



Net-Centric Systems Test Big Data Test and Evaluation Challenges

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*Mr. Gil Torres
NST Executing Agent
gilbert.a.torres@navy.mil*



Challenge Statement

By 2020 demonstrate T&E technologies that provide a more agile and integrated T&E environment to assess Joint Net-Centric Operations, Systems of Systems (SoS), and Software Intensive Systems through modeling and simulation, automation, and distributed T&E.

- Advancements in the warfighter's Net-Centric Military Operations capability are increasing at a rapid rate and outpacing the current capabilities of the Test & Evaluation (T&E) environment.
- Net-Centric Military Operations can consist of a Net-Centric system, a loosely coupled set of systems operating together, or different degrees of tightly coupled systems acting together as a System of Systems (SoS) or software intensive systems operating as a system or systems.



NST Overview

Complex Warfare Environments

Innovative approaches to how we fight, posture our force, and leverage our asymmetric strengths and technological advantages*



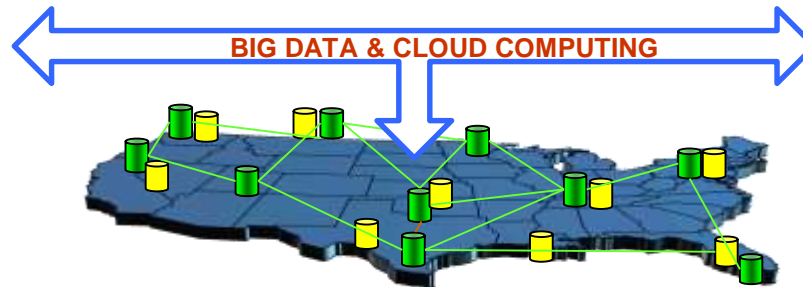
Battle increasingly sophisticated adversaries in increasingly complex environments*

* 2014 Quadrennial Defense Review



Test Automation (TA)

- Advance Big Data Collection, Analysis & Visualization
- Improve Test Execution thru Automation/Cloud Computing



Distributed Testing (DT)

- Reduce Distributed T&E Effects
- Improve Security Posture of Systems
- Advance Mission Context Data Collection
- Analysis & Visualization



Modeling & Simulation (M&S)

- Required Fidelity in Live and Simulated Environments
- V&V Techniques
- Aggregation Techniques
- Run-time Performance for RT Applications
- Systems, Communications, Environmental Representations

Innovate T&E: Joint, Early, Often, and Agile

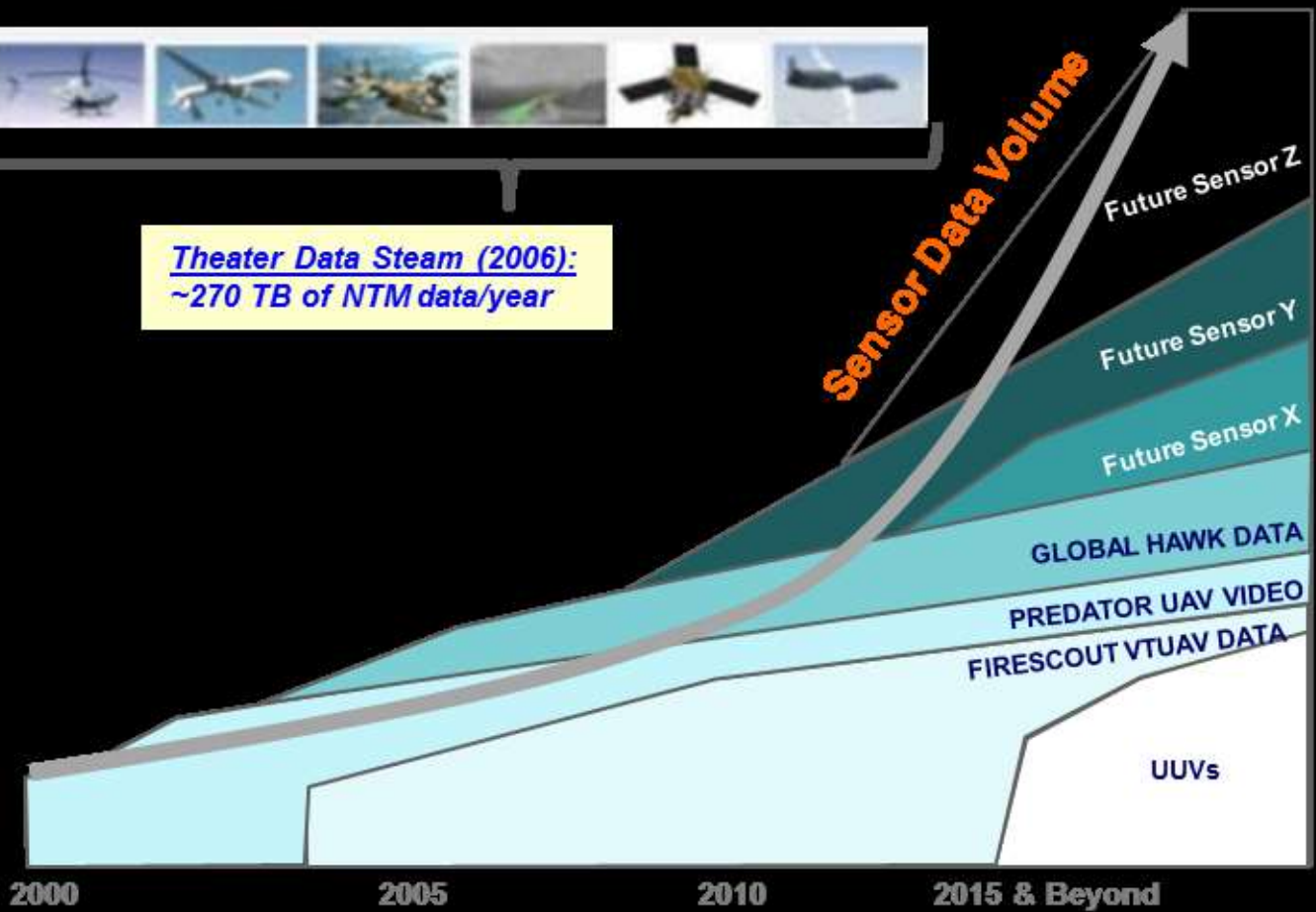
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Big Data Here and Now!!

Exponential Data Growth: Enabler & Challenge!



Theater Data Steam (2006):
~270 TB of NTM data/year

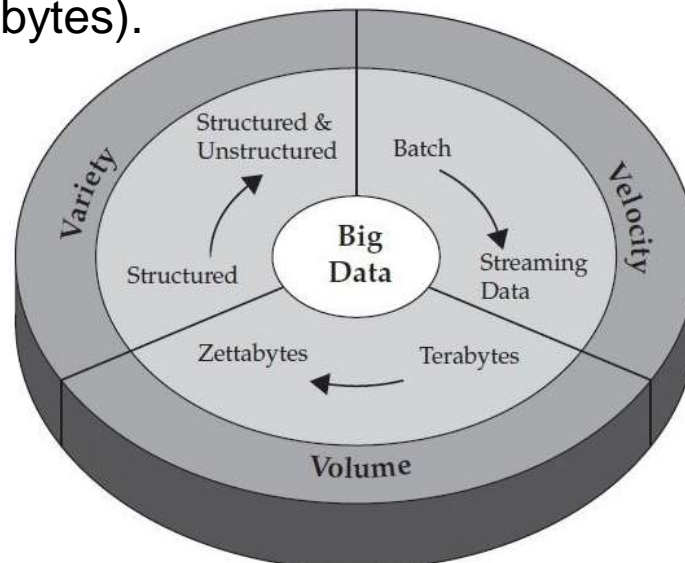


Based on 2011 AFCEA C4ISR Symposium – Cyber Defense in a Denied Environment Panel (Dr. Langston)



Big Data Definition

- For C4I systems, the trend is accelerating in the three “V” dimensions of big data
 - Velocity increases requirements for D2D to operate in real-time processing.
 - Variety increases requirements to process many types of structured (Variable Message Format), semi-structured (Link 16), and unstructured (voice, chat, video) data.
 - Volume increases requirements to process larger and larger amounts of data (e.g. petabytes).





Big Data T&E Needs



1) Unstructured Data Collection, Analysis, and Visualization

- Rapid Analysis of Test Big Data (D2D) and Automated Reporting
 - Capability to efficiently process, store, retrieve, and analyze the vast amounts of test data to decisions (D2D) in a shorter period of time

2) Advance Mission Context Data Collection, Analysis and Visualization

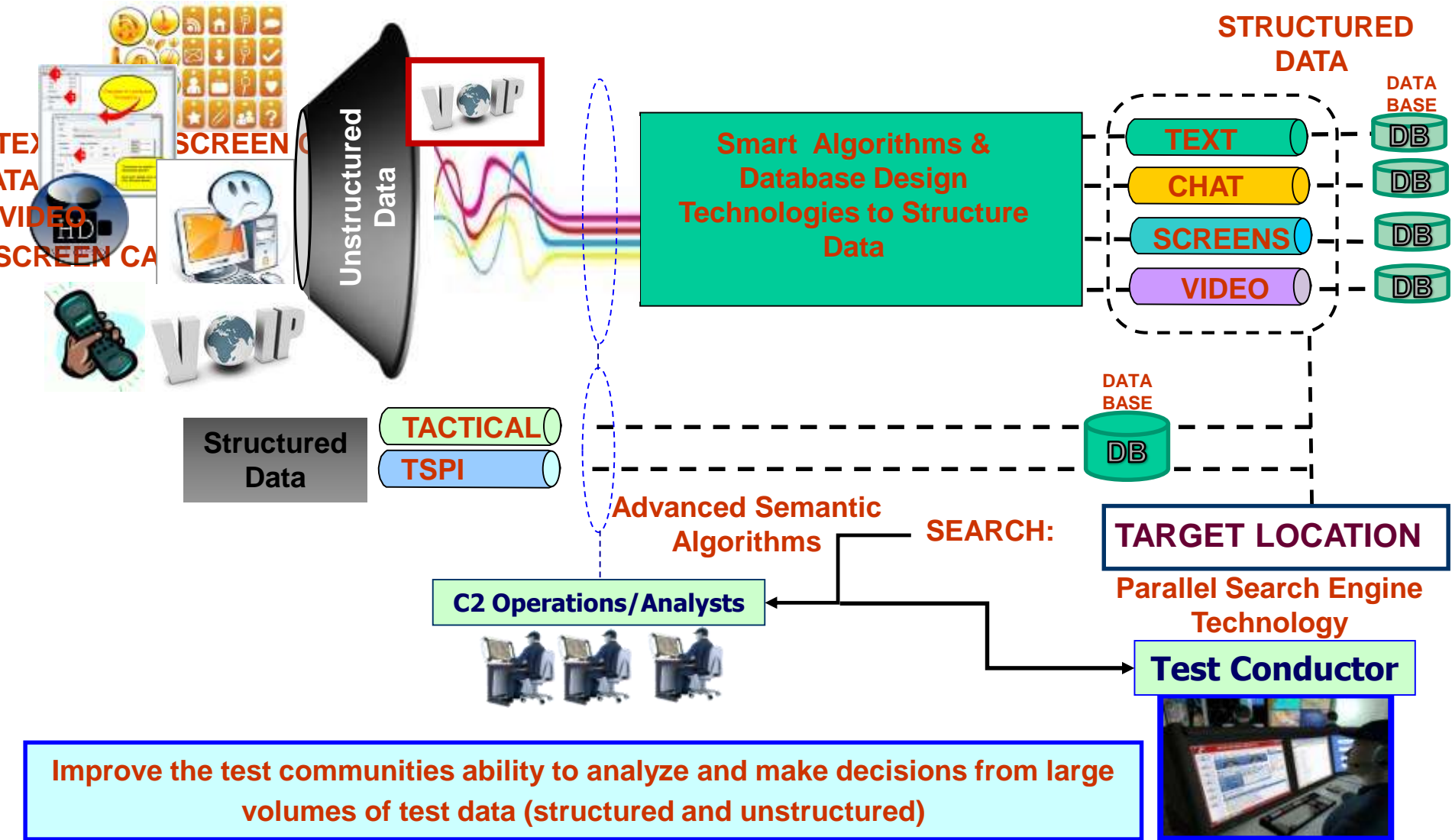
- New Assessment Technologies for DoD Platforms Employing Big Data/Cloud Environments
 - Technologies to test warfighter systems incorporating complex IT infrastructures that have massive parallel file systems, distributed SQL and NoSQL databases, and advanced analytics.





Assessment Technologies

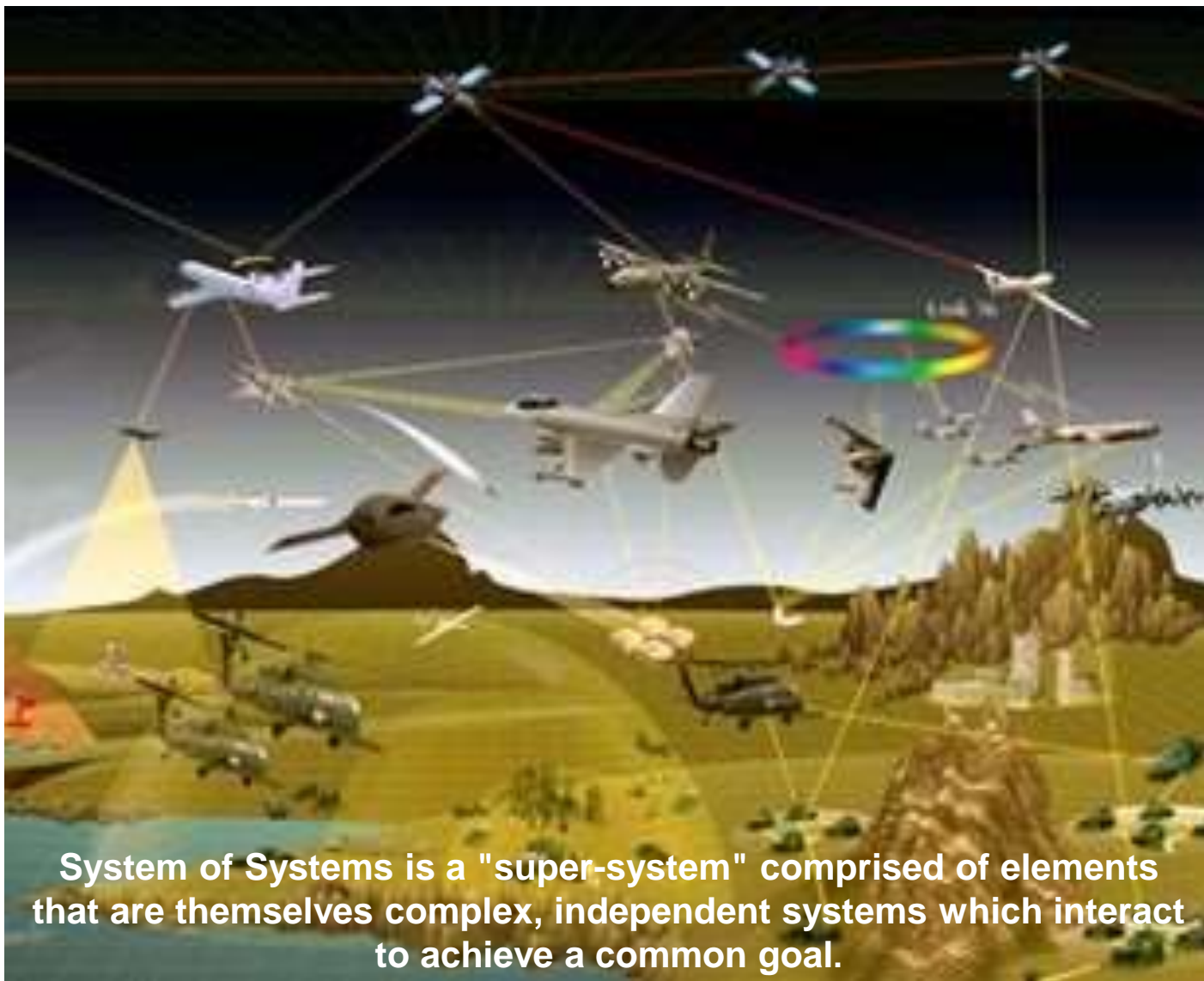
Automated Data Collection, Visualization, Analysis & Reporting





Assessment Technologies

DoD Platforms Create Big Data Environments



System of Systems is a "super-system" comprised of elements that are themselves complex, independent systems which interact to achieve a common goal.

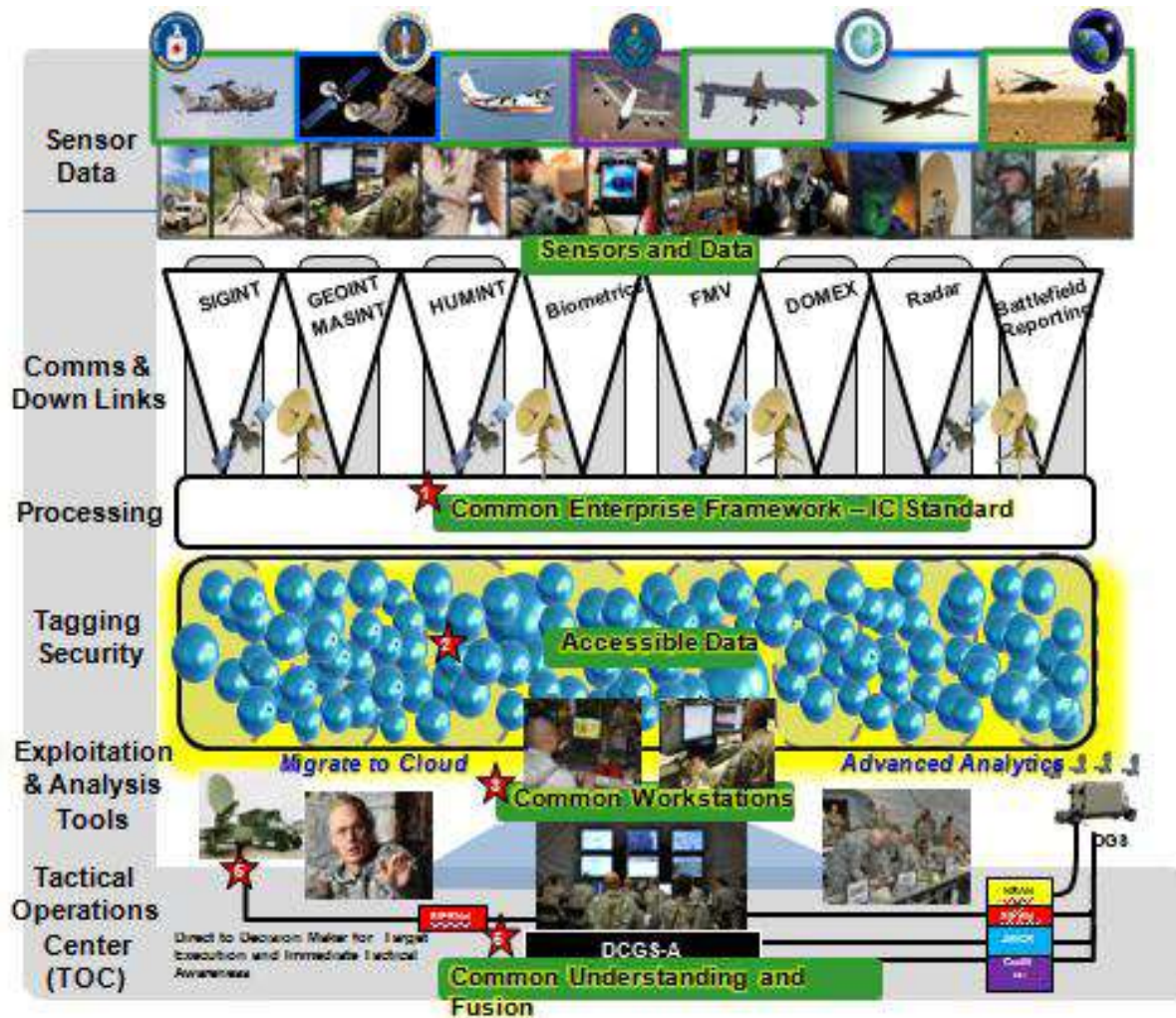
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Assessment Technologies

DoD Platforms Employing Big Data Environments

DCGS-A System of Systems





Decision Engine for Structured & Unstructured Data (DESU) Project

Morgan State University/Baltimore, MD



Improve Near Real-Time & Post-Test Analysis for T&E Big Data

Description: Developing Big Data technologies for rapid analysis of voluminous structured & unstructured heterogeneous data (audio/video/text) in support of data to decisions for automated event pattern discovery.

Enables: Assessment of large volumes of test data, real-time data fusion & analysis capability.

Current Status: Developing event classifiers & algorithms to correlate within/across data sets

Transition Partner / Date: Naval Air Systems command Patuxent River

Test and Evaluation (T&E) Needs

- Lack of tools to efficiently filter, process, store, analyze, and retrieve vast amounts of data in near-real time
- Limitations exist in current computational software tools to extract meaningful patterns and trends from structured and unstructured data to facilitate decision making

Science and Technology Challenges

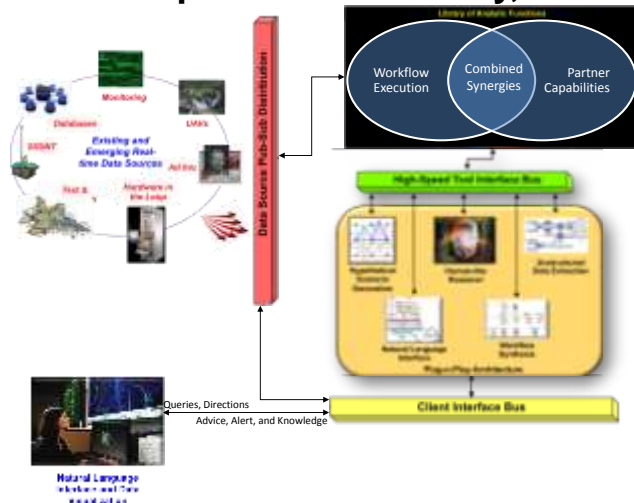
- Adapt a NoSQL data storage solution for large scale real-time net-centric data
- Develop a semantic wrapper for unstructured data based on an information domain specific ontology
- Develop an automated method of detecting trends and patterns in heterogeneous data and recommend suitable actions



Real-time Automated Insight Engine for Data to Decision (RAID) Project



NASA Joint Propulsion Laboratory, Pasadena, CA



Description: Developing Big Data technologies to automate data to decision for Big datasets. Develop an automated, intelligent, flexible framework to drive the interaction of big data system components, manage the semantic content of information products, and synthesize insight for guiding the tester.

Enables: Assessment of large volumes of test data, real-time data fusion & analysis capability.

Current Status: Project commenced.

Transition Partner / Date: Naval Air Systems Command Patuxent River, F-35

Test and Evaluation (T&E) Needs

- Automated data understanding across big-data environment
- Deliver crucial insight to decision makers in actionable format
- Manages knowledge across weapon system lifecycle
- Enables DT quality testing in OT environments
- Enables testing of SoS technologies with real-time, in-situ analytics

Science and Technology Challenges

- Adapt a NoSQL data storage solution for large scale real-time net-centric data
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Closing



- **Trend is Warfighter systems are increasing adoption of big data**
 - T&E infrastructure and tools must advance thru game changing technologies
 - Improve Automated Data Collection, Visualization, Analysis & Reporting tools
 - ❑ DESU addressing technologies to collect, tag and visualize big data
 - ❑ RAID addressing technologies for big data analytics
 - Improve T&E of DoD Platforms Employing Big Data Environments
- **NST is tackling Big Data T&E needs by investing in game changing technologies**

