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Introduction

General Dynamics Mission Systems (GDMS) is a trusted partner of the U.S. Department of Defense and the Intelligence Community for more than 35 years. The General Dynamics Mission Management Center of Excellence (COE) develops and deploys workflow support and automation capabilities directly supporting mission requirements. Machines are making tasks easier, but the gap between what we need to do and what we are able do is getting wider. Innovation in technology and tradecraft is radically changing expectations from consumers, producers, and suppliers in how technology will serve their needs. The GDMS Mission Management COE is focused on delivering a Mission Environment that enable capabilities for Customer organizations to evolve towards innovative and flexible solutions, while methodically maintaining current operations, and shifting away from legacy systems.

Our vision for Mission Management is to create seamless human/machine interaction to accelerate decision making through utilization of contextually relevant mission data.

To achieve our vision, the Mission Management strategy sets five goals:

- **Anticipate:** Anticipate user needs through artificial intelligence and machine learning of daily activity patterns, data sources, mission requirements, and event responses.

- **Broker:** Identify and deliver the right data to meet mission needs by optimizing choices between available platforms, sensors, and data sources.

- **Interact:** Streamline Human-Machine interaction by integrating language, gesture, and other intuitive interaction capabilities.

- **Employ:** Generate higher-value intelligence by utilizing contextually relevant data.

- **Protect:** Ensure data is trusted through advanced access control, provenance, and pedigree data protection capabilities.

Our strategy showcases how we envision capabilities that can look across multiple sources of data to broker the most relevant for a user. Then perform actions against the data using a tailorable suite of services orchestrated to meet mission needs. The data is employed by users and machines on a variety of platforms. The orchestration steps are captured and utilized to perform anticipatory workflow. Finally, all steps in the process follow rigorous guidelines to ensure data provenance is maintained.

The focus of this strategy is on Analysts gaining more efficient capabilities and processes, services that can anticipate data needs, and better ways to discover, display, and utilize data to create actionable intelligence. These capabilities also apply to warfighters, first responders, data scientists, mission leads, and decision makers.

The following sections will further discuss each of these goals.

**Anticipate**

This goal anticipates user needs by learning daily activity patterns, data sources, mission requirements and user responses to new events. Anticipate starts with the system understanding the context of what the user is trying to achieve through a Mission Environment paradigm. Mission Environment (ME) is comprised of systems and enterprises that are needed to execute the mission. The ME system employs deep learning to understand the context of the mission, including Areas of Interest, intelligence topics, and desired results. The system learns
Automatically provide users with the right data at the right time in the right format.

by passively tracking the activities of the user. As the user is using tools, websites, data sources, etc., the system is passively gathering these details to identify and suggest other capabilities or data sources that could be of benefit. The system also tracks daily activity patterns, within PII guidelines. For example, the system knows that its user arrives at work at 8 a.m. every morning, so it begins actively scrubbing data sources and pre-staging data and tools prior to the users arrival.

The system provides anticipatory workflow. For example, this means it knows that when a user looks at a certain data source, the user will then want to view it in another tool. Since the system already knows this pattern, it has opened the tool in the background and loaded the data. This can be intrusive, where the tool automatically comes up on the user’s interface or it can wait in the background until requested by the user. The systems will be continually tracking and adjusting activities based on changes in user patterns and based on external events. For example, an external event occurs in the user’s area of interest. The system instantly begins parsing and staging data and tools, so the user has the most relevant data available. This parsing or brokering of data sources is covered in our next goal, Broker.

Broker

Our goal is to identify and deliver the right data to meet mission needs by optimizing choices between available platforms, sensors, and data sources. Broker starts with the system understanding the data sources available for use. This includes physical platforms, sensors, travel patterns (i.e. flight pattern, orbit), delivery networks, etc. It also includes data types across the “INTs,” data gathering strategies like Activity Based Intelligence (ABI) and Structured Observation Management (SOM), and finished intelligence products. The brokering then comes into play with the system assessing the user’s need and access and then determining which data source or sources best meets those needs. The system then pulls the relevant data, transforms it to match the user’s desired interface, and presents the data. Broker also includes the active scrubbing of new data sources as they come on-line. Mathematical models, such as Stable Matching or Bayesian are employed to calculate the “best-fit” for each user’s mission needs.

In the event that new tasking for a platform is required, the system automatically provides a strategy for tasking available assets. For example, we anticipate a tiered brokering structure, with assets leveraged at each tier. At the top tier would be systems tracking activities across multiple domains both from a security standpoint (TS, S, U) and across logical domains (space, ground, air, cyber). Systems at the macro-level assess and prioritize tasking requests to optimize available platforms and quickly meet user needs. Gaps in coverage or capabilities are quickly identified and highlighted for decision makers to optimize development of new sensors or platforms. This macro level brokering ensures optimal usage of assets in the event of platform or sensor loss, i.e. wartime scenarios. By actively assessing remaining asset capabilities, the system can quickly reassign assets to meet user needs. While the first two goals are focused on the back-end system functions, the next goal focuses on improvements to interacting with the system.
Interact

Our goal is to streamline Human-Machine interaction by integrating language, gesture, and other intuitive interaction capabilities into user interfaces. Interactions can include spoken commands, hand movements, head/eye movements, haptic environments, and improved visual presentation. There are multiple capabilities on the market today for interacting with a system, but we envision further refinement both in language understanding, gestures, presentation, and anticipating needs. The need for simpler interaction increases the more these capabilities are pushed to the front line soldier. Manually inputting a command via a touchscreen or virtual keyboard takes time. Soldiers need to tell the system what they need and it needs to be executed immediately. This means the system has to understand multiple ways to receive a command and still provide the same outcome.

By incorporating capabilities from the anticipate goal, the need for interaction is reduced. For example, instead of a soldier telling the system to identify red forces in the local area, the system already knows the soldier has started a patrol and is already providing that information. Easier interaction with the system is one aspect to improve mission effectiveness. The system must also help users utilize or employ the contextually relevant data to effectively generate intelligence as discussed in our next goal.

Employ

Our goal is to generate higher-value intelligence by utilizing contextually relevant data. Expending human resources, managing data, and performing repetitive tasks is done at the expense of conducting higher-level mission related activities. The system provides orchestration across the various tools, including seamless use of legacy tools. Using configurable UI frameworks, automation, and on-the-fly data transformation, the system presents the right data, at the right time, in the right context to allow users to discover patterns, see connections, and take action.

Analysts need easy ways to build products for consumption by a variety of users and in different formats. Interactive products, 3-D models, and legacy systems must be supported, but it cannot be arduous for the Analyst. By bringing together elements of orchestration and anticipatory workflow, products can be generated once by the Analyst and the system can anticipate the consumer demand for a particular type of product and deliver it real-time or on-demand. This lessens the burden on the Analyst, reduces waste in production, and speeds up the automated operations as the system doesn’t have to decompose a product to create a new one. Analysts and decision makers can then utilize these capabilities to help answer intelligence questions, forecast adversary behavior, and support a broad range of mission areas. While exposing and using data is imperative, new capabilities are needed to ensure data is protected as discussed in our final goal.
Protect

Our goal is to ensure data is trusted through advanced access control, provenance, and pedigree data protection capabilities. Data and network access control mechanisms must be resilient to tampering and fault tolerant, ensuring the integrity of stored data. For example, GDMS has implemented BlockChain technology, which captures cryptographic evidence of every action taken on a datum. Tamper detection and tamper checking techniques are employed to verify the record’s integrity. By leveraging the data’s pedigree, provenance captures the origin and history of the data as it is used or updated. This allows a user to know how the data was captured, who has used it, and if it’s in any finished intelligence product. Access control secures the integrity of all data elements at rest thereby enabling assured access control for data discovery and access and supporting cross-domain data dissemination to authorized users.

The system must provide effective and efficient methods to secure all data elements within the data environment. Data must be correctly marked for security and author provenance, and synchronized data is only accessible by entities with the appropriate security authorization. Data discovery and dissemination is enabled across multiple security environments, allowing access by individuals and nonhuman entities with a digital identity.

Summary

The National Defense Strategy states that, “We face an ever more lethal and disruptive battlefield, combined across domains, and conducted at increasing speed and reach—from close combat, throughout overseas theaters, and reaching to our homeland.” The General Dynamics vision for the future of Mission Management provides updated and new techniques to manage the battlespace across all domains and ensure our military advantage. Our vision combines anticipatory workflow, brokering, robust human/machine interfaces, and data integrity to accelerate decision making and the exploitation of contextually relevant data.

General Dynamics Mission Systems is a leader in Mission Management to support the mission both today and in the future. Our offerings include Multi-Level Security services, Blockchain, Analytic Workflow, and our enterprise Mission-Management ToolKit (eMTK). All of our offerings provide agile, flexible multi-mission and multi-source support to users and applications in cloud, native, or hybrid environments. We welcome the opportunity to discuss this strategy and our capabilities to meet your critical mission needs.