Real time awareness for MRV data

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MARENER 2017

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Topics

- Introduction
- MRV
- Real tine decision
- Stream reasoning
- Conclusions – Future research

CO2 Emission Reduction

- Energy EEDI indicators and EEOI
- SEEMP environmental management plan
- Market-based measures under discussion
- Doctrine: What is not measured can not be reduced
- European Commission, (2013), REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the monitoring, reporting and verification of carbon dioxide emissions from maritime transport and amending Regulation (EU) No 525/2013

MRV

- Vessels should monitor:
  - Fuel consumption
  - Distance traveled
  - Time spent at sea
  - Loaded cargo
- Annual energy efficiency indicators
- Ships larger than 5.000 gt. These ships represent about half of the fleet calling at EU ports, and are the source for about 90% of greenhouse gas emissions
- Vessels moving to and from EU ports must be monitored and report CO2 emissions starting from January 2018

Application Time Plan

- July 1st 2015. EU/MRV legislation comes into power
- August 31st 2017. Operators must submit to the Recognized Organizations a monitoring plan for their vessels.
- January 1st 2018. Monitoring of CO2 emissions starts
- April 30th 2019. Deadline for the Operators to submit their reports for 2018.
- June 30th 2019. EC publicizes CO2 reported for 2018

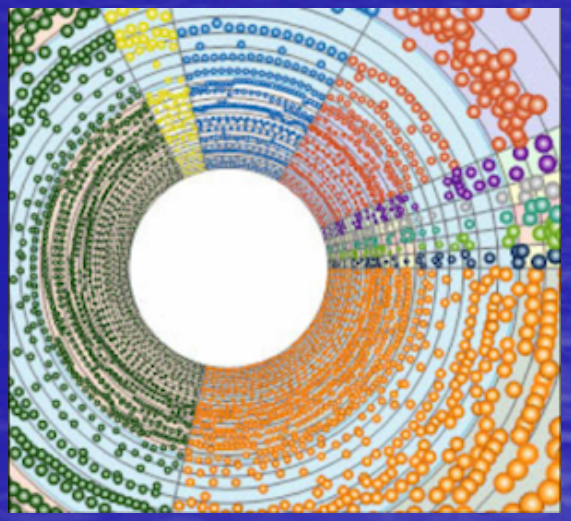
MRV in practice

- The data to be collected as part of the MRV program will support further evaluation of the more recently proposed indicators and programs,
- MRV alone will not lead to a significant reduction of emissions or efficiencies but could be an awareness tool for improving the ship's operation

Create a database of performance data and emissions. This will give a realistic picture of CO2 emissions of shipping in conjunction with the introduction of innovative monitoring technologies (using IoT initiatives)

Real Time Decision (RTD)

- Intelligence on past activity vs as it happens
  - Traditional data approaches
  - Events in motion
- Real-time decisioning involves….
  - Detect meaningful events in real-time
  - Visual/Infer events into
    - Threats
    - Opportunities
  - Decide on the action
- Defining real-time



RTD Architecture/ Technologies

- Event-driven business process management (ED-BPM)
- Business Activity Monitoring (BAM)
- Business intelligence (BI)
- Message-oriented middleware(MOM)
- Complex Event Processing (CEP)

RTD using Complex Event Processing (1/2)

- Introduction to Event Stream Processing
  - Event
  - Stream
  - Event Stream processing
    - Event producers
    - Intermediary Processing
    - Event Consumers

RTD using Complex Event Processing (2/2)

- Complex Event Processing
  - Is Event Processing
  - Combines event from multiple sources
  - Identifies a pattern
  - Infers a business situation
    - Threat
    - Opportunity
  - Responds
    - Act- Forward to futher workflow
    - Inform – Generate alerts
    - Enrich- cleanse, compute additional fields
- Key Characteristics
  - Scale of events
  - Latency of events

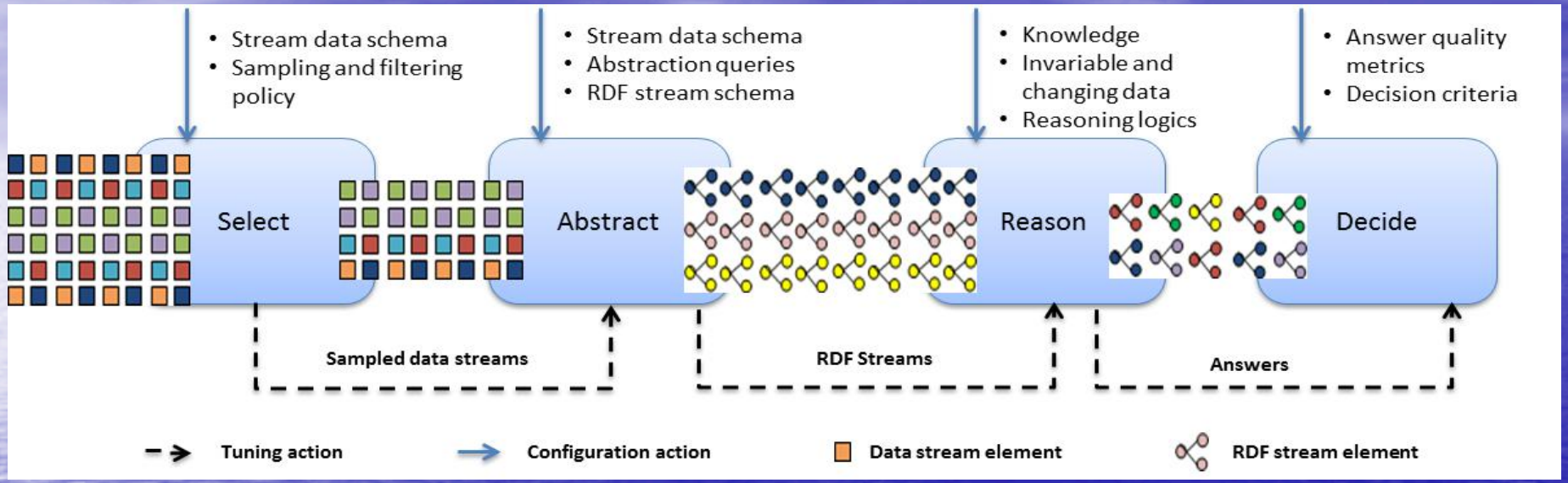
Database vs. DataStream

- Database driven application
  - Data is resting in a database
  - Queries are ad-hoc/varying
  - Data patterns is relational
- CEP application
  - Data is moving in a data stream
  - Queries are standing and continuous
  - Data patterns is relational and temporal

Previous Research

- SERSCIS (Semantically Enhanced Resilient and Secure Critical Infrastructure Services) FP7 research project
- V.Tsoulkas et. al '*Semantic Modeling & Monitoring for Real Time Decision Making: Results and Next Steps within the Greek Cyber Crime Centre of Excellence (GCC)'* presented at UKSIM 2013

New Approach: Stream Reasoning



- Information arrives as a stream of "time-stamped" data
- The Knowledge base can be continuously updated and reasoning goals are continuously re-evaluated as new assertions arrive
- Reasoning is implemented from a Finite – Time Window and not at a Single Instant !!.
- Research Efforts on Stream Reasoning is still at its First Steps and at its Infancy.

3 basic – steps in Stream Reasoning

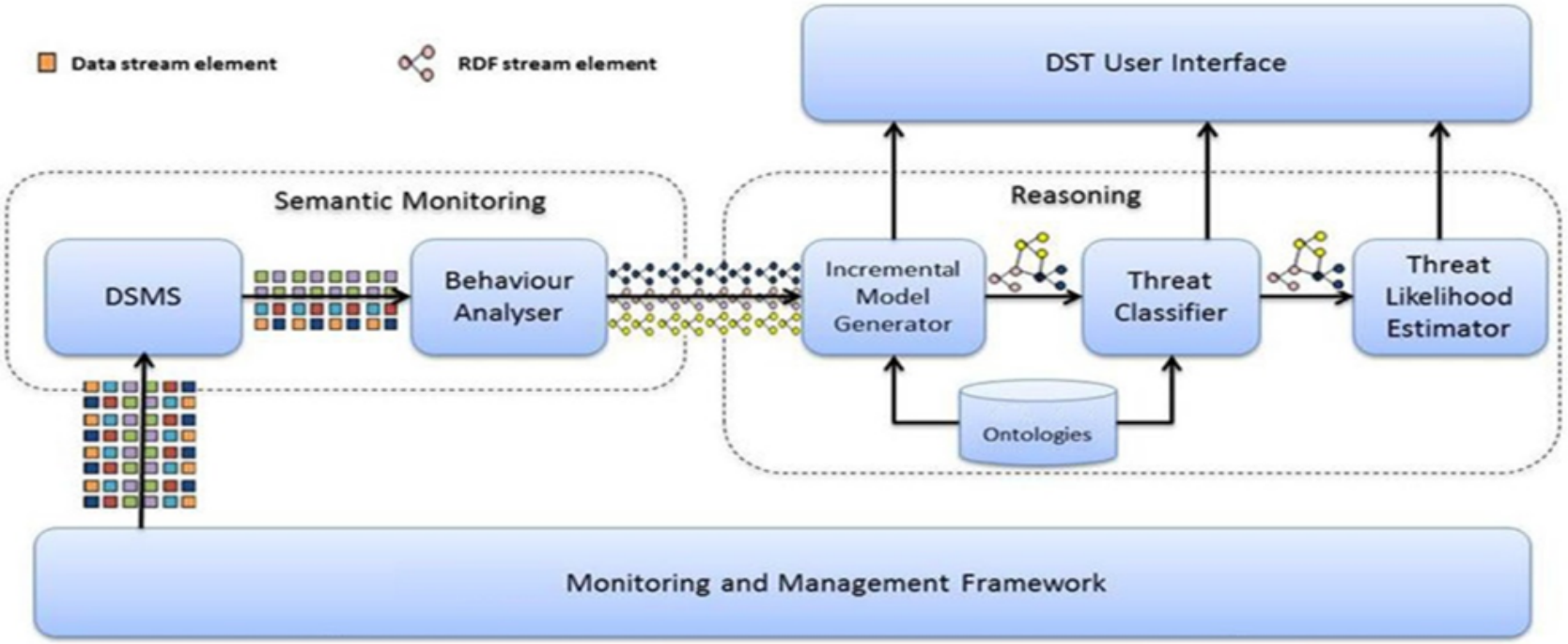
- **Select**: Relevant Data from Input Streams by using Sampling Policies that probabilistically drop stream elements to address bursty streams of data (unpredictable peaks).

- **Abstract**: Sampled streams are input to Abstract block to generate aggregate events by enforcing aggregate events continuously.

  Output is RDF streams (ρ, τ) with **ρ – RDF triple and τ – time stamp** (logical arrival time of RDF statement. *Use of **C-SPARQL***.

- **Reason**: RDF (*Graph Streams*) streams are injected into background knowledge for reasoning tasks. Incremental implementation of RDF snapshots.

Proposed framework



Conclusions

- Experience from other sectors could be useful for real time decision related with MRV's data.
- Implement the proposed framework in real conditions
- Future improvements on Behavior Analyzer component, Bayesian threat likelihood estimator

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Thank you for your attention

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