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EFFECTIVE DECISION MAKING (EDM): THE ART AND THE PRACTICE

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ABSTRACT

This paper discusses Effective Decision Making (EDM): A Decision Support Capability. This capability enables leadership to leverage decisions merged with technology while maintaining dynamic relevancy to achieve organizational goals. It allows outputs from approved decisions to dynamically update situational awareness. It simultaneously updates the architecture data so users can quickly identify doctrine, organization, training, material, leadership and facilities (DOTMLPF)ⁱ gaps and strengths associated with each command capability. EDM is the solution to ensure information supporting day-to-day operations achieves desired effects outlined by goals and objectives framed by the mission and vision.

An objective of EDM is to provide enhanced situational awareness and knowledge decision makers need to make better, timelier decisions with the ability to evaluate post decision success. This EDM decision support capability provides clarity for understanding the value of information, improve relationships and generate a coordinated recommendation for decisions. Outputs from decisions dynamically update data to produce actionable decision information in support of core processes. This data-centric approach provides stakeholders a reusable architecture knowledge base. Outputs from EDM updates architecture data to produce knowledge and understanding people need to influence positive changes. It also promotes learning for the organization and the ability to measure progress and performance over a specified timeframe to achieve desired effects.

ESTABLISHING THE FRAMEWORK FOR ENABLING EFFECTIVE DECISION MAKING

The Problem. Think big, start small, scale fast by harnessing *people, processes* and *technology*. Transform from the traditional "need to know" approach to information sharing to a more collaborative "need to share" imperative without compromising the security of sensitive information that could help an enemy.ⁱⁱ This type of thinking is weaved throughout guidance provided by the National Security Strategy, National Defense Strategy, National Military Strategy, Unified Command Plan, Strategic Planning Guidance, Transformation Planning Guidance and Quadrennial Defense Reviews. This top-level strategic guidance drives the development of Joint Operations Concepts (JOpsC), which are the impetus for deriving military capabilities needed to shape the future joint force.ⁱⁱⁱ The following needs are recurring themes derived from these concepts:

- The need for unparalleled information sharing and collaboration
- The need for adaptive organizations
- The need for greater unity of effort via synchronization and integration of force elements.
- The need to make superior decisions achieving desired effects

These needs highlight information-driven problems we face today. Better information sharing and collaboration, for example, is about bringing the relevant information and cognizant decision makers together at the right time and not merely a bigger "Google" capability. Adaptively of organizations is about using relevant information within a risk and opportunity framework to re-shape themselves and their decision-making capacity necessary to achieving and maintaining

information superiority. The JOpsC family of concepts helps drive investment decisions to reduce or eliminate these problems in the future.

Amidst a sea of information-derived products, we rely on actionable information to formulate, render and execute decisions. The scope of military decision-making forms a continuous although frequently only loosely coupled thread spanning the operational planning and capabilities development sides of the spectrum (Figure. 1). On the planning side of the decision spectrum are the strategies to meet military objectives, the missions that satisfy the strategies, and the tasks to accomplish the missions. The architectural side of the decision spectrum encompasses the DOTMLPF solutions that provide the capabilities across functional, spatial and temporal dimensions to perform the tasks to accomplish the missions that satisfy strategies.

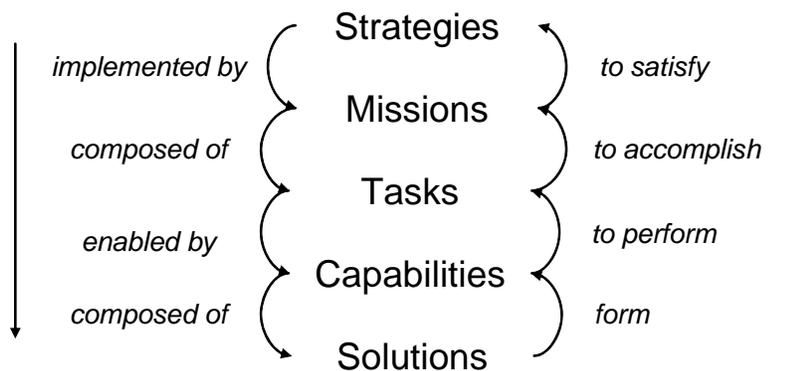


Figure 1, the piece-wise continuous spectrum of military decisions and decision-making.^{iv}

Where are the threads of continuity between the operational planning products that reveal capability needs and gaps and the capability development products such as JCIDS documents and DODAF views? In decision terms, how can the commander know if the command is planning missions effectively, investing in the correct capabilities, or purchasing the correct quantities? How can the program manager know if the program is investing in correct technology and integrating/ transitioning technologies to warfighting capabilities in a timely manner?

EDM is about going beyond the mere information products by applying a data-centric framework consisting of both the data behind the products as well as the meta-data essential to linking data to dynamically form relevant actionable information for decision support.

Introduction to EDM. EDM enables people to clearly understand the value of information, improve relationships and generate a coordinated recommendation for decisions. The EDM capability merges *people*, *processes*, and *technology* with *decisions* to leverage dynamic relevancy for achieving organizational goals and missions.^v It generates actionable decision information to generate knowledge and understanding stakeholders need to make decisions and to evaluate post decision success. EDM leverages outputs from decisions to update situational awareness templates and applies this data to generate architecture products and actionable information supporting core processes. This provides stakeholders of warfighting, business, Joint Capability Integration and Development System (JCIDS)^{vi}, and the Joint Training System (JTS)^{vii} processes a reusable and coherent knowledge base they can apply to make decisions achieving desired effects (Figure 2).

Many organizations allocate vast resources to manage and maintain architectures. While the common bond across these architectures is data, frequently the efforts focus on managing the architecture products as opposed to the underlying data and its metadata. Data producing actionable information binds the architecture to warfighting, business, JCIDS and JTS processes. Guidelines for these core processes provide the framework for architecture data to influence positive change. Unfortunately, by focusing on the architecture products most of these guidelines do not address *how* architecture data produces actionable decision information in support of these core processes. As a result, architecture products do not actively identify command capabilities and, more importantly, capability gaps.

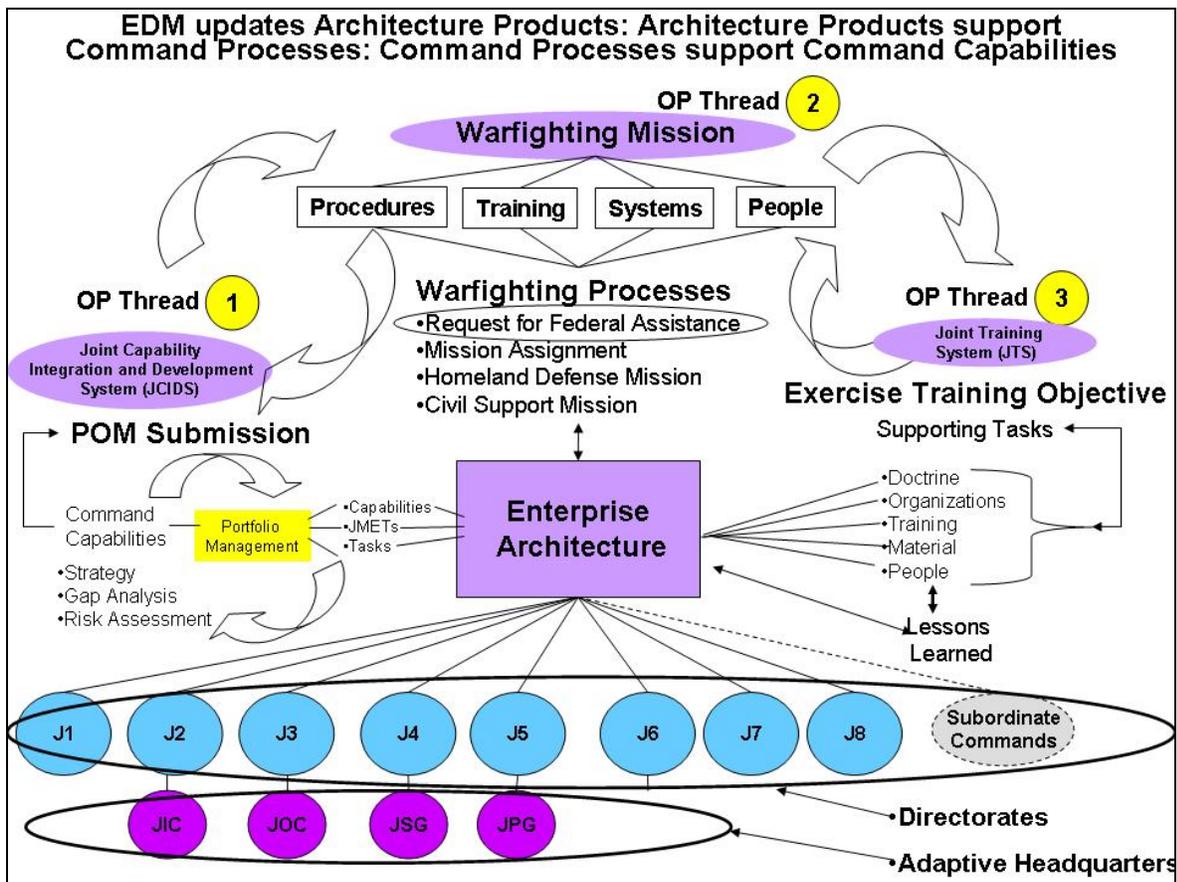


Figure 2, Framework for effective decision making (EDM)

EDM: A Decision Support Capability. EDM enables stakeholders to leverage outputs from approved decisions to dynamically update situational awareness and simultaneously update architecture data (Figure 3). In this way, the familiar architecture products can be re-generated, but more significant this produces actionable information stakeholders can quickly apply to support core processes and identify DOTMLPF strengths and shortfalls. This feedback loop expands the knowledge required to refine plans and allocate proper resources to achieve mission success while sustaining capability-based DOTMLPF assets. This actionable information promotes knowledge JCIDS users need to influence positive changes through the portfolio / investment management process and the Planning Programming Budgeting and Execution System (PPBES)^{viii}. Additionally, EDM provides JTS users the knowledge required to identify

training and education solutions associated with individual, collective, and essential tasks supporting the mission and the overall vision. In short, EDM provides actionable decision information in support of core organizational processes.

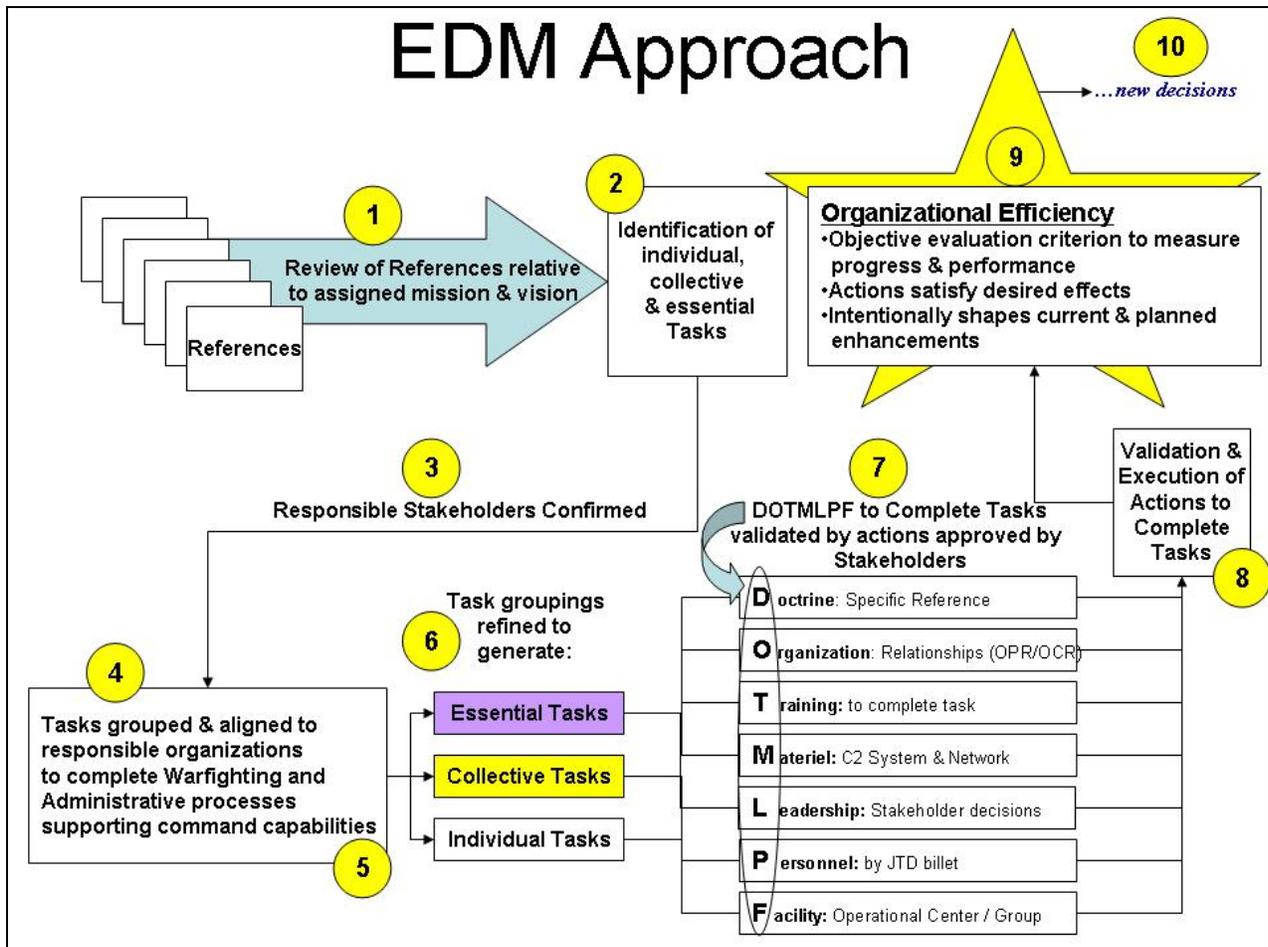


Figure 3. EDM approach

Objectives of EDM. EDM enables people to make effective decisions across the multiple domains of the military decision-making spectrum. It accomplishes this by leveraging information promoting knowledge and understanding required to make sound decisions and to generate feedback needed to evaluate post decision success. All EDM modules support the following objectives:

- **Objective 1:** Archive and log actionable information.
- **Objective 2:** Assess the value of actionable decision information.
- **Objective 3:** Produce knowledge supporting decisions.
- **Objective 4:** Generate feedback to evaluate post decision success.
- **Objective 5:** Leverage knowledge visualization to enhance situational awareness.
- **Objective 6:** Leverage adaptive planning to produce capability-based plans and products.
- **Objective 7:** Generate an architecture knowledge base promoting learning organizations.

Data-centric Approach. Updated data provides the end, means and ways to leverage a data-centric architecture capable of producing a knowledge base with actionable decision information. Data supporting information exchange requirements (IER)^{ix} stimulate this approach. Every time a user makes a decision, that decision influences change through actionable information people can apply to complete essential tasks. EDM links these tasks via IERs aligned to key words, and subsequently aligns them to responsible stakeholders and organizations. Stakeholders validate information every time they make a decision. Outputs from these decisions influence actions to complete essential tasks supporting core processes. By executing these processes, commands satisfy their concepts of operation, while taking into consideration varied cultural mindsets and environmental considerations. Successful execution of these core processes achieves desired effects.

Stakeholders	C4ISR Products	Operational View	Systems View	Technical View
Planners	<ul style="list-style-type: none"> ▪ Overview and Summary Information ▪ Integrated Dictionary ▪ High-level Operational Concept Graphic 	<ul style="list-style-type: none"> ▪ Operational Information Exchange Matrix ▪ Command Relationships Chart ▪ Activity Model ▪ Operational Rules Model ▪ Operational State Transition Description ▪ Operational Event / Trace Description 	<ul style="list-style-type: none"> ▪ Operational Node Connectivity Description ▪ Organizational Relationships Chart ▪ System Communications Description ▪ System Evolution Description ▪ System Technology Forecast ▪ Systems State Transition Description 	<ul style="list-style-type: none"> ▪ Operational Event Trace ▪ Technical Architecture Profile
Owners	<ul style="list-style-type: none"> ▪ Overview and Summary Information ▪ Integrated Dictionary ▪ High-level Operational Concept Graphic ▪ Logical Data Model 	<ul style="list-style-type: none"> ▪ Operational Information Exchange Matrix ▪ Command Relationships Chart ▪ Activity Model ▪ Operational Rules Model ▪ Operational State Transition Description ▪ Operational Event / Trace Description 	<ul style="list-style-type: none"> ▪ Operational Node Connectivity Description ▪ Information Exchange Matrix ▪ Organizational Relationships Chart ▪ System Communications Description ▪ Systems Functionality Description 	<ul style="list-style-type: none"> ▪ Operational Event Trace ▪ Technical Architecture Profile
Designers	<ul style="list-style-type: none"> ▪ Logical Data Model 	<ul style="list-style-type: none"> ▪ Operational Information Exchange Matrix ▪ Command Relationships Chart ▪ Activity Model ▪ Operational Rules Model ▪ Operational State Transition Description ▪ Operational Event / Trace Description ▪ Business Process to System Function Matrix 	<ul style="list-style-type: none"> ▪ System Interface Description ▪ Business Process Model ▪ System Communications Description ▪ Systems Matrix ▪ Operational Activity to System Function Traceability Matrix ▪ System Information Exchange Matrix ▪ System Performance Parameters Matrix 	<ul style="list-style-type: none"> ▪ Business Process Model ▪ Technical Architecture Profile
Builders	<ul style="list-style-type: none"> ▪ Logical Data Model ▪ Physical Data Model 	<ul style="list-style-type: none"> ▪ System Interface Description and System Functionality Description 	<ul style="list-style-type: none"> ▪ System Interface Description ▪ Systems Event Trace ▪ System Communications Description ▪ Systems Matrix ▪ System Rules Model ▪ Physical Data Model 	<ul style="list-style-type: none"> ▪ Systems Event Trace ▪ Technical Architecture Profile

Figure 4. Architecture Products

Using EDM, stakeholders manage DOTMLPF to complete individual, collective and essential tasks supporting core processes. Each process is comprised of multiple tasks linked by information exchange to support a common essential cause. Organizational relationships are attributes associated with each task. Stakeholders at these organizations are responsible for

actions necessary to complete assigned tasks. Stakeholders continue to refine and validate IERs every time they make decisions. Outputs from decisions generate alerts stakeholders consider before sending them to organizations responsible for gathering feedback. This feedback generates actionable information for evaluation of post decision success. In addition, outputs from approved decisions dynamically update situational briefs and data producing architecture products. Figure 4 identifies several architecture products required by the Department of Defense Architecture Framework (DoDAF)^x. EDM enables stakeholders to leverage these products, as well as actionable decision information in support of core processes. The architecture produced by this approach generates a re-useable knowledge base with actionable decision information that stakeholders can apply to manage changes over time.

Joint Task Forces (JTF). JTFs deploy into unfamiliar locations within complex, uncertain, and rapidly changing situations. No two JTFs are exactly alike, so that a cookie-cutter approach towards their capabilities could be detrimental. To succeed in these environments, there is a need to integrate varied, dynamic and unanticipated sets of capabilities. JTF commanders draw these capabilities from the Joint Force and its mission partners. The ability to share information across other DoD, non-DoD and multinational forces enables the assigned JTF and mission partners to collaborate and coordinate topics of concern. Knowledge gained from collaboration and coordination enables the JTF and other partners to determine required actions to adapt rapidly (e.g., a modification to a mission) in an ever changing operating environment.

EDM provides the ability to share information with other DoD organizations, non-DoD agencies, and multinational forces across multiple system and network domains. Using current C2 systems, it provides a foundation to build a knowledge base leveraged by all forces in a net centric environment. Using EDM, people can access dynamically updated architecture data to support core warfighting and business processes.

Furthermore, we have seen numerous JTFs take on a more standing role over longer timeframes. In this case, the validated decision information that allowed the JTF to evolve its decision processes within its environment can also become the basis for institutionalizing the “best practices” for efficient sustained operations across the entire life of the JTF.

Striking a Balance. EDM helps people to quickly transition data to actionable decision information with quality feedback. This feedback enables stakeholders to measure progress and performance and evaluate post decision success.

EDM leverages the basic tenets of command and control to support decision-making throughout planning, execution and evaluation. EDM empowers decisions by stakeholders to maintain an effective balance between command and control to achieve desired effects framed by the mission and vision.

EDM: THE ART

Doctrinal Foundation. The joint definition of capability is “the ability to achieve a desired effect under specified standards and conditions through combinations of means and ways to perform a set of tasks.”^{xi} Joint Capability Areas (JCAs)^{xii} provide a common capabilities language for use across many related DoD activities and processes. The Secretary of Defense endorsed the following 21 JCAs.

-Joint Battlespace Awareness

-Joint Command and Control

31 March 2006

-Joint Network Operations	-Joint Interagency Coordination
-Joint Public Affairs Operations	-Joint Information Operations
-Joint Protection	-Joint Logistics
-Joint Force Generation	-Joint Force Management
-Joint Homeland Defense	-Joint Strategic Deterrence
-Joint Shaping & Security Cooperation	-Joint Stability Operations
-Joint Civil Support	-Joint Non-Traditional Operations
-Joint Access & Access Denial Operations	-Joint Land Control Operations
-Joint Maritime/Littoral Control Operations	-Joint Air Control Operations
-Joint Space Control Operations	

Joint Capability Areas (JCAs) are collections of similar capabilities grouped at a high level in order to support decision making, capability delegation, and analysis.^{xiii} JCAs provide a means to transition joint functional concepts and joint operating concepts to joint execution success. JCAs influence the joint and service programs capable of producing integrated solutions and satisfying the Joint Operations Concepts (JOpsC).

A common theme identified by all joint concepts is the “need to share information”^{xiv}. Unfortunately, as military organizations improve their ability to share information, they encounter additional problems such as information overload, limited bandwidth, and stove-piped capabilities. History is full of examples where sharing information is a symptom of but not the root cause of the overall problem. A close review of Joint and service level command and control doctrine identifies decisions as the primary capability to influence change and maintain command and control. People making decisions tend to use the following classifications of information to make decisions and to evaluate post decision success:

- Raw Data: Un-synthesized information
- Processed Data: Information with value
- Knowledge: Situational awareness derived from processed data.
- Understanding: Improved situational awareness achieved by applying judgment and experience to previous knowledge.

It is worth noting that architecture products represent a specific roll-up of specific processed data, like a report. A specific roll-up of processed data may not preserve all of the framing data essential for assessing relevance, driving purpose-oriented information sharing, and collaboration.

Information sharing is a critical enabler in the decision making process. Through decisions, people transition information into actions. A sound decision intentionally shapes the future to achieve organizational objectives. EDM enables users to quickly realize the value of information and harness that information to make sound decisions. Outputs from these decisions influence their ability to optimize command and control. Through EDM, outputs from decisions dynamically update architectural products and produces actionable decision information in support of core processes. This data-centric approach centered on the basic tenets of C2 produces a re-useable architecture knowledge base.

Enterprise Architecture. Military and federal organizations allocate vast resources to manage and maintain enterprise architectures. DoDAF establishes the guidelines for systems engineering based architectures. The Enterprise Architecture Management Maturity Framework (EAMMF)^{xv} mandates the criterion for assessing and improving enterprise architecture management over five

stages of maturity. Pre-determined measures of performance (MOP) help users to evaluate each level of maturity. No DoD organization has met all five stages of EAMMF maturity.

Value of Architectural Data. Enterprise architecture data in an executable framework has the potential to influence positive changes in the acquisition process. Ideally, boards, panels, and councils use a four-step analysis process described by JCIDS to access deficiencies identified by architecture data. The Initial Capabilities Document (ICD)^{xvi} makes the case to establish the need for a materiel approach to resolve a specific capability gap derived from the JCIDS analysis process. ICDs will eventually be based entirely on integrated architectures.^{xvii} EDM provides stakeholders the ability to generate a data-centric integrated architecture.

Architecture Views. DoDAF guidelines describe three major perspectives or views of the architecture. These three architecture views are the operational, system and technical views. The operational view (OV) identifies what the organization does to achieve mission and vision success and the information exchange between different organizations or nodes to complete these tasks. The systems view (SV) describes the systems and networks needed to exchange information requirements between various nodes. The technical view (TV) describes the conditions and standards adhering to joint technical standards to maintain interoperability. The common bond with all three views is information requirements, which link all three views to construct a re-usable enterprise architecture knowledge base.

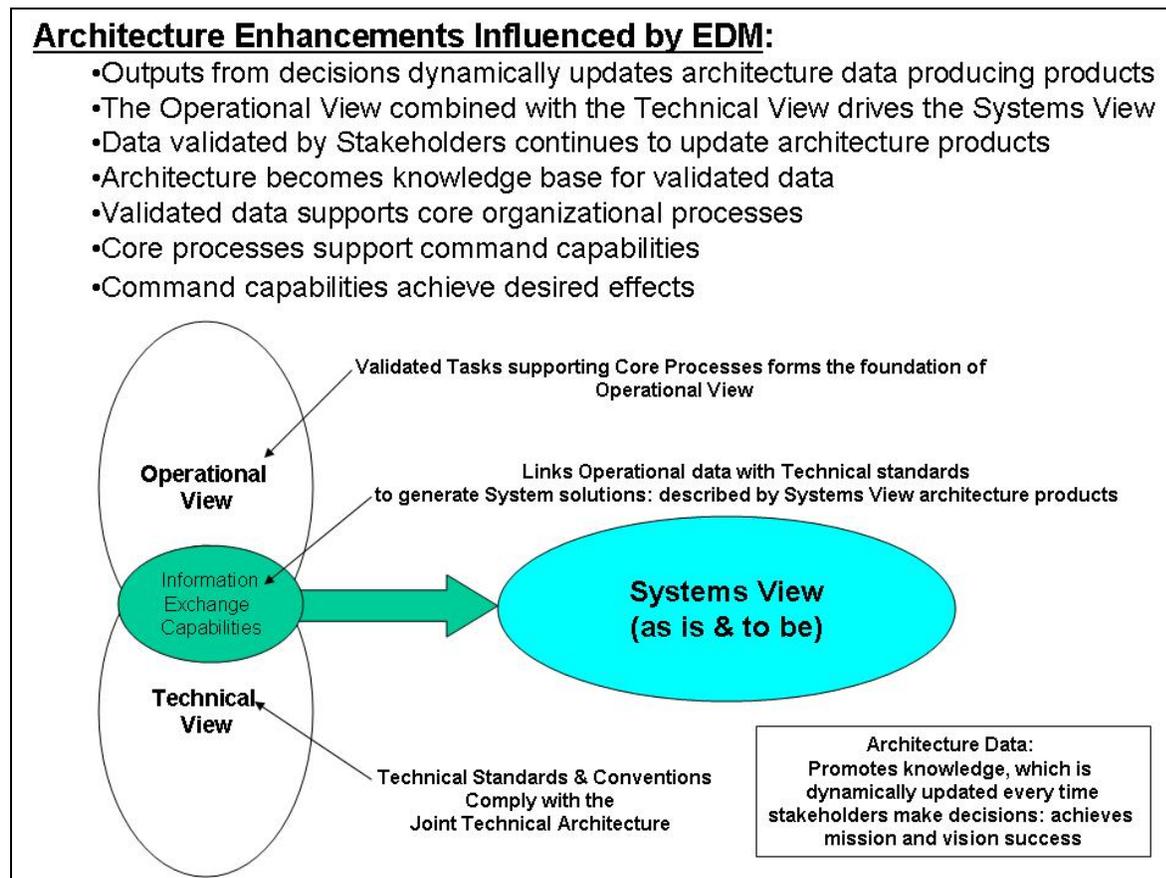


Figure 5. Operational view and technical view driving systems view solutions

The EDM Decision Support Capability leverages data to produce actionable information to update operational view products. By applying approved standards and conditions identified in the technical view with required operational view data, stakeholders are able to apply actionable information generated by EDM to identify the proper number and type of system view solutions. Stakeholders then compare these results to the current baseline architecture to quickly identify shortfalls. Stakeholders responsible for the JCIDS assessment process review these shortfalls to determine if these shortfalls contribute to a command gap. Stakeholders can then leverage the portfolio / investment management and acquisition processes to correct approved gaps. Figure 5 describes how the OV combined with the TV can effectively drive SV solutions.

DoD guidelines provide the framework for architecture data to influence positive changes through JCIDS. Current guidelines however, do not address how architecture data identifies DOTMLPF as data attributes associated with tasks supporting core processes and command capabilities.

EDM: A VALUABLE DECISION SUPPORT CAPABILITY

EDM Modules supporting Command and Control. Figure 6 depicts the seven basic modules of the EDM concept presently implemented. All EDM modules leverage the basic tenets of Command and Control to support decision-making. Transitioning data to actionable decision information promotes knowledge and understanding stakeholders require to make decisions achieving desired effects.

The **Logger** module provides the ability to log and archive actionable information derived from volumes of data.

The **Assessment** module provides actionable information promoting knowledge to identify and refine organizational relationships and evaluation criteria.

The **Decision Recommendation** module leverages assessments from multiple COIs to generate a consolidated decision recommendation. This actionable decision information promotes knowledge and a level of understanding stakeholders require to make critical decisions. Additionally, this module generates evaluation criteria, which provides a means to measure and evaluate post decision success.

The **Visualization** module ensures outputs from approved decisions *dynamically* updates situational awareness templates.

The **Briefing** module ensures visualization products and text are combined to dynamically update situational awareness templates for briefs supporting ongoing and planned missions, as well as priorities established by the Commander.

The **Planning** module ensures inputs, actions and outputs from each step of a capability-based planning process produces actionable information. This ensures plans and planning products adjust to support changes in the operating environment.

The **Architecture** module leverages validated data to dynamically update operational, system and technical views. This produces architecture products and generates actionable decision information supporting core processes. As stakeholders make decisions, the *quality* of architecture continues to improve. The architecture knowledge base promotes a learning environment and the ability to evaluate progress in a net centric environment.

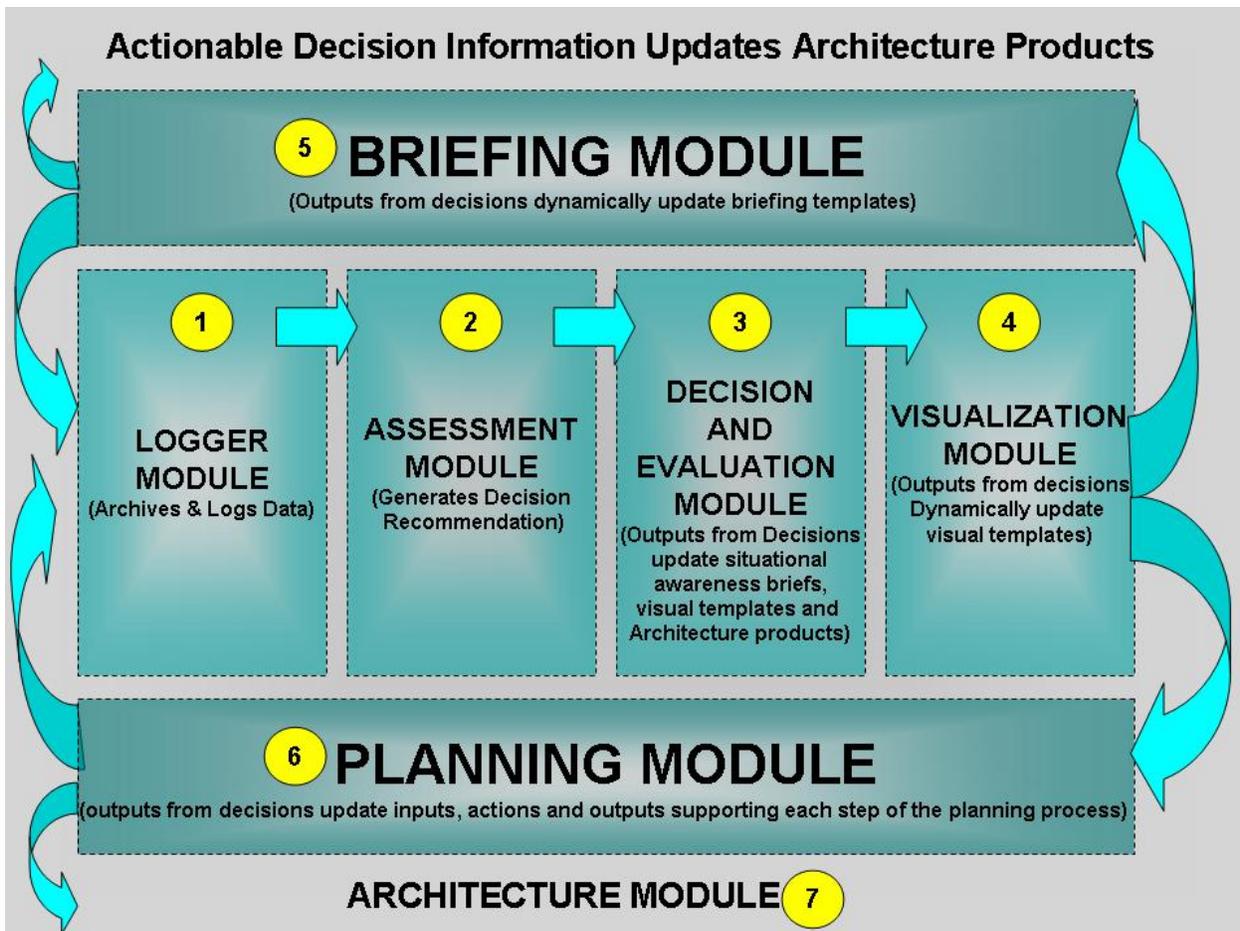


Figure 6. EDM modules

Managing Changes. Changes and enhancements to each module are approved using pre-determined evaluation criterion and procedures outlined by a Change Management Plan (CMP). The CMP describes a disciplined approach by which integrated, cross-domain solutions satisfy validated needs. This is crucial in the face of an ever-changing operating environment. Changes generated by the CMP enable stakeholders to:

- Quickly translate data to actionable information.
- Collectively harnesses corporate knowledge of individual action officers.
- Learn from experiences
- Provide robust search, archive and retrieval capabilities.
- Dynamically update actionable information.
- Streamline and improve accuracy of situational awareness.
- Promote information sharing in a net centric environment.
- Provide a flexible and adaptable decision support capability.
- Produce actionable decision information in support of core processes.

EDM Enterprise Model. Using web-based portals, EDM enables users to exchange information across current, all be it somewhat stove-piped, system boundaries. EDM does not purport to supplant existing authoritative data sources, but rather empower the use of the

information from those authoritative sources as it supports decision processes. Through the decision process, stakeholders can update data stored on the back end using relational databases. EDM enables stakeholders to manage and validate data producing actionable information using current systems. Changes to this data trigger alerts. These alerts are sent to responsible stakeholders at organizations managing the supporting databases. This enables stakeholders to realize what data requires updating and simultaneously produces actionable decision information that highlights the value of this shortfall relative to the situation, time, and mission.

EDM: THE PRACTICE

Translating Data to Actionable Decision Information. In a command and control environment, many decisions are cyclic. Making decisions is dependent upon information. The amount of information available creates overloads that plague most military organizations. This scenario is compounded in any situation where a military organization is expected to work with other DoD organizations, non-DoD agencies or multi-national forces. Organizational relationships, national and military policy, intelligence collected by military forces operating in the United States, and sharing of information are several key challenges faced by personnel protecting our homeland. The ability of military personnel to collaborate and coordinate with a myriad of organizations and agencies (normally not in their chain of command) is essential to maintaining both strategic and tactical awareness. This intentional interaction and exchange of information produces knowledge to enhance understanding. The ability to transition data to quality information (e.g., accurate, concise, relevant, complete and timely information) promotes knowledge and understanding that stakeholders can apply to make decisions achieving mission and vision success.

EDM has its own database driven by a logger kind of function that actually maintains both decisions and relevant information relations about the underlying data from other systems. The workflow process core is the means by which EDM relates and manages the data.

Framework for EDM. A portal solution, such as SharePoint (SPS) 2003 provides the operational framework for which the EDM capability operates on. The *Logger* module maintains its own database structure, while the *Assessment* and *Decision / Evaluation* Modules utilize one database. This structure enables EDM modules to function as separate web applications as well as seamlessly integrate with the SPS architecture. All modules within the EDM Decision Support Capability have been or will be built upon a .Net framework.

Effective Decision Making (EDM) Modules. As a decision support capability, each of EDM's seven modules supports a specific aspect of decision-making. Figure 7 highlights the value of EDM to support the information hierarchy. EDM modules work in synchronization to promote actionable information and knowledge supporting decisions. Outputs from these decisions dynamically update architecture products.

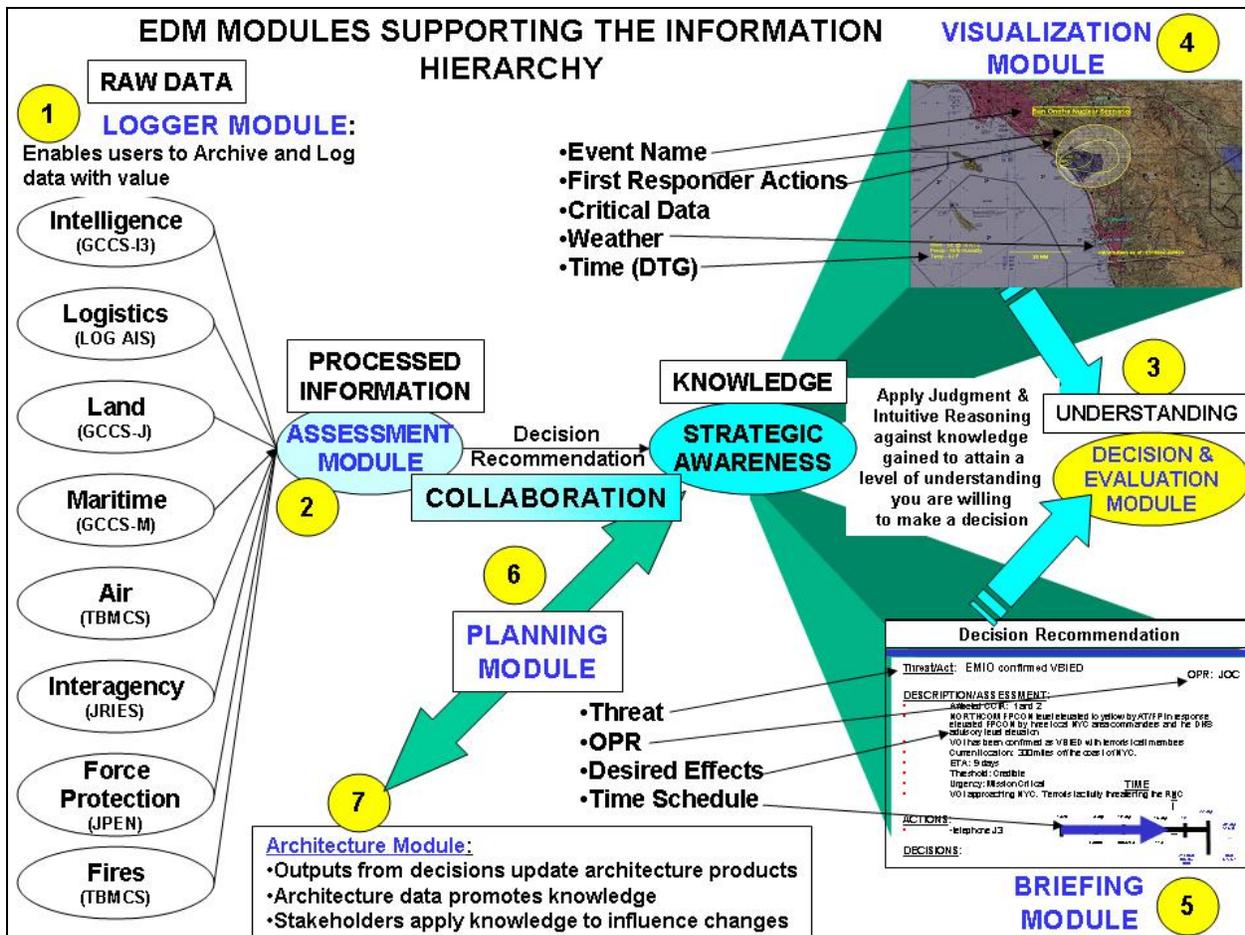


Figure 7, EDM supporting the Information Hierarchy

1. Logger Module: The *Logger* module provides stakeholders the ability to log and archive command data. This data produces actionable information. The *Logger* Module is the backbone for sharing actionable information using EDM. It is the means by which stakeholders can gather raw data from multiple COIs. Collaboration and coordination of raw data generates actionable information stakeholders can apply to gain knowledge of the situation and mission. This provides stakeholders with a means to efficiently collect and distribute actionable information. It sets the stage for enhanced collaboration and sharing across multiple COIs using current capabilities.

2. Assessment Module: The *Assessment* module links actionable information to assigned missions, Commander's Critical Information Requirements (CCIR) and supporting COI. The *Assessment* module prompts users to categorize and identify the criticality of actionable information. Using this module, responsible users can provide stakeholders the best quality information possible in the form of actionable decision information.

3. Decision and Evaluation Module: The *Decision Recommendation* Module generates decision recommendations from coordinated assessments. This module provides a means for multiple COIs to quickly coordinate and consolidate decision recommendations with actionable decision information stakeholders require before they make decisions. This information includes

items such as desired outcomes and effects. It permits a decision maker to annotate whether or not he/she concurs with the recommendation. All decisions made within the *Decision Recommendation* module provide data traceable to the original feed in the *Logging* Module.

4. Visualization Module: The *Visualization* module presents actionable decision information promoting knowledge and understanding. It reduces the effort necessary to manually generate visualization products. In this module, visual information dynamically updates. It is in this module that users can obtain the Command's analyzed situational awareness, mission or event summaries, updates to command priorities, domain assessments and other information promoting knowledge and understanding.

5. Briefing Module: The *Briefing* module harnesses outputs from approved decisions to update pre-determined fields in briefing templates forming the foundation for daily updates to the Command, primary battle staff and external commands. Pre-determined templates accessible on a permission basis provide actionable decision information the Commander, the battle staff and external organizations need to maintain situational awareness. This enhanced awareness promotes knowledge and understanding required to make decisions achieving desired effects and to redirect forces based on new knowledge derived from post decision evaluation.

In most commands, one finds a cadre of personnel dedicating many hours to prepare and present daily briefs. Using the *Briefing* Module, the cadre of personnel is reduced to one or two personnel with the authority to approve data. This generates a brief, which automatically updates templates with data derived from approved decisions. This data-centric approach helps people to understand the value of changes relative to priority of current and planned topics of interest. Adjustments to briefing templates influence changes to prioritization of alerts.

6. Planning Module: This module captures data from all other modules and integrates information derived from different COIs to support each phase of an adaptive capabilities-based planning process. Outputs from each step of the planning process provide inputs to the next planning step. The quality of data supporting running staff estimates is updated and refined by outputs from approved decisions. Tailored situational templates and enhanced understanding of the environment support planning horizons established by planning teams and groups. Changes in the current situation alert planners. They use this information to determine unintended consequences prior to approval of the plan. Key outputs from this module generate capability-based force flows. This enables planners to modify resource allocation for changes occurring in the operating environment. As plans execute, outputs from decisions dynamically update briefing templates and stimulate decision recommendations for planned and unplanned decision points. This ensures DOTMLPF to support each capability provides the ends, ways and means to achieve mission success. Actionable information generated by this process helps planners to identify strengths and shortfalls of the proposed courses of action prior to approval.

Actionable information provides useful architecture description of DOTMLPF to support mission needs and approved concepts of operation. Outputs from decisions link plans to execution and evaluation. This module ensures approved plans are dynamically updated and adjusted based on changes in the situation and operating environment.

7. Architecture Module: This module ensures data outputs from approved decisions dynamically updates architecture products producing operational, systems and technical views.

This module ensures DOTMLPF attributes are directly associated with architecture data. This produces an integrated architecture. This actionable information identifies DOTMLPF required by organizations to achieve mission and vision success. The data-centric architecture enables stakeholders to submit queries, which produce actionable information they can apply to objectively identify organizational strengths and gaps. These gaps are corrected through the portfolio / investment management and acquisition processes. As stakeholders continue to make decisions, the quality of architecture data improves. This data provides responsible stakeholders a knowledge base, which is dynamically updated by decisions and learning experiences.

Net centric information gateway. Portal capabilities leverage information processed by different systems and across functional and technical domains. The front end of EDM is a web portal, which provides a net centric gateway. This enables JTF personnel to share and update architectural information with other data repositories managed by different COI. The portal enables the Joint Task Force to share information with other DoD, non-DoD, and multinational forces. EDM helps personnel to quickly recognize and understand the value of data to produce actionable information supporting command decisions, assigned missions and planned events. This enables people to share and collaborate this information with COIs capable of transitioning this information to actionable decision information. Results empower stakeholders with the ability to intentionally shape the future through decisions.

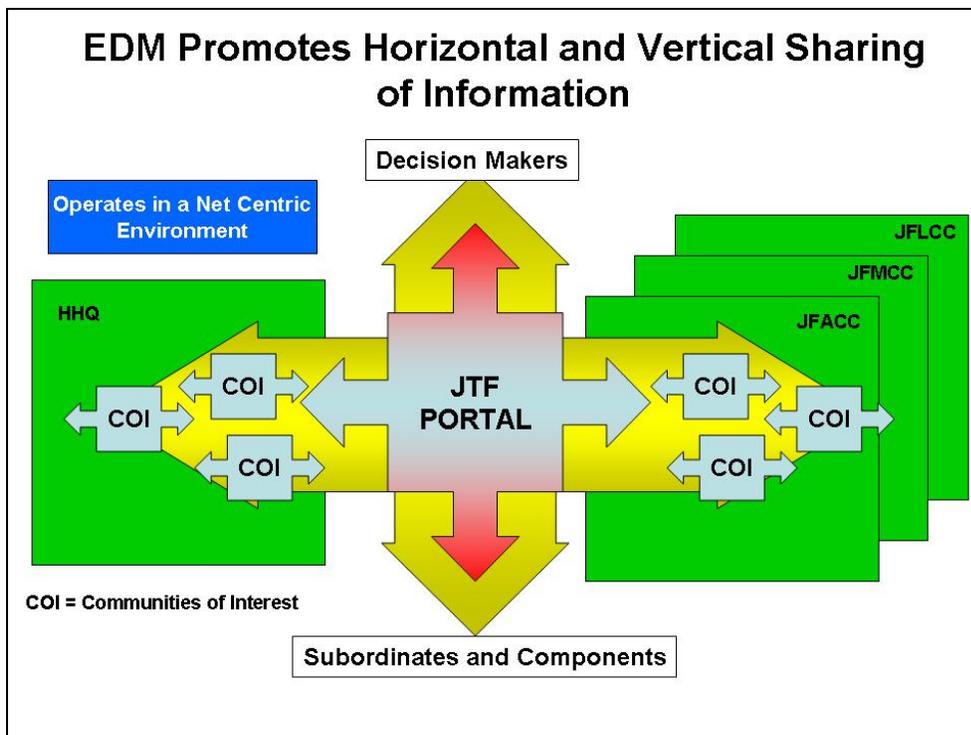


Figure 8, EDM promotes horizontal and vertical sharing of information

Information Sharing. Horizontal and vertical sharing of information across multiple COIs enables EDM solutions to function as a decision support capability in a net centric environment. Each element or module of EDM provides a level of support leading to fast, effective, and efficient decisions. For example, if raw data is processed and holds value to an organization, the logging module of EDM archives the captured data as a log entry. Multiple log entries associated

with the same topic of interest are consolidated and coordinated. The responsible stakeholder generates a collaborative decision recommendation. This decision recommendation provides decision makers actionable information promoting knowledge required to make decisions. Data generated from approved decisions dynamically updates architecture products, refine situational awareness templates and generates alerts. Based on approval by the decision-maker these alerts are sent to COIs responsible for gathering feedback to help the decision-maker with evaluation of post decision success. Figure 8 highlights the value of horizontal and vertical sharing of information using EDM.

EDM tracks information within its integrated decision process perspective is the real key for how EDM supports and promotes information sharing at the right time to the right people such that it enhances decision-making ability.

Validation of Information. Often, multiple organizations support major commands. Responsible stakeholders in these organizations routinely update validated information requirements, baseline systems and technical standards/conditions supporting mission essential tasks. Stakeholders validate these tasks as Joint Mission Essential Tasks (JMETs)^{xviii}. The Defense Readiness Reporting System (DRRS)^{xix} establishes a mission-focused, capabilities-based, common framework for all JMETs. This framework provides combatant commanders, military services, Joint Chiefs of Staff (JCS), and other key DoD users a data-driven environment and tools in which to evaluate, in near real-time, the readiness and capability of U.S. Armed Forces to carry out assigned and planned missions. EDM leverages DRRS information. Once stakeholders validate mission essential information, the same information updates the EDM key word list. This Key Word list describes topics of interest supporting mission essential tasks, as well as key topics addressed by the Commander's Critical Information Requirements (CCIR)^{xx}. In the Key Word list, responsible COIs are associated with each key topic. This relationship helps people to understand the value of information relative to the situation, time and mission.

Realizing the value of information promotes knowledge stakeholders require to make decisions. Outputs from these decisions update situational awareness briefs, command priorities, and data producing architecture products (refer to Figure 4). This ensures architecture data remains accurate, complete, concise, timely, valid and relevant. Results produce quality information shared across responsible COIs in a net centric environment.

Information Hierarchy. Military organizations generate quality information by interpreting the value of raw data before generating it into actionable information in the form of products and reports. Interpretation of these products and reports help determine their value in generating knowledge and improving situational awareness. Decision makers then apply judgment and intuitive reasoning against this knowledge to attain a level of understanding needed to make a decision. The decision maker needs feedback to evaluate post decision success. Figure 7 graphically depicts how this raw data, processed data, knowledge and understanding supports the decision making process as well as how EDM supports the information hierarchy.

Command Processes. Within a combatant command, processes are evident in all aspects of decision making. Examples of warfighting processes are managing the Commander's Critical Information Requirements (CCIR), reducing uncertainty, updating the battle rhythm, maintaining situational awareness, and planning. JCIDS describes acquisition processes. JTS describes training and education processes. All processes identify actions to complete individual,

collective and mission essential tasks. These tasks are link by information exchange and mapped to responsible organizations to satisfy a common cause. Command processes enable people to leverage command capabilities to achieve desired effects framed by the mission and vision.

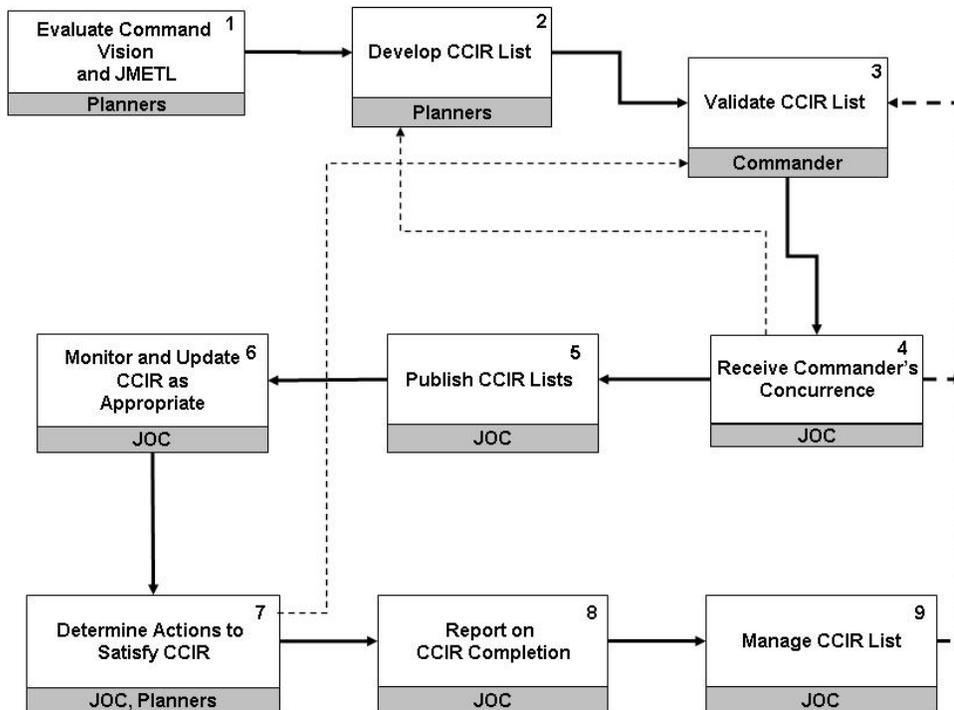


Figure 9, Core Process: Managing CCIR

EDM promotes knowledge and understanding people need to refine and improve efficiency to complete command processes and to evaluate progress and performance over time. Figure 9 depicts a warfighting process titled Managing Commander's Critical Information Requirements (CCIR). At the combatant command level, the CCIR process supports all command capabilities and is essential in supporting command decisions achieving desired effects for assigned missions.

Requirements Management. EDM enables stakeholders to leverage information requirements supporting command processes. For commands that do not document command processes, EDM can still assist by identifying actions people apply to complete individual, collective and essential tasks. This information helps people to identify command processes. Every major command identifies JMETs. The Department of Defense Readiness and Reporting System (DRRS) is a tool leveraged by responsible stakeholders to manage this data. Joint Mission Essential Tasks (JMETS) are mission essential tasks for the command. In DRRS, conditions and standards, to include measures are associated with each JMET. Additionally, DRRS identifies supporting tasks to each JMET. Supporting tasks are analogous to collective tasks. DRRS does not identify Individual tasks. Tasks identified in operational procedures support concepts of operations to achieve mission success. Stakeholders using EDM are able to utilize DRRS data to refine essential tasks and validate collective and individual tasks through decisions. Outputs from these

decisions ensure essential, collective, and individual tasks dynamically update architecture products. Knowledge from these products helps stakeholders to update and refine DRRS data.

EDM links information requirements to actions supporting individual, collective, and mission essential tasks. This knowledge helps stakeholders to validate and improve the quality of information and DOTMLPF to complete mission essential tasks. Additionally, EDM alerts personnel when they are applying resources to tasks not previously validated. Any application of DOTMLPF not linked to the mission or vision causes inefficiency.

EDM also helps stakeholders to identify the proper allocation of DOTMLPF resources to complete each task. Approved decisions validate and update this knowledge. Actions (influenced by early identification of deficiencies) promote additional knowledge needed to implement corrective action before shortfalls become command gaps.

Using EDM to Conduct Mission Analysis (Requirements Management Process). As illustrated, EDM provides the Joint Task Force a Decision Support Capability as a means for horizontal and vertical sharing of information across multiple domains. This solution harnesses existing capabilities to improve battle space awareness, generate capability-based solutions and improve Joint Command and Control in a Net Centric environment.

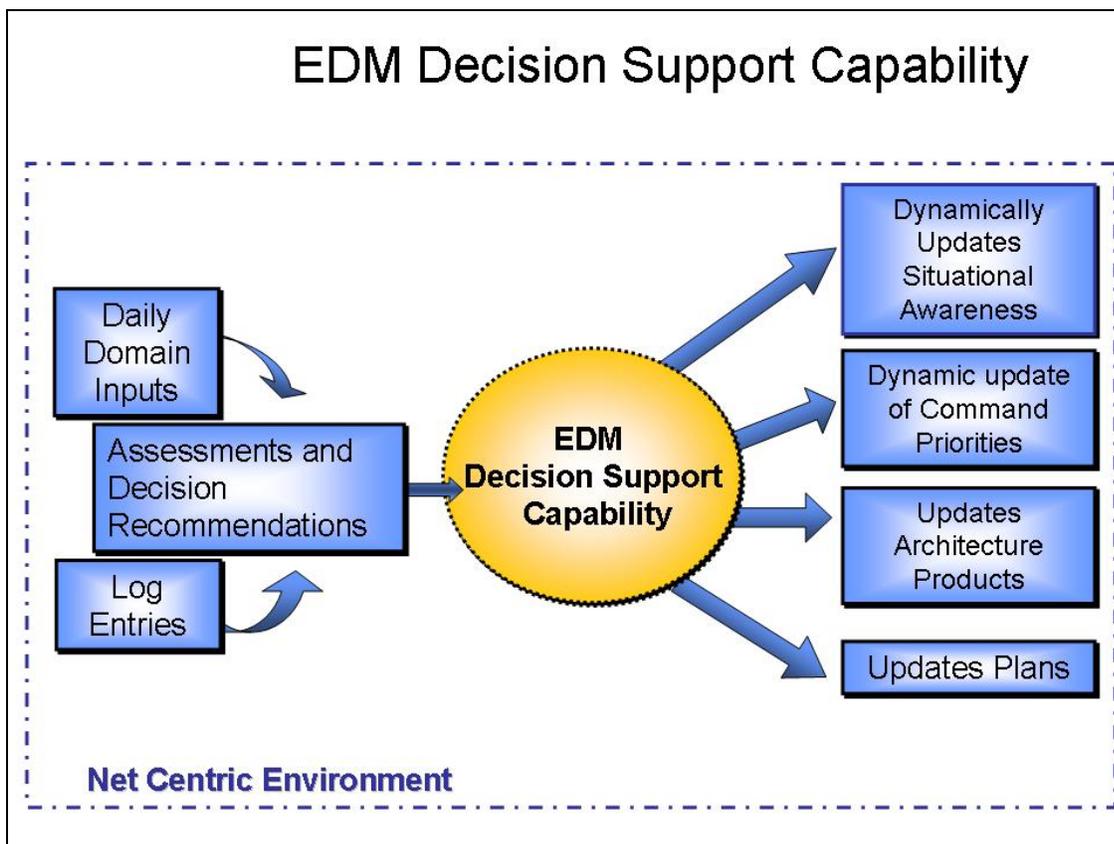


Figure 10. EDM Decision Support Capability

EDM enables personnel to gather, analyze, and distribute information in a manner leveraging the joint operating concepts. As illustrated by Figure 10, this information is in the form of daily domain inputs, a basic log entry, or decision recommendation coordinated by responsible COI. Regardless of the format, all inputs enter the Decision Support Capability

through an analysis phase. During the analysis phase, the Logger helps people to process raw data. This processed data transitions to knowledge and understanding through the Assessment and Decision Recommendation modules. Resulting products dynamically align information to command topics of interest. Each topic of interest then aligns to specific briefing templates, which promotes situational awareness and enhanced knowledge. These actions improve strategic and situational awareness of the operating environment.

To accomplish approved user information requirements, EDM performs a series of activities that include providing inputs, tracking and recording those inputs, assessing information, and recording decisions. With this end in mind, EDM takes into consideration the myriad of stove-piped systems and networks used by different COI. Planned enhancements enable this capability to share and access information from multiple situational awareness capabilities. EDM leverages other planned enhancements. It is through this cyclic decision support process that the command is able to quickly and effectively translate information to actions, as well as maintain a dynamic situational awareness environment.

Information validated by stakeholders updates architecture products supporting JCIDS, JTS and warfighting processes. Information validated by one stakeholder updates numerous other architecture products, which multiple COIs re-use to support their specific needs. This ensures the architecture provides a mechanism for understanding and managing complexity. EDM enables stakeholders to quickly update and synthesize warfighting and business information requirements through decisions. These updates promote knowledge stakeholders need to identify sound investments leading a learning organization.

Traceability. The systems view is documented and traced to operational view products. Core warfighting and business processes document these tasks. Core processes describe actions to complete tasks supporting a common cause. Tasks linked by information exchange are mapped to organizations. These tasks are traceable to actions achieving success. Doctrine, organizations, training, material, personnel, and facilities are attributes associated with each task. This documentation dynamically updates when people make decisions. Actions not linked to the mission or vision highlight potential shortfalls. The portfolio / investment management process and the acquisition process, as appropriate correct shortfalls evaluated as gaps.

DOTMLPF to complete operational tasks are traced to systems design and code. This provides the foundation for requirements identification supporting planned enhancements. With the EDM key word list, future users of planned enhancement are identified early so that they can participate in the assessment and evaluation process in a meaningful way. Future users participate in the requirements identification process using a structured approach oriented around the language of the user community. Often current users become future users. Changes in the environment trigger alerts to help users manage future requirements. A block and spiral approach enables users to generate an "evolutionary development" life cycle model for requirements definition.

This integrated architecture is capable of supporting future release requirements. Business rules and information exchange requirements are linked to actions supporting core processes. Identifying these linkages occurs early during the requirements identification definition stage. Structured reviews occur every time a stakeholder makes a decision. Outputs from each decision dynamically update templates supporting situational awareness updates. Additionally, outputs from these decisions generate alerts sent to responsible stakeholders for new decision recommendations and post decision feedback.

CONCLUSION

Interface Management Produces Integrated Solutions. EDM modules enable people to share information across functional, organizational and system domains. Web-based capabilities enhance the exchange of information by allowing stakeholders to access and update data derived from stove-piped systems.

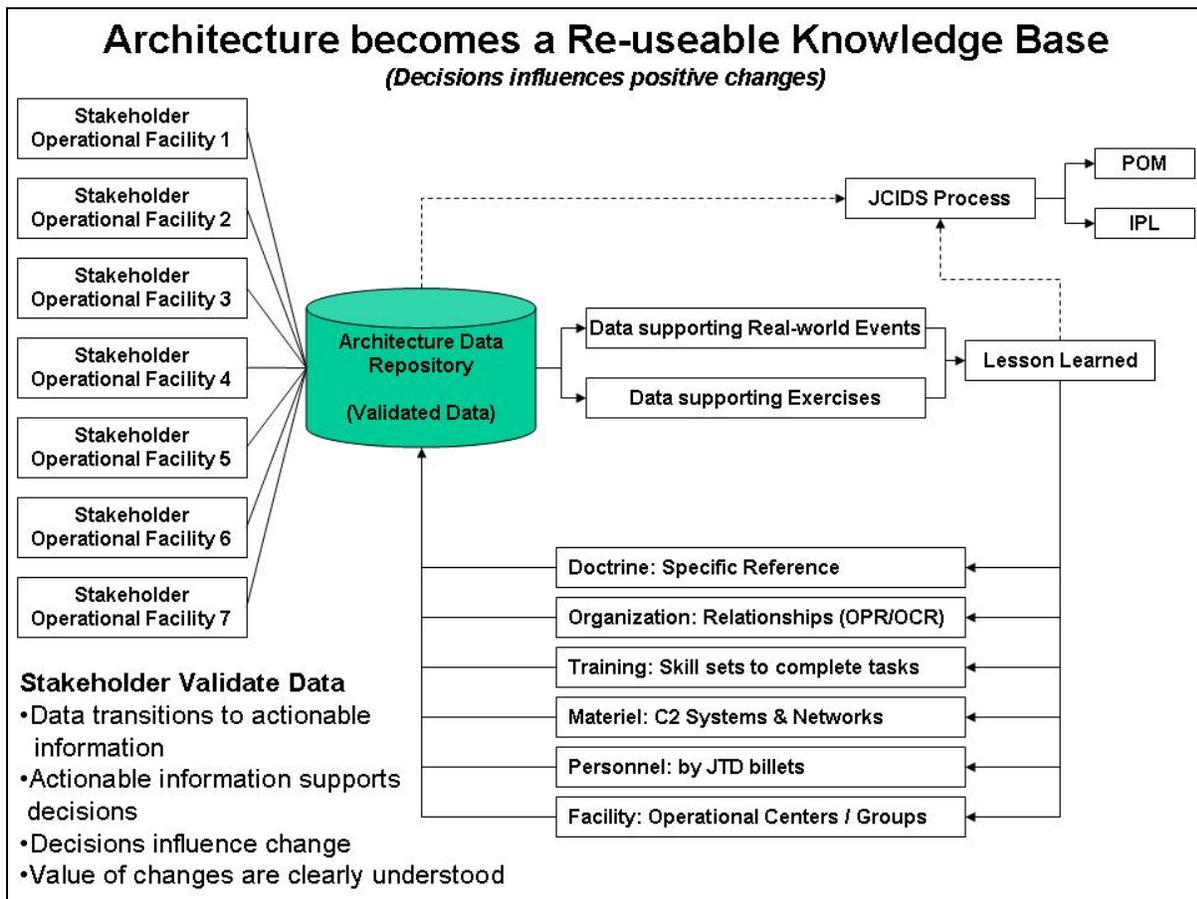


Figure 11, Stakeholders update Architecture products through decisions

Fingers on the Pulse of Success. EDM enables stakeholders to leverage *people, processes* and *technology* through decisions to update architecture data and produce actionable decision information in support of core processes (Figure 11). This generates knowledge stakeholders require to identify DOTMLPF strengths and gaps. This knowledge advances learning and increases levels of understanding stakeholders require to make sound decisions. People that routinely make decisions achieving desired effects tend to be successful leaders.

This solution ties all levels of the military and the government to share critical information. It enables leaders to learn as they grow, even in the face of uncertainty to achieve goals and objectives.

EDM promotes knowledge and understanding the Commander requires to intentionally shape the future through decisions to achieve desired effects. This is the way to achieve Decision Superiority.

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