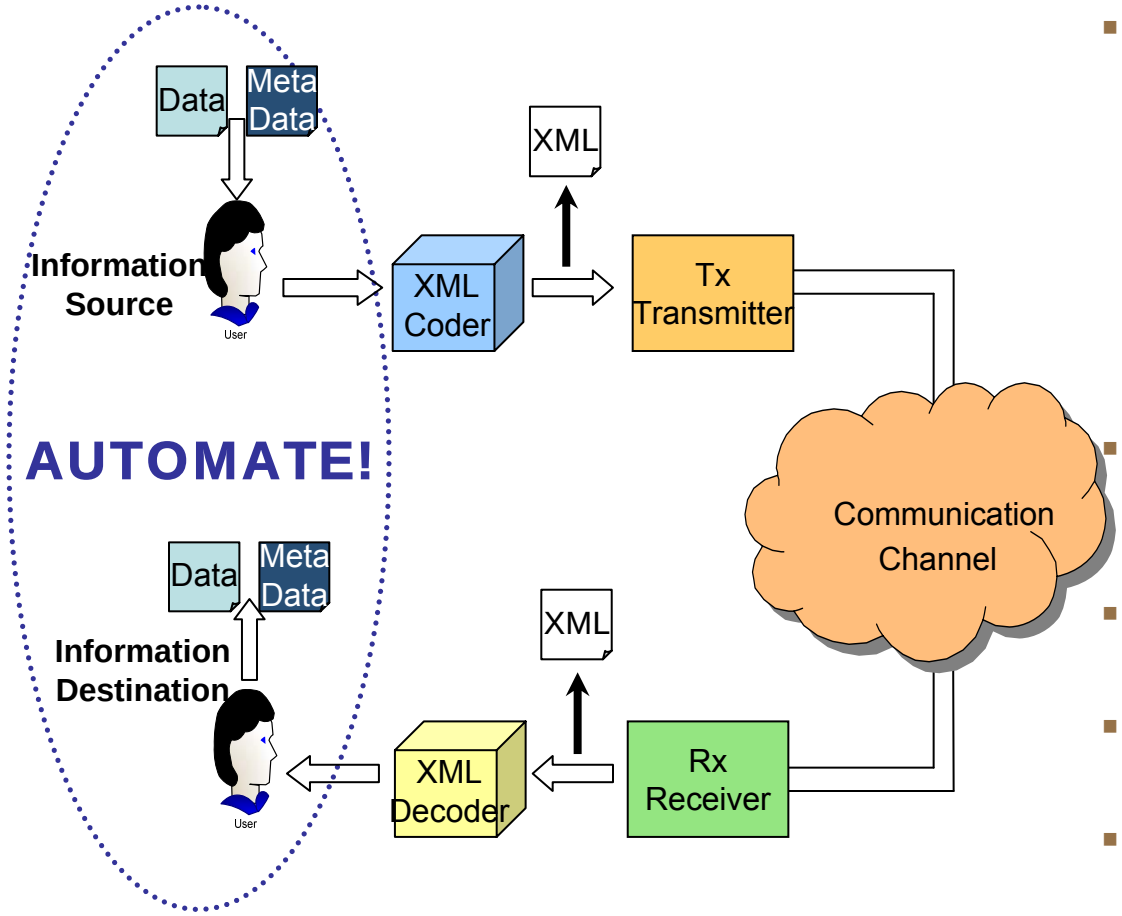
University of Puerto Rico, Mayagüez Campus (UPRM)

May 2007

Problem Formulation

How to develop methods for the coupling/binding representation of data and metadata entities associated with physical sensors pertaining to environmental surveillance monitoring (ESM) applications.

Methodology (Information-theoretic Approach)



Shannon's Theory and XML Processing

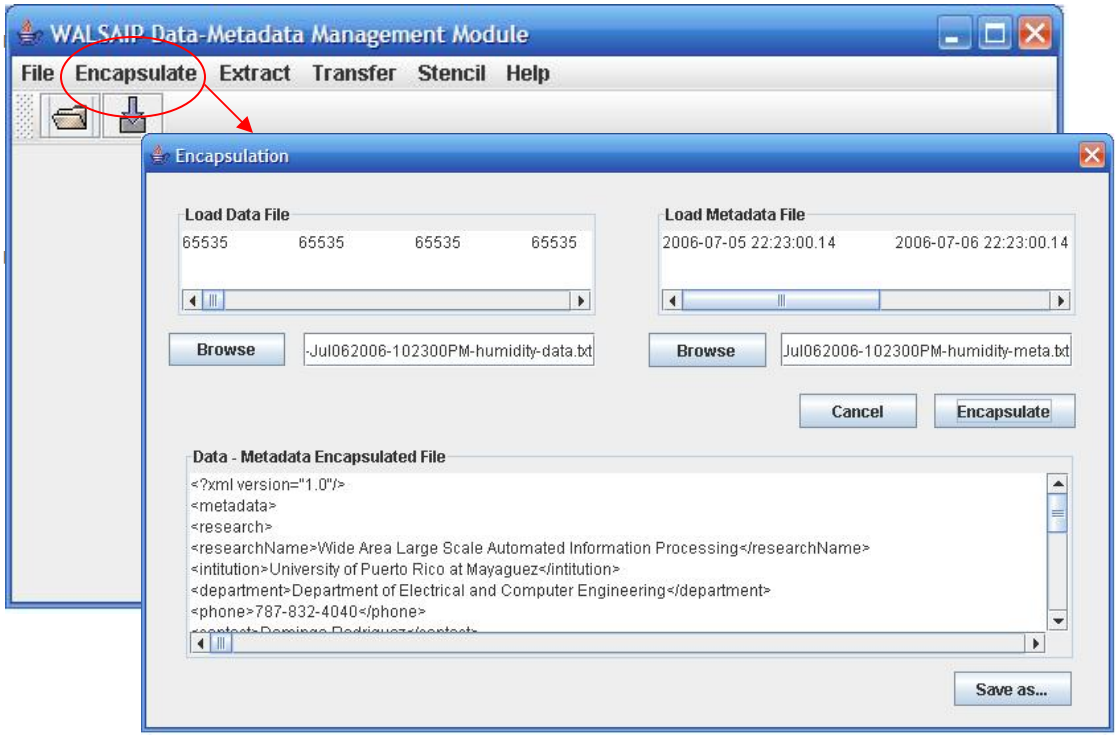
- Information theoretic measures are used to study how the extensible markup language (XML) may serve as a means for integrating symbols and meaning (semiotics and semantics parts), from metadata, with signals and structure (syntactic part) from sensor based raw signal-data.
- Users may develop "stencils" in order to customize "XML tags" during encapsulation.
- Proposed solution contemplates *dynamic metadata management*.
- Data and metadata may be enhanced with user observations.
- Users may comment on received data by annotating additional comments and parameters (added metadata).

Application Tools

- Java
- FTP – File Transfer Protocol
- XML – eXtensible Markup Language is a general purpose markup language capable of describing many different sets of data. It provides a text-based means to describe and apply a tree-based structure to information.

Research Results

- Encapsulation
  - Encapsulation feature takes default stencil to merge two files together: data and metadata.
  - In addition to merge the two files into a new file, the encapsulation feature adds XML tags to each piece of data on the files.



Web-Based Data Processing For Environmental Surveillance Monitoring Applications

By: Lola Bautista, MS Student

Advisor:
Prof. Domingo Rodriguez

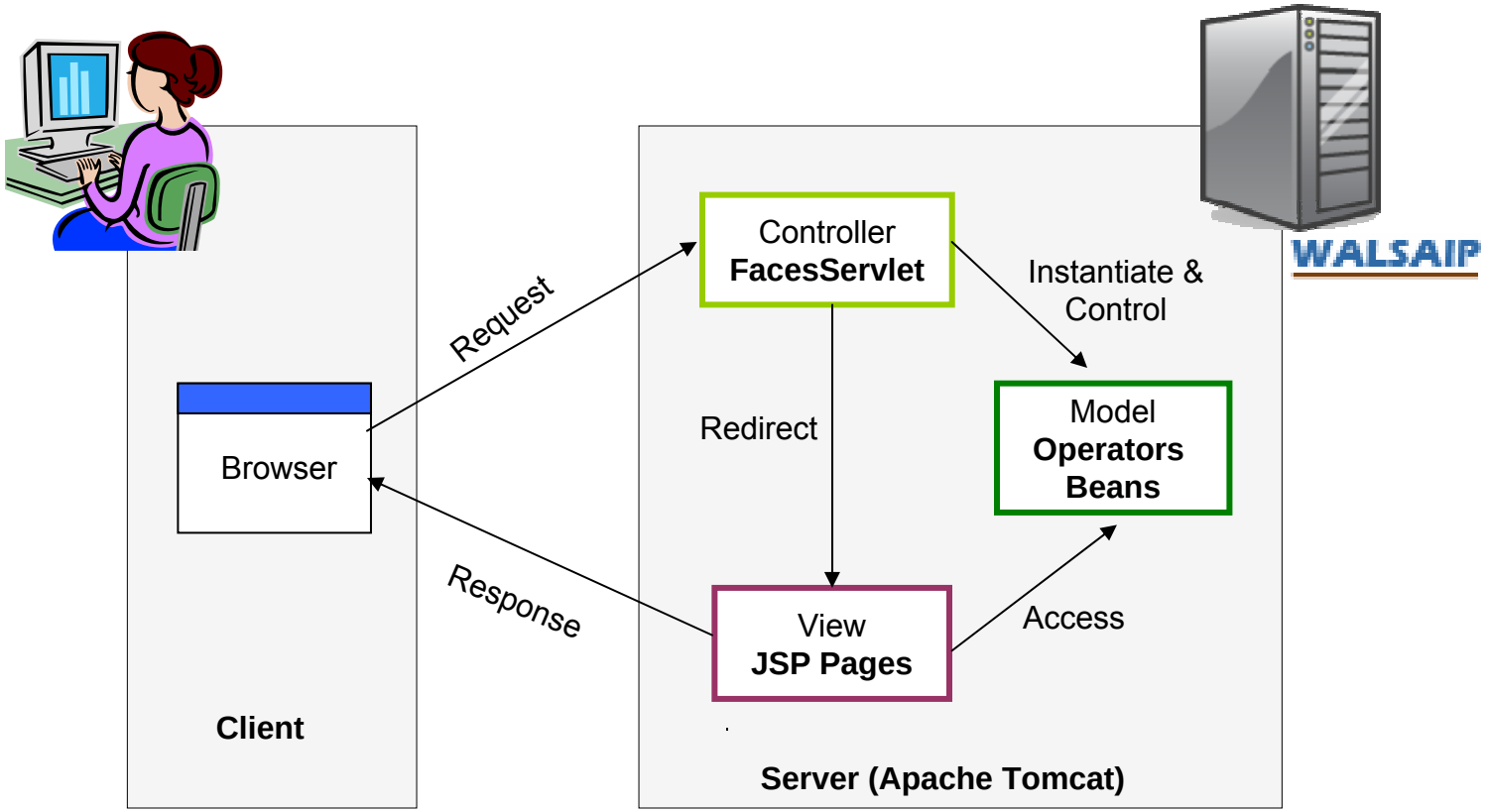
WALSAIP

Automated Information Processing Laboratory (AIP)
University of Puerto Rico, Mayagüez Campus (UPRM)
May 2007

Problem Formulation

How to present in an unified manner fundamental principles of signal processing theory, under an integrated computational and information processing environment, to assist/aid in the solution of environmental surveillance monitoring (ESM) applications.

Web Application Architecture

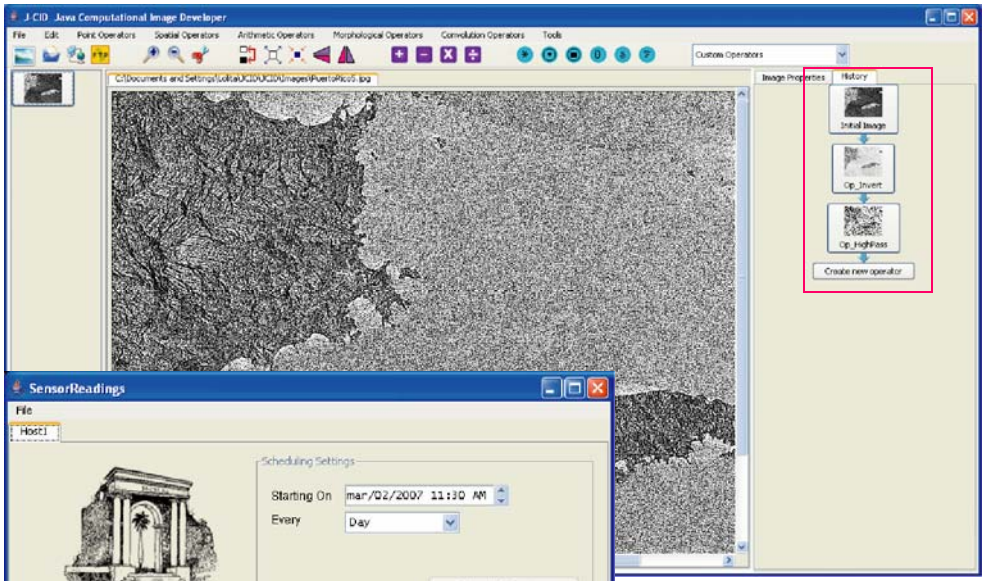


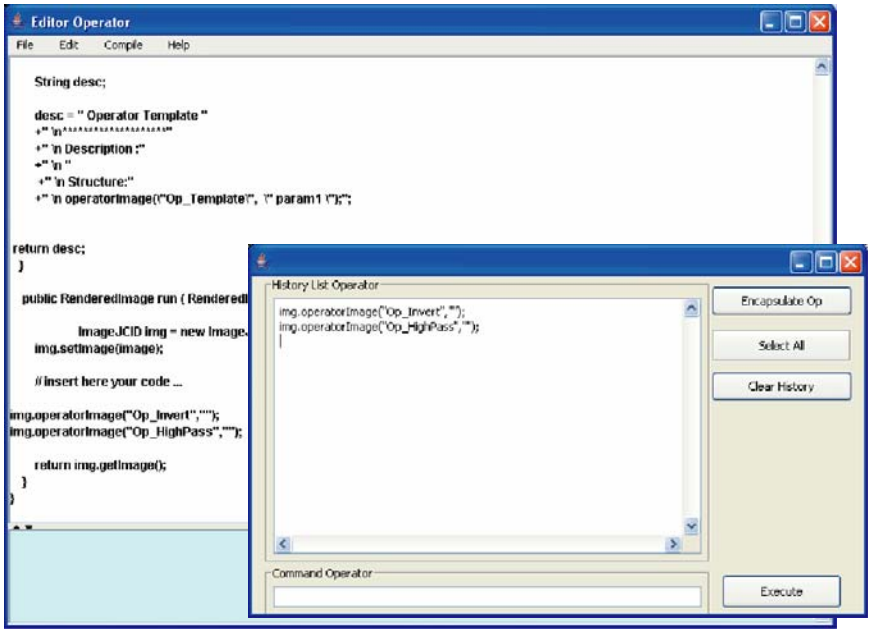
Model-Control-View Architecture

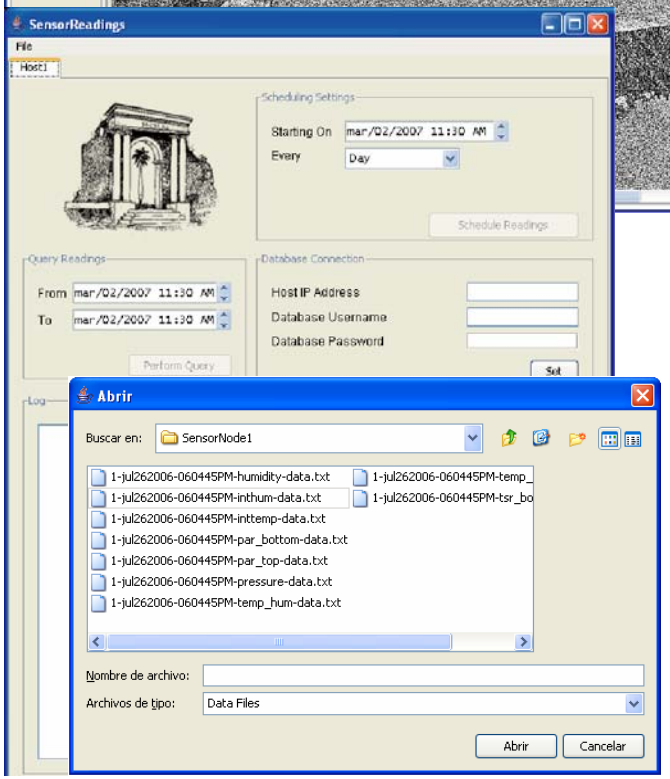
Application Tools

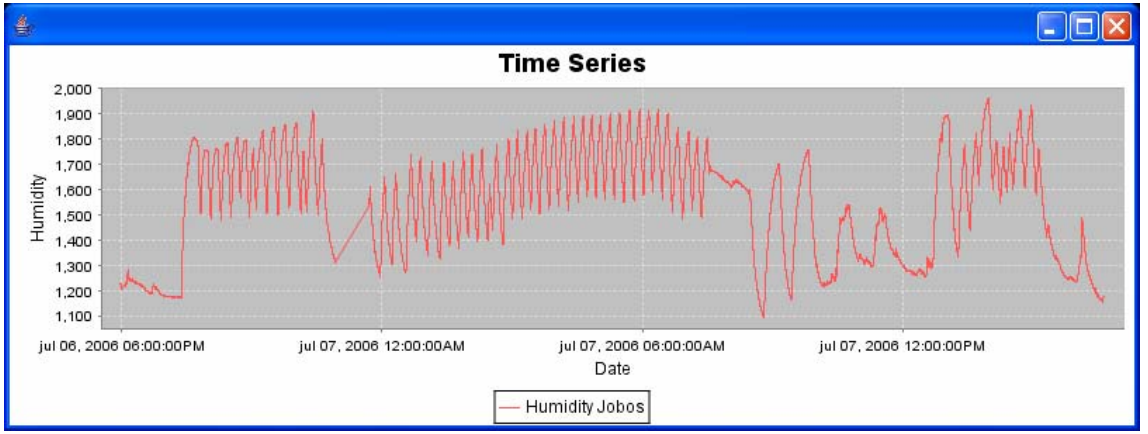
- J2EE (Java 2 Platform Enterprise Edition)
- Java Advanced Imaging API
- Java Image I/O
- Flanagan's Java Library for complex arithmetic
- JavaServer Faces
- Apache Tomcat (Web server)
- JFreeChart (Open source API to make charts)
- J-FTP (For FTP connection of JMethods Inc.)

Research Results (JCID: Java Comp. Image Developer)









WALSAIP

AIP Group
Automated Information Processing

A Grid-based Tool for the Composition of Distributed Signal Processing Operators

By: Mariana Mendoza-Botero, MS Student

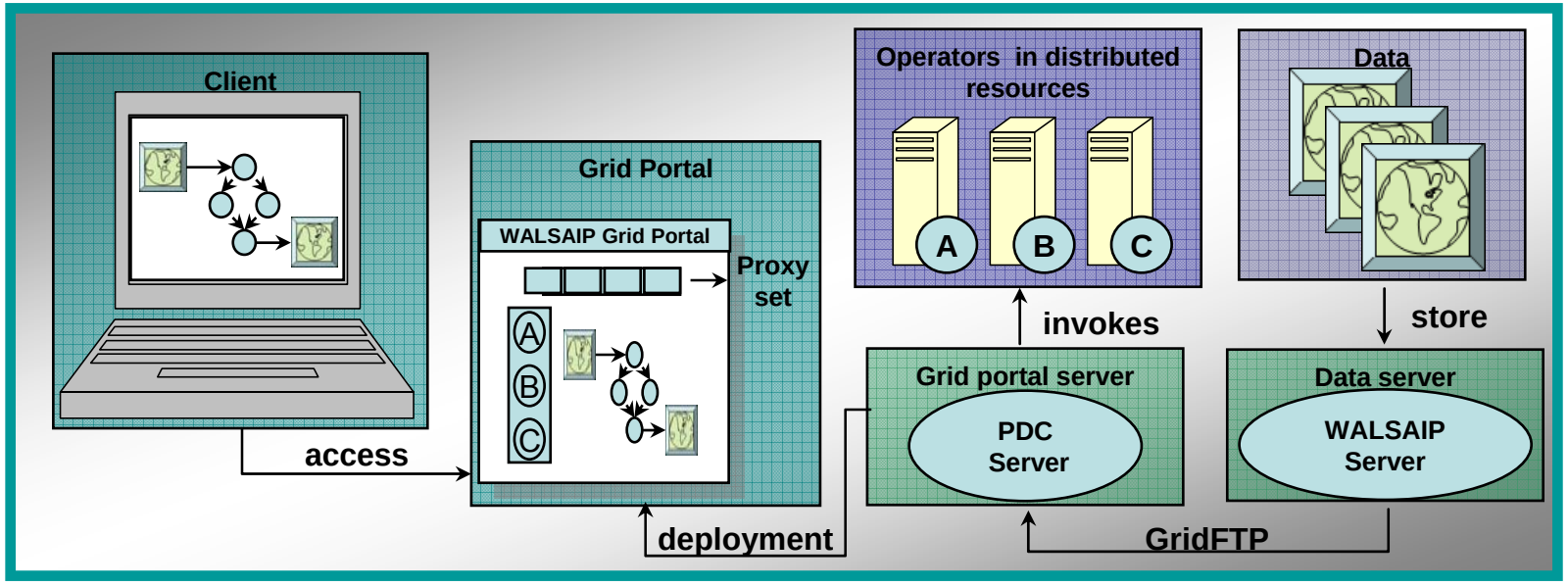
Advisor:
Prof. Wilson Rivera

WALSAIP

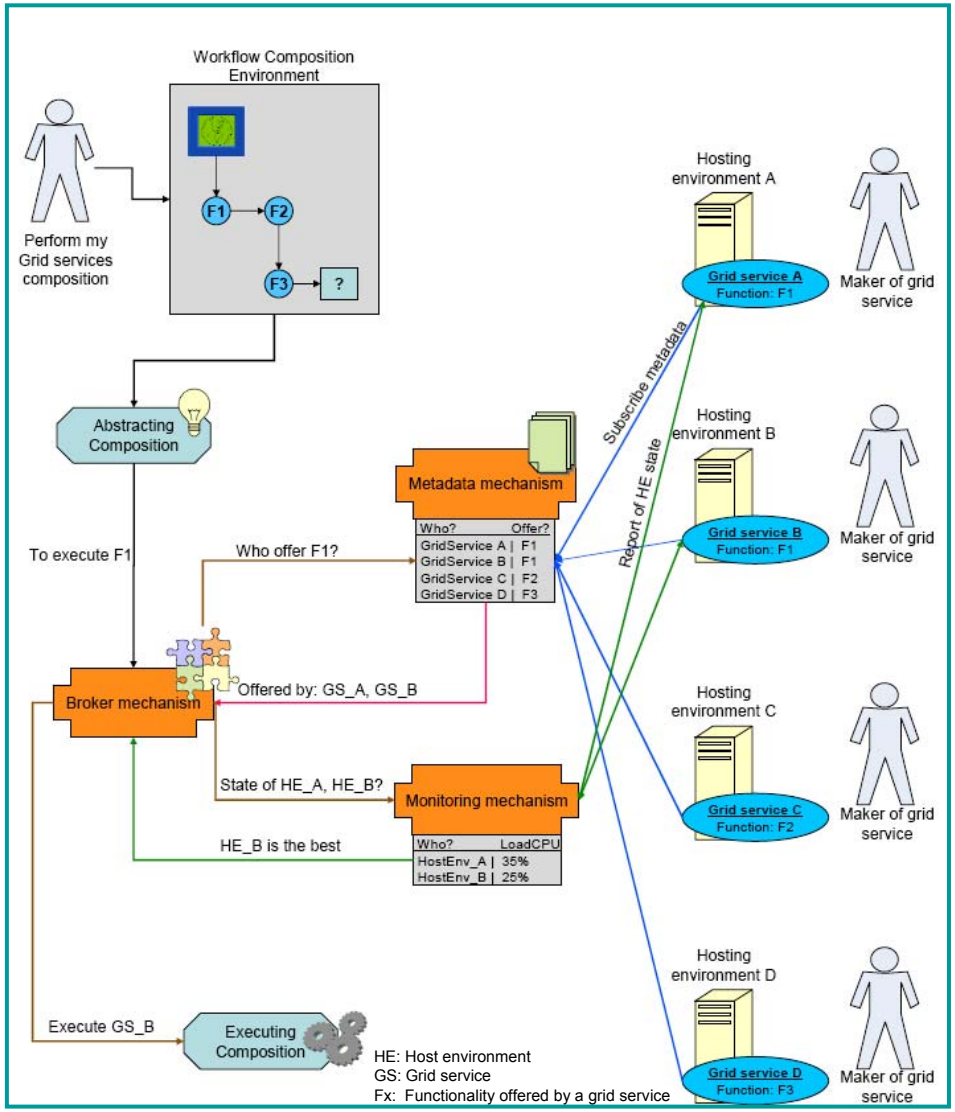
Parallel and Distributed Computing Laboratory
University of Puerto Rico at Mayaguez (UPRM)
May 2007

Problem Formulation

- Problem
  - How to compose signal processing operators in a distributed (grid) environment.
- Design Requirements
  - Signal processing operators may be geographically distributed in different domains and developed by different researchers.
  - Efficient utilization of resources for the composition workflow.
  - Appropriate use of signal processing metadata.



Methodology (Technical Approach)



- **Metadata Mechanism**
  - Automatically generates a descriptor file for each operator.
  - The descriptor file contains metadata associate to the creation and functionality of the signal processing operator.
- **Monitoring Mechanism**
  - Supplies information regarding the availability and utilization of resources hosting the operators.
  - The model abstracts the composition constructing a XML descriptor.
- **Broker Mechanism**
  - Uses metadata and monitored data to perform the resultant operator-based grid service.

Application Tools

Globus Toolkit

Open source middleware used for building grid systems and applications.
We use GT 4.0.1 it to support the grid environment functionality of grid-based tool.

Gridsphere Portal Framework

Portal framework to create reusable portal components (portlets) that can be integrated in a common portal container system.
We use GridSphere 2.7 to construct the grid portal and portlet for visual composition of operators.

Java

Object-oriented programming language.
Signal processing grid services are implemented in Java .

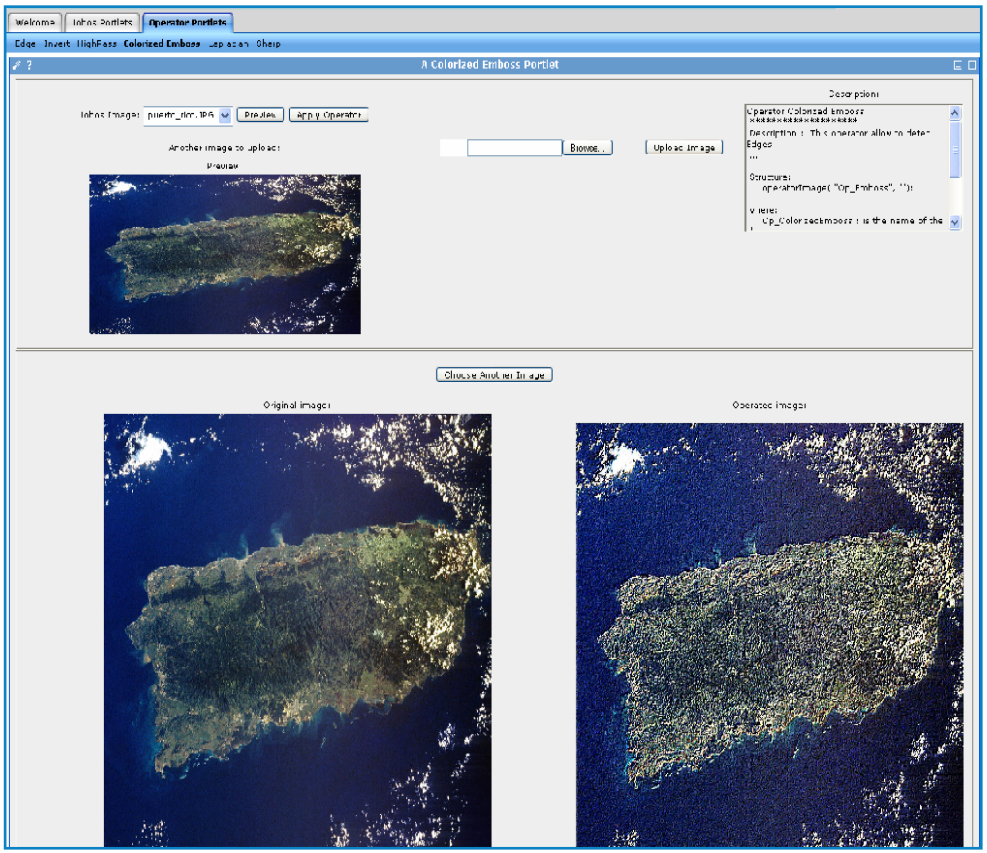
Java Advanced Imaging (JAI) API

API that provides a set of object-oriented interfaces that support a simple, high-level programming model to manipulate images easily.
We use JAI to execute signal processing operators.

Eclipse IDE

Integrated Application development environment

Research Results



Signal Processing Portlet

- A set of signal processing operators deployed on distributed grid enabled resources.
- A prototype of a grid portal to access data and operators via portlets.

"Grid Portal Development for Sensing Data Retrieval and Processing"
D. Arias, M. Mendoza, F. Cintron, K. Cruz, and W. Rivera
IEEE/ACM Second International Workshop on Grid Computing Environments (GCE06), Supercomputing 2006

Efficient Query Execution In Replicated Environments

By: Angel Villalain, MS Student

Advisor:

Prof. Manuel Rodriguez

WALSAIP

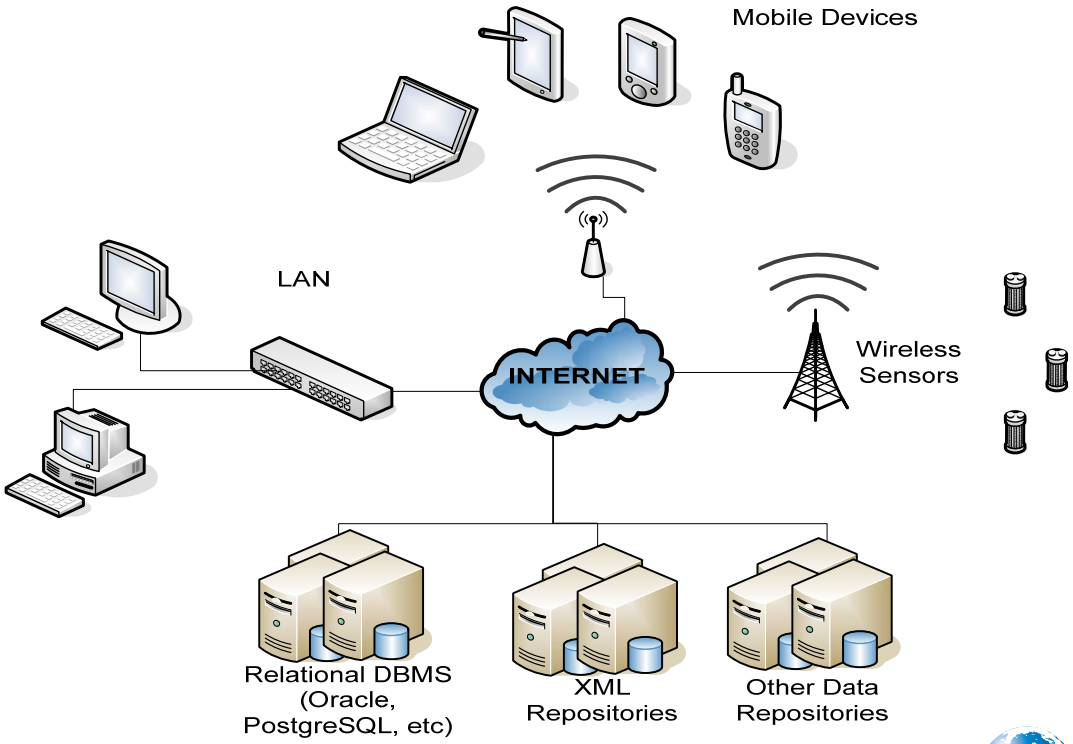
Advanced Data Management Laboratory

University of Puerto Rico at Mayaguez (UPRM)

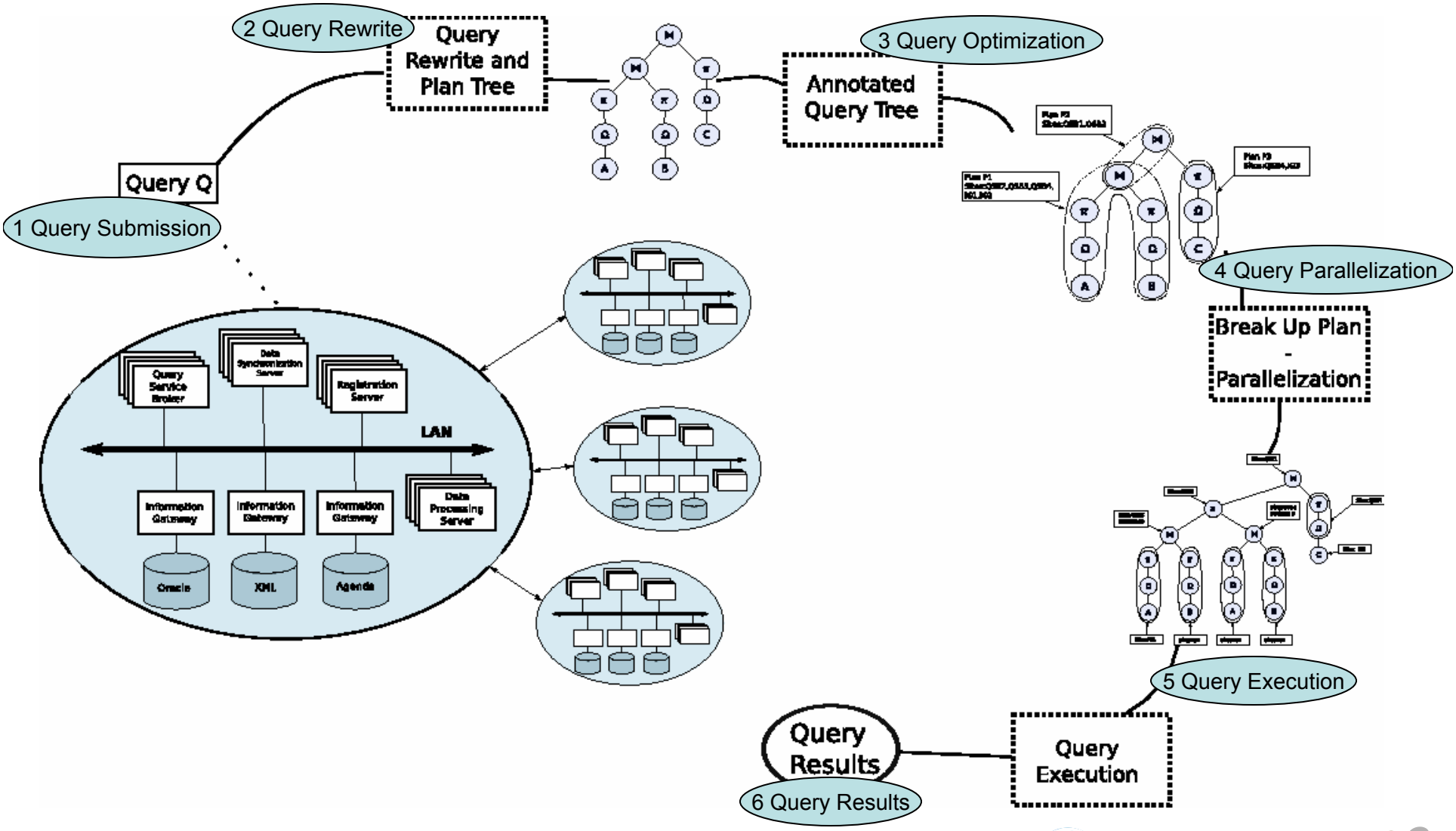
May 2007

Problem Formulation

- How to Solve distributed queries in cooperative fashion for Database Middleware Systems (DMS) on replicated environments.
- DMS have been widely used to integrate and access vast quantities of data, but it is time consuming solution.
- Research efforts on DMS usually considered replication as a way to ensure reliability and availability but little attention to address time constraints.



Methodology



Application Tools

- Java SE 1.5 – programming language
- Axis Web Toolkit – Web services
- Eclipse 3.2 – development environment
- JDBC – database connectivity
- Apache Tomcat – Web container
- Relational DBMS
  - PostgreSQL
- Unix

Research Results

- Parallel Query Execution Algorithms
  - Modified Grace Hash Join
  - Hash Access Mechanism
- Load-balancing via a Hybrid Strategy for query processing amongst replicas
  - Static data and plan partitioning methods
  - Dynamic data and plan partitioning methods
- IEEE ICDE 2008 Paper submission (06/07)
- Upcoming Software Release (08/07)

Provisioning and Orchestration in Distributed Wide Area Large Scale Infrastructures

By: John Sanabria, PhD Student

Advisor:

Prof. Wilson Rivera

WALSAIP

Parallel and Distributed Computing Laboratory

University of Puerto Rico at Mayaguez (UPRM)

May 2007

Problem Formulation

How to orchestrate multiple services in grid environments to provide adaptivity under resource and service availability uncertainty.

Grid System Model

Resources are connected via two-level hierarchical networks. The first level is a wide are network that connects local area networks or virtual organizations at the second level.

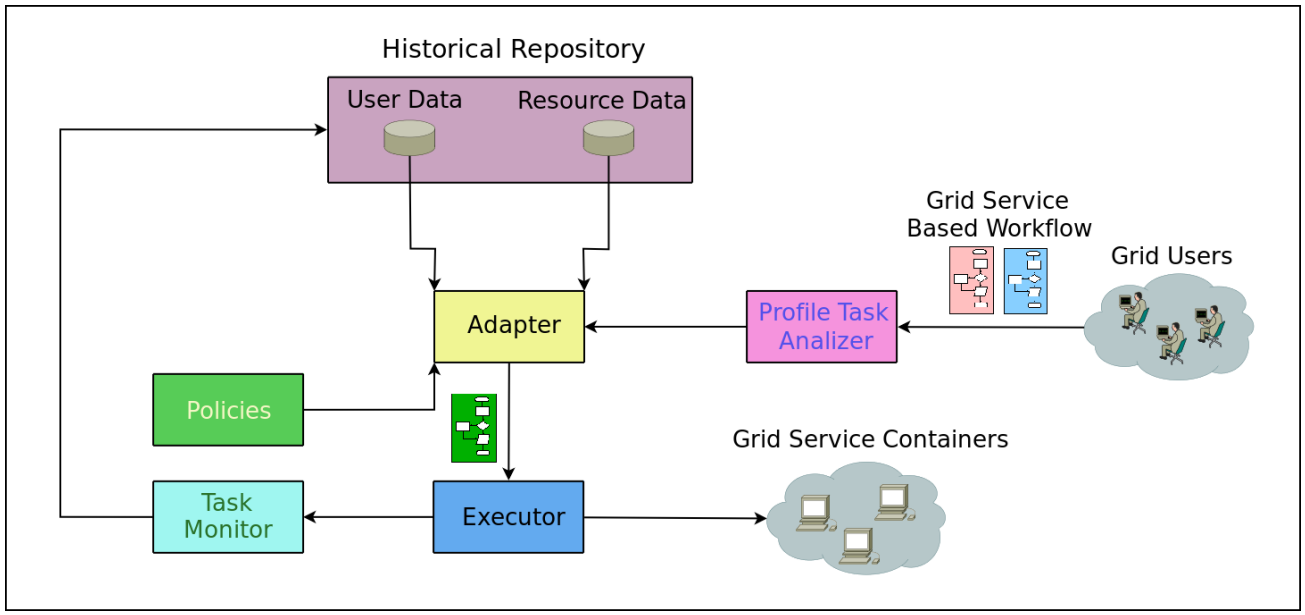
Uncertainty

max $E[f(x,y)]$

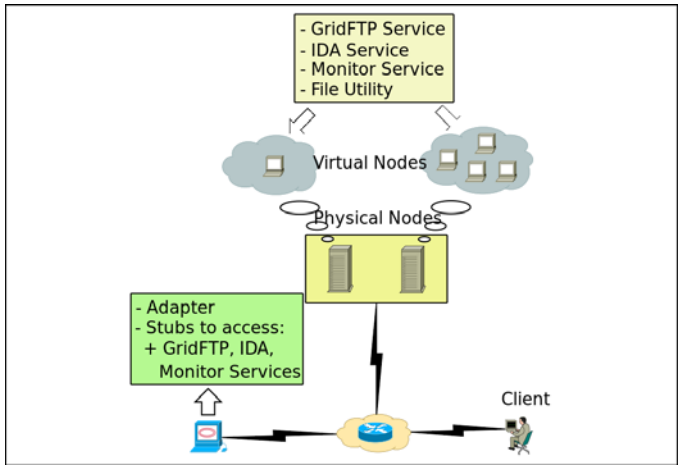
subject to:

$E[gj(x,y)] \ 0, j = 1, 2, \ldots, p$

Methodology



Gateway Architecture

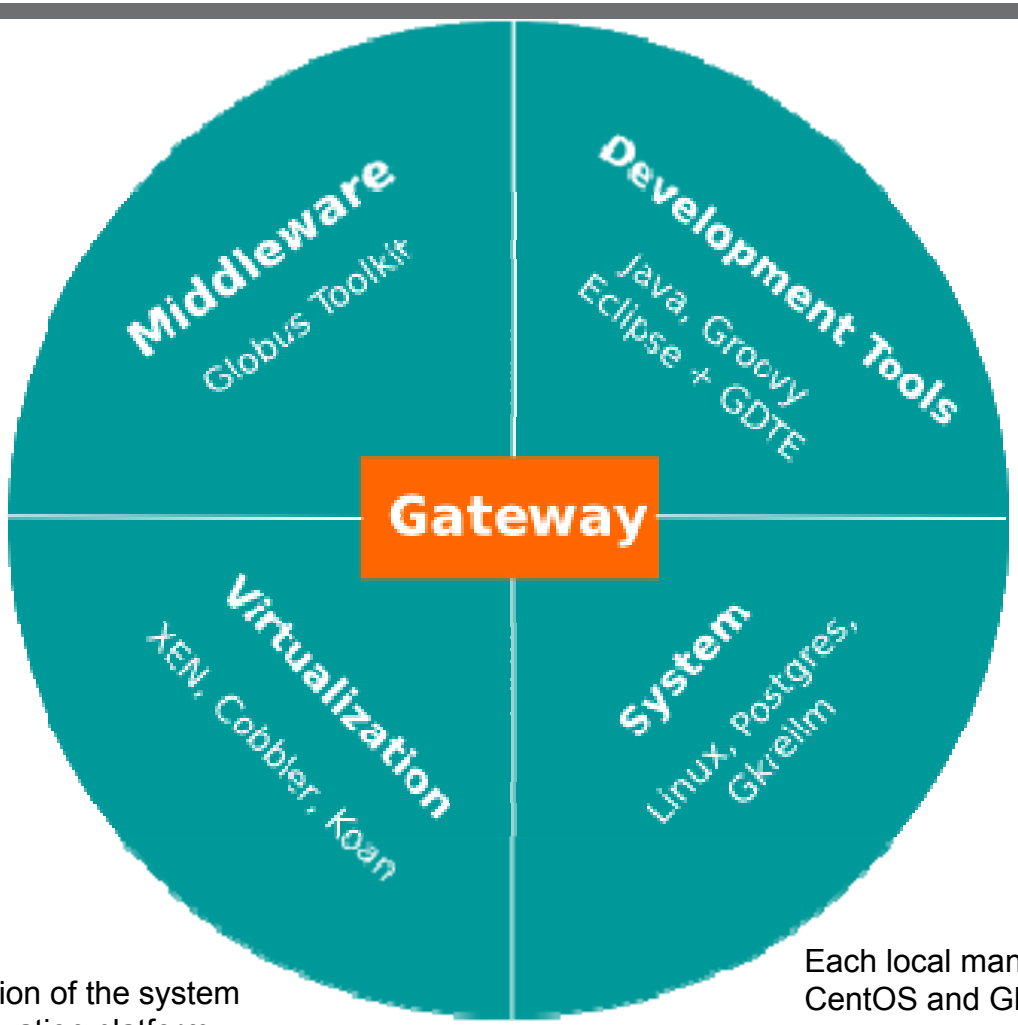


Local virtualized environment

Hierarchical Approach

- Global (distributed) gateways implement orchestration policies
- Local managers implement provisioning policies.

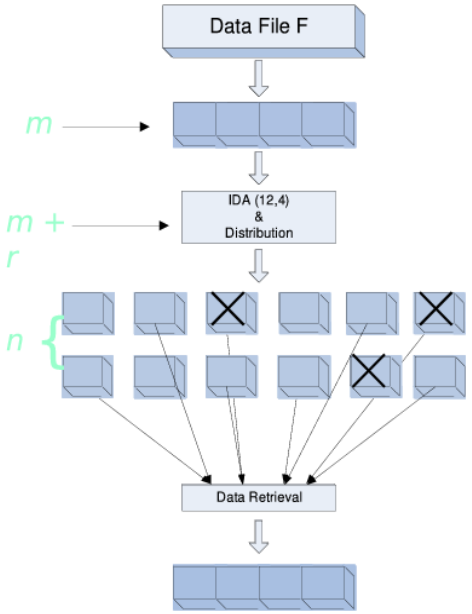
Application Tools

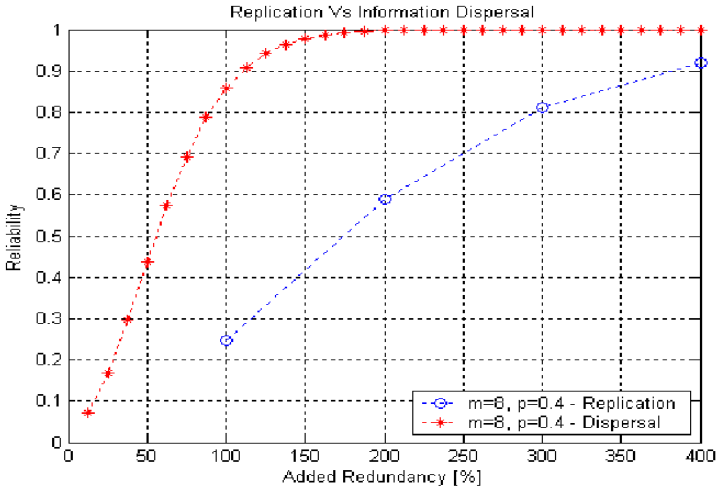


The current implementation of the system uses XEN as the virtualization platform and Cobble and Koan for automated deployment

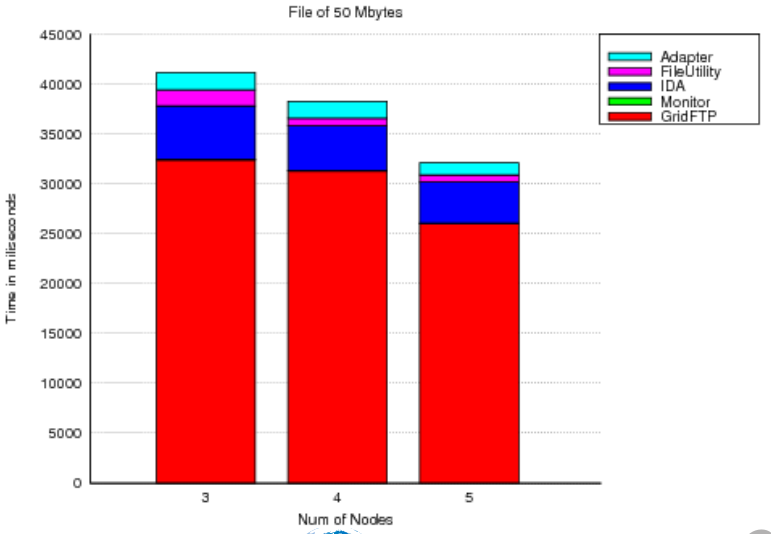
Each local manager has pre-installed CentOS and Globus Toolkit plus a set of management tools developed under the PDCLab

Research Results





- A hierarchical model for orchestration and provisioning has been defined.
- Experimental results obtained for dispersion/replication of data files demonstrate the viability of the proposed environment.



Publications: "Grid Based Pervasive Distributed Storage "
D. Arias, J. Sanabria and W. Rivera
IEEE International Symposium on Wireless Pervasive Computing (ISWPC), 2007

Scheduling Divisible Tasks with Message Passing Interface

By: Jaime Ballesteros, PhD Student

Advisor:

Prof. Jaime Seguel

WALSAIP

Parallel and Distributed Computing Laboratory

University of Puerto Rico at Mayaguez (UPRM)

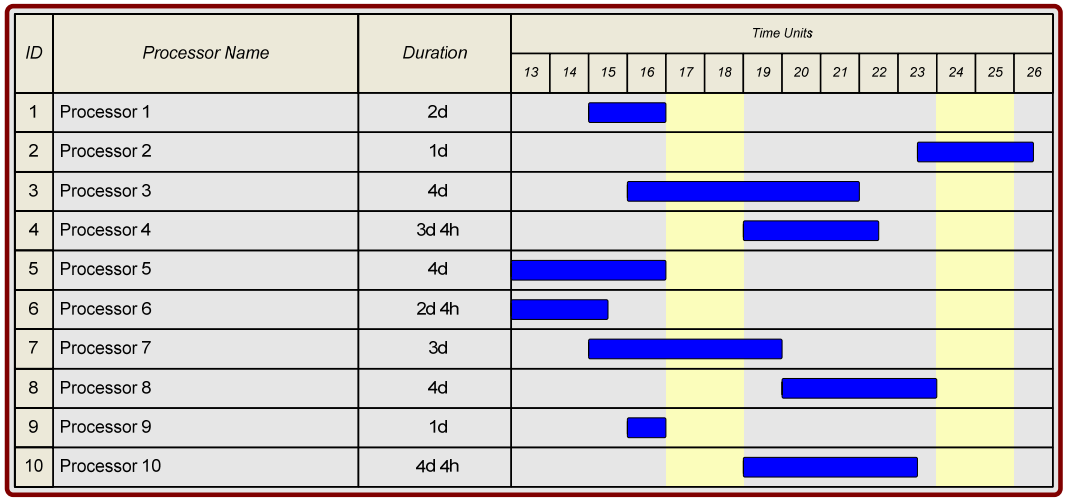
May 2007

Problem formulation

How to effect task scheduling in a distributed system, specifically in numerical simulations with an MPI-flavor, in order determine the most effective orchestration of communications and computations that will give the optimal throughput of the system.

Justification:

Numerical simulations require optimal throughput in order to return accurate results in a reasonable time. Sometimes using a distributed system to compute simulations will give better results, but orchestration of communications and computations has to obey a predefined scheduling policy, that, in some cases, is unlikely to reach an optimal throughput in a expected time.



ID	Processor Name	Duration
1	Processor 1	2d
2	Processor 2	1d
3	Processor 3	4d
4	Processor 4	3d 4h
5	Processor 5	4d
6	Processor 6	2d 4h
7	Processor 7	3d
8	Processor 8	4d
9	Processor 9	1d
10	Processor 10	4d 4h

Methodology (Solution Approach)

Steady-state scheduling:

- Provides the asymptotically optimal throughput scheduler in master-slave applications (i.e. divisible applications).
- Solved in polynomial time with linear programming

$$\text{Maximize } n_{\text{task}}(G) = \sum_{i=1}^{p} \frac{\alpha_i}{w_i}$$

Subject to

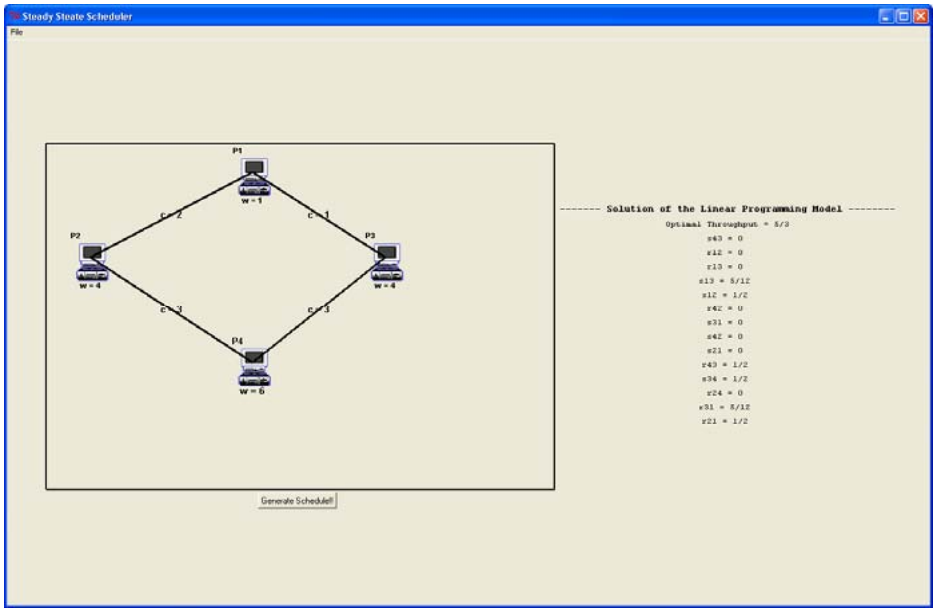
$$\begin{aligned}
&\forall i, && 0 \le \alpha_i \le 1 \\
&\forall i, \forall j \in n(i), && 0 \le s_{ij} \le 1 \\
&\forall i, \forall j \in n(i), && 0 \le r_{ij} \le 1 \\
&\forall e_{ij} \in E, && s_{ij} = r_{ij} \\
&\forall i, && \sum_{j \in n(i)} s_{ij} \le 1 \\
&\forall i, && \sum_{j \in n(i)} r_{ij} \le 1 \\
&\forall e_{ij} \in E, && s_{ij} + r_{ij} \le 1 \\
&\forall i \ne m, && \sum_{j \in n(i)} \frac{r_{ij}}{c_{ij}} = \frac{\alpha_i}{w_i} + \sum_{j \in n(i)} \frac{s_{ij}}{c_{ij}} \\
&\forall i \in n(m), && r_{mj} = 0
\end{aligned}$$

Elements of divisible task complexity theory:

- Atomic tasks, unit tasks; volume and communications
- Provides the asymptotically shortest schedule for processes with single communication phase. All process end processing at the same point in time.
- Solved in polynomial time

The system will receive the user code, identify the atomic tasks and communication graph, applied the theoretical framework and emit code, pretty much in the spirit of the FFTW or some parallel data base search algorithms.

Applications Tools

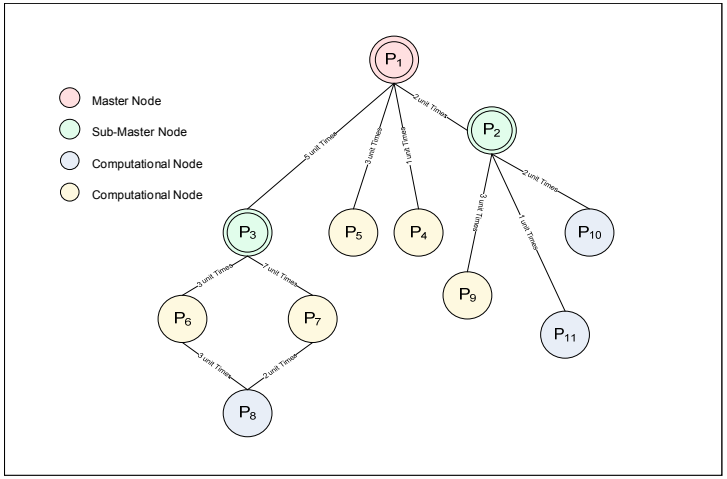


In our first study of Steady State scheduling theory we implement Steady State Scheduler V1.0 in Python and it:

- Allows to change communication and execution times.
- Uses Glpk® to solve the Master-Slave linear programming problem.
- Constructs a theoretical schedule.

Open MPI and GCC will be our primary tools:

Process and communication scheduling will be reflected in the source code and “controlled” with a feed-back control mechanism based on the communication flow.



Research Results

1. By using the demo, we could identify some observables in the system and the subsequent behavior in order to make an in-depth study of steady state scheduling mechanism.
2. We have extended (or perhaps) unified the theory of load divisible and steady state scheduling for application tasks that can be mapped as starts or trees.
3. We first modified the divisible load scheduler to make it periodic, saving thus a significant amount of start-up overhead. Then, we applied the same technique to the steady state scheduler to get a hybrid method that is provable superior to both of its ancestors.
4. We also developed a communication centric formulation of the new scheduler. Such formulation allows for the absorption of transients (decline in the processor or network speed).

Tool for Creating Contours of Spatial Data

By: Omar Valenzuela, MS Student

Advisors:

Prof. Néstor J. Rodríguez

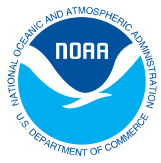
Prof. José A. Borges

WALSAIP

Human Computer Interfaces Group (HCIG)

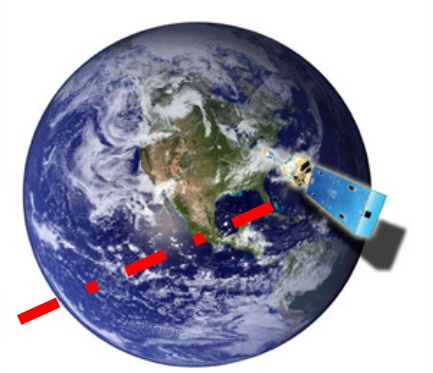
University of Puerto Rico at Mayaguez (UPRM)

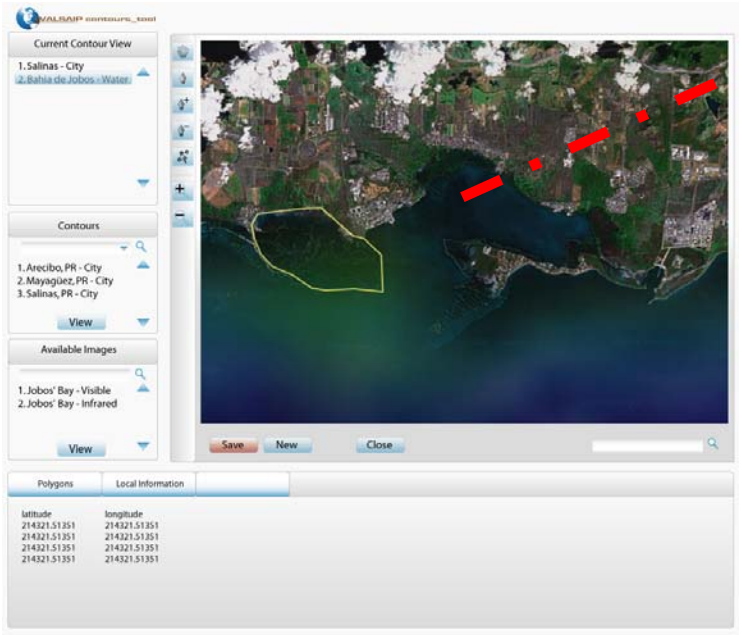
May 2007



Problem Formulation

How to help researchers delineate geographical areas of interest and manage images of them, when researchers usually need to rely on previous knowledge of the images such as their coordinates or specific database where these are stored.





Methodology

- A clean and organized User Interface
  - Built from the ground up for delineating a region of interest,
  - Easy search of images that correspond to a sector or region of interest,
  - Fast access to stored contours via a database query.
- Top-of-the-line Web-based technology
  - Can be deployed on any network for remote or local access.
  - Multiplatform.
- Open Source code
  - Free distribution
  - Facilitates enhancements and modifications and integration to other applications

Application Tools

- HTML, DHTML, and CSS
- MySQL DBMS
- JavaScript
- PHP 5
- AJAX technique (Web 2.0 technology)

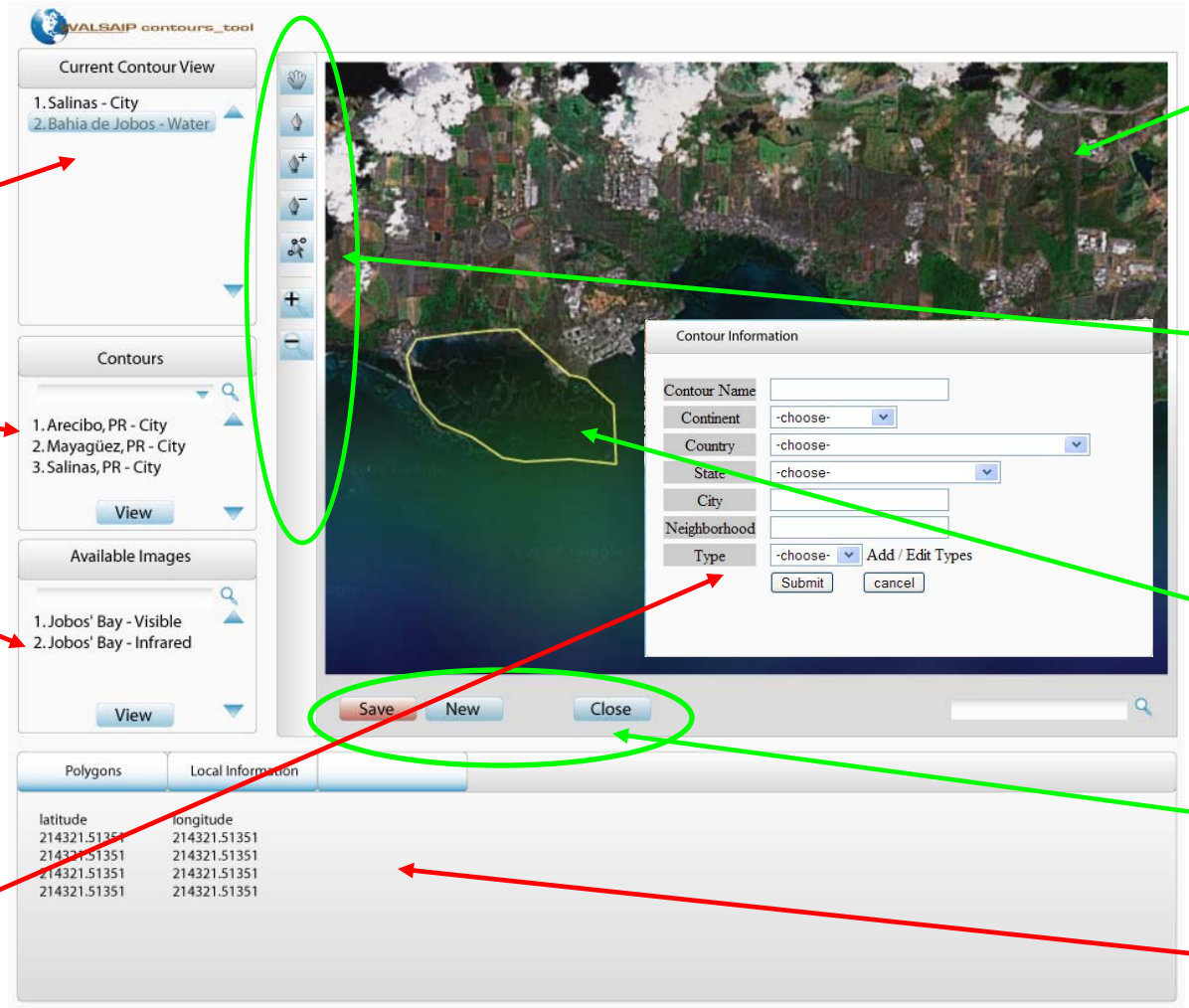
Research Results

Contours currently at work.

Locally available contours.

Available background images.

Contour Information gathering controlled by the Save option.



Map area where researchers can browse the map.

Tools (drag, create, add, delete, edit, zoom control).

Contour

Save, New Contour.

Dynamic Information Display.

Image: Jobo's Bay @ Salinas, Puerto Rico

Log-on now and play with our demo at:
http://136.145.116.243/demo/

Geoportal : Geographic Data Visualization

By: Viky Arnedo, MS Student

Advisor:
Prof. José A. Borges

WALSAIP

Human Computer Interfaces Group (HCIG)
University of Puerto Rico at Mayaguez (UPRM)
May 2007

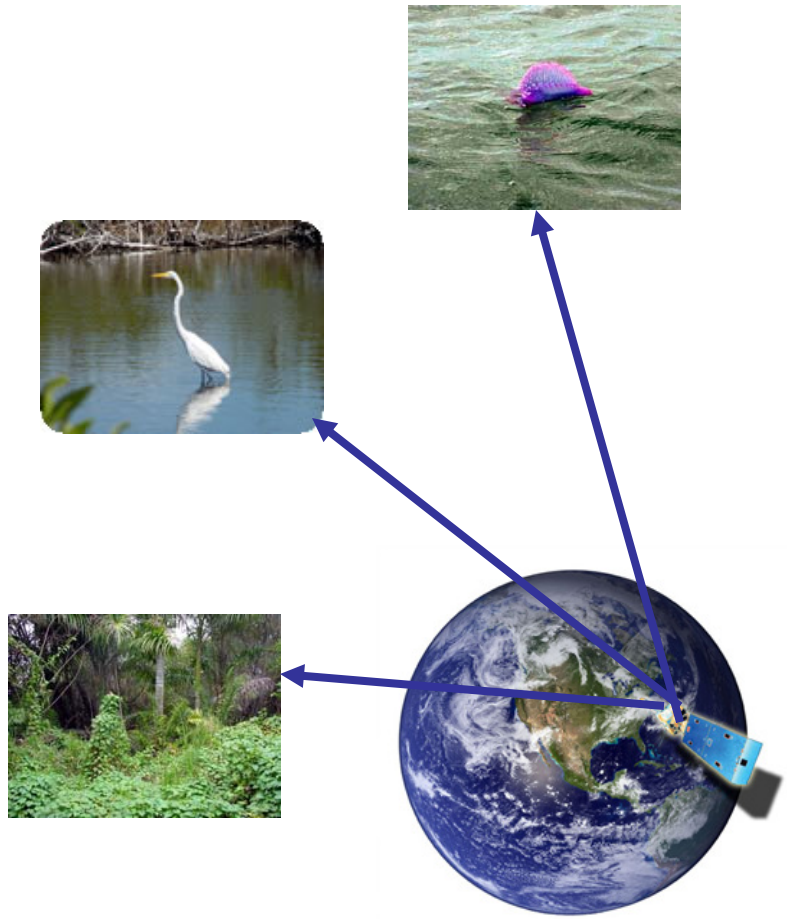
Problem Formulation

How to develop efficient and usable representation of environmental data.

How to design a Geoportal able to display geographical information that manages and manipulates data from different resources.

Justification.

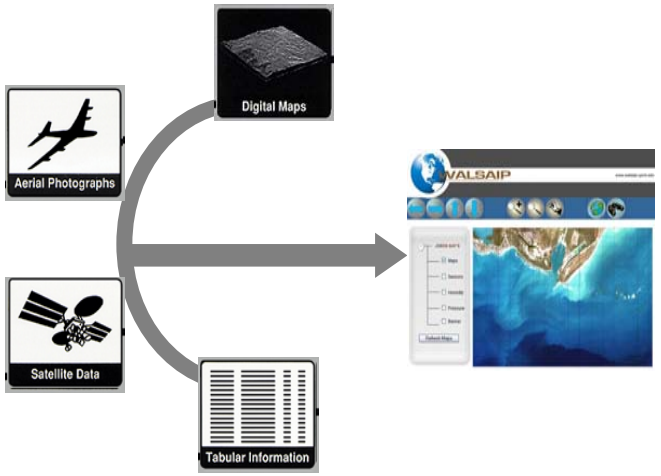
Environmental researchers need multiple software applications to analyze environmental data and to represent the results in a useful and understandable manner. This hinders their ability to evaluate data variations and trends, their decision making process, and their ability to create contingency plans regarding environmental changes.



Methodology

Develop a Web-based integrated environment (Geoportal) with a friendly user interface that will facilitate the access, display, and use of geo-referenced images and data.

The Geoportal will be developed to manage and provide visual representations of environmental data such as: temperature, water quality, and barometric pressure. The main objective is to provide researchers a tool to manage the data and allow them to conduct analysis and evaluations.



Application Tools

Integrated development environment (IDE), for visually designing, constructing, testing, and deploying Java 2 Enterprise Edition (J2EE) applications.

Cross-platform development and deployment.

Accessing MySQL Database

Technique used for creating interactive web applications.

Used for client-side web development.

Research Results

The proposed Geoportal is a web-based application designed to manage, analyze, and manipulate spatial and temporal geo-referenced data.

http://www.ece.uprm.edu/~s060505/Demo/demo.jsp

END