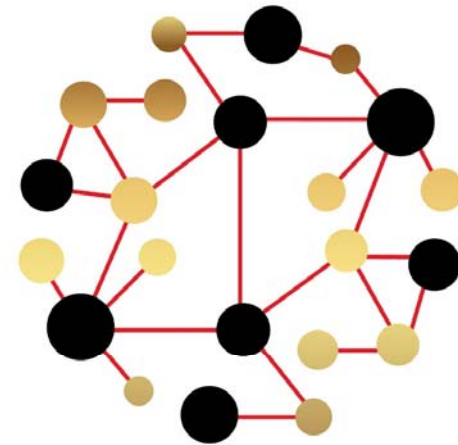


2019 S&ME Conference: Systems and Mission Analysis in a DOTMLPF-P Knowledge Graph

Matthew Maher and Rob Orlando

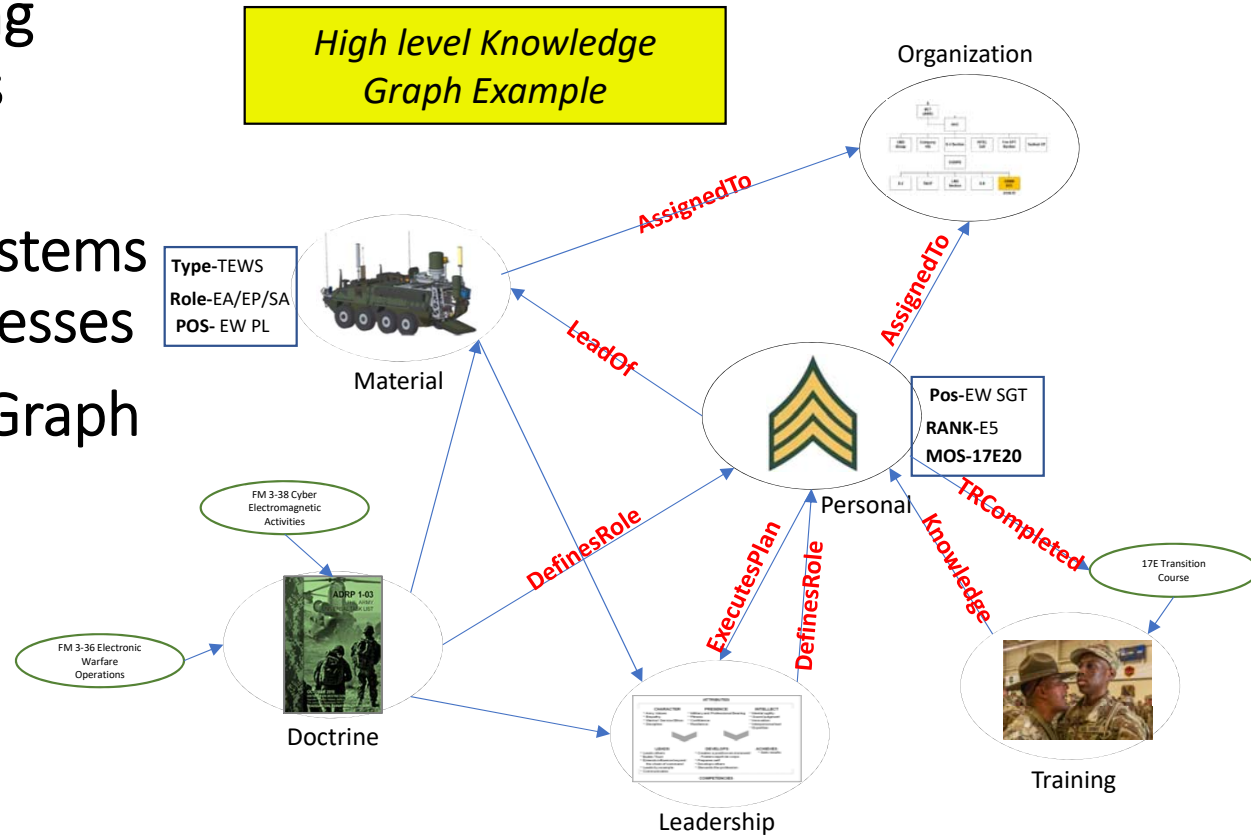


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*"Helping non-experts make expert
decisions to achieve faster and more
effective outcomes"*

Agenda

- Why use Knowledge Modeling (KM) with Knowledge Graphs (KGs)?
- Integrate KGs into Existing Systems Engineering or Business Processes
- DOTMLPF-P in a Knowledge Graph for CEMA Optimization
- Summary
- Next Steps
- Questions

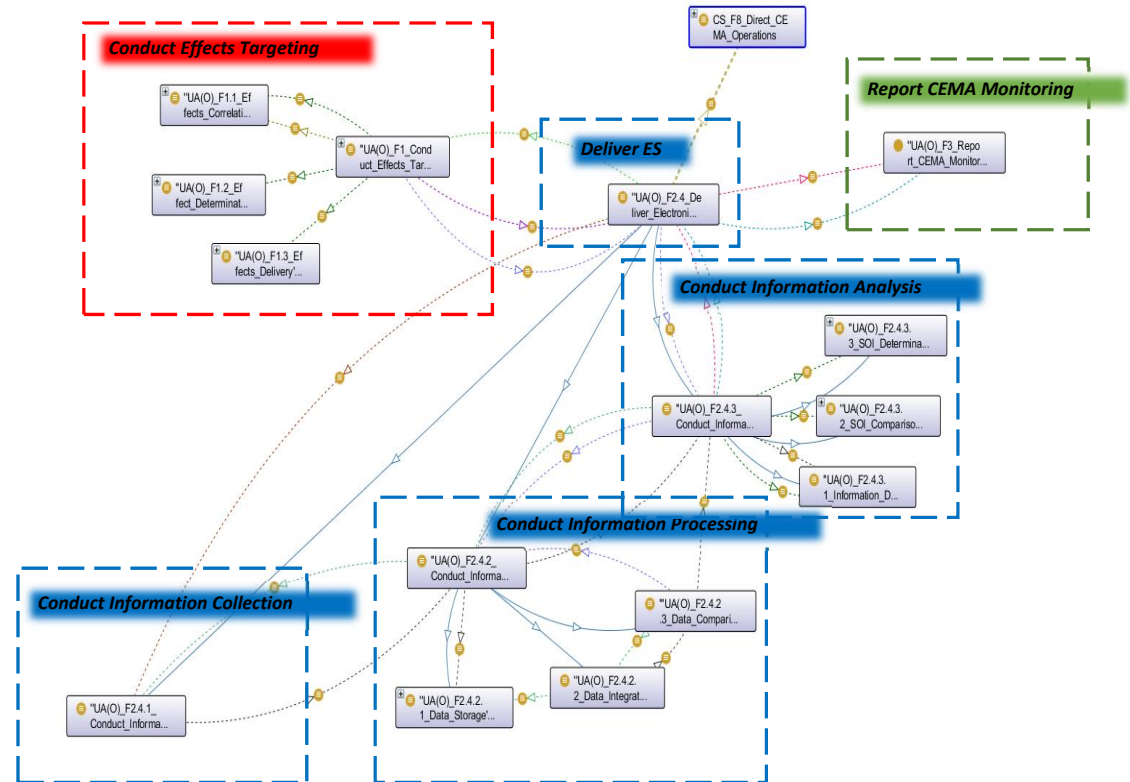


Why Use Knowledge Modeling with Knowledge Graphs?

Knowledge Modeling is the process of capturing knowledge and intelligence in the form of Knowledge Graphs or Ontologies.

Knowledge Graphs answer the following questions:

- How do I fit into the big picture?
- Are we doing the right things?
- How do we work together?



Use Knowledge Graphs to Answer Three Core Questions

How do I fit into the big picture?

- Create dynamic Situational Understanding (SU) by combining data with knowledge. Understanding that allows non-experts to make expert decisions.
- Data + Knowledge = Understanding. Understanding leads to faster, more accurate, and better coordinated decision-making.

Are we doing the right things?

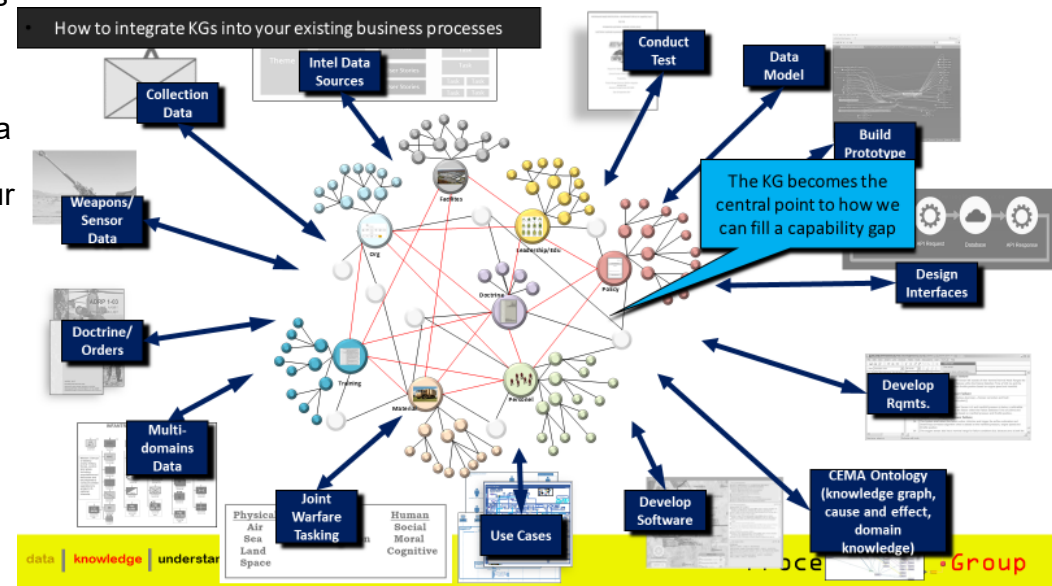
- Define an explicit representation of a domain so everyone has the same starting point. Provide references that create a machine and human readable knowledge base that can be used to support cognitive capabilities.
- KGs map the cause and effect relationships of data and knowledge to information throughout the DOTMLPF-P domain enabling rapid understanding of second and third order effects of decisions and actions.

How do we work together?

- Break down silos by translating between functional teams through the mapping of the cause and effect relationships.
 - Depending on the scope, functional teams could refer to acquisitions (i.e. logistics, technical, test, business analysts, etc.), functional teams could refer to operations (i.e. intel, sustainment, maneuver, fires, signal, etc.), or functional teams could refer to both groups.
- KGs improve Knowledge Management and knowledge retention. Not everyone speaks DoDAF/MoDAF, SysML/UML. We all, however, speak subject-predicate-object.

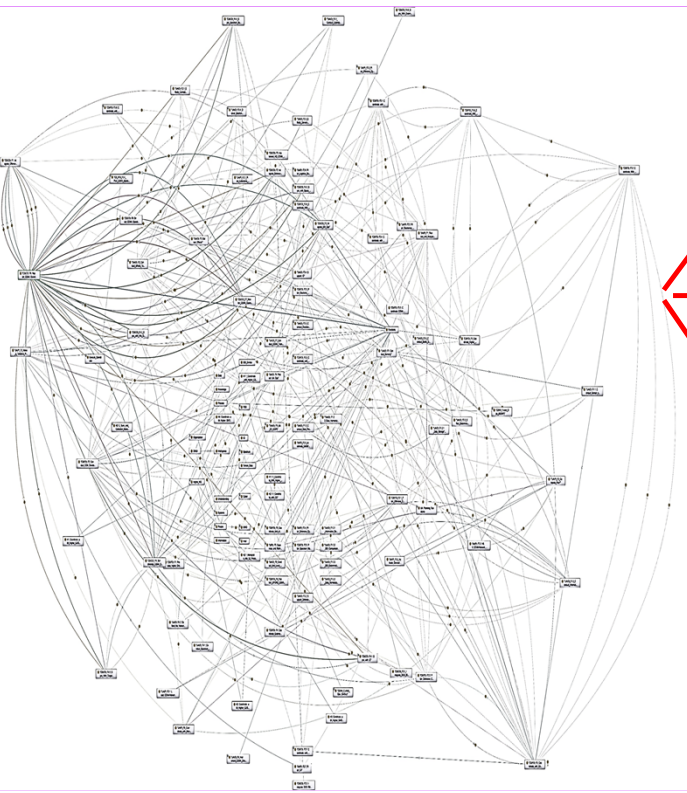
Integrate KGs into Existing Systems Engineering or Business Processes

- Develop a multi-domain model in a KG that addresses multiple levels of depth and breadth
 - Decision makers focused on the What/Why use the same data as the decision makers focused on the How.
- KGs becomes the central point for Data Strategy
 - KGs provide the ability to siphon structured and unstructured data organization-wide, helping to make well-informed decisions by gaining further insight through analytics and bringing value to your data.
- KGs integrate with the Risk Management process by dynamically tracking cause and effect relationships
- Enhances Change Management process through the use of SPARQL queries to quickly extract relevant knowledge of the proposed change.
 - Queries use the subject-predicate-object format that is easily understood.
- KG development aligns with an agile approach.
 - KG development fits easily within your sprints- The turnaround time is quick, and the focus areas of the model can easily be identified in retrospectives and sprint planning sessions.
- DOTMLPF-P Knowledge Graphs provide the end-to-end infrastructure an organization needs to accelerate outcomes for future AI/ML/ANN capabilities.

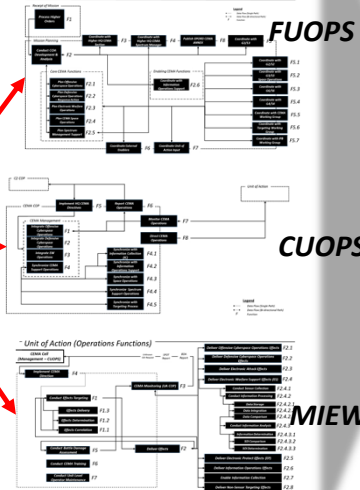


DOTMLPF-P for CEMA Optimization

CEMA Knowledge Graph



Domain Conceptual Process model = Planning



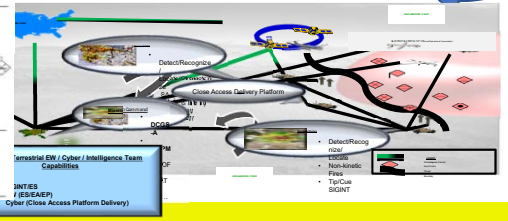
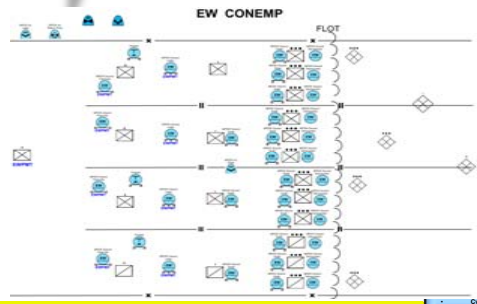
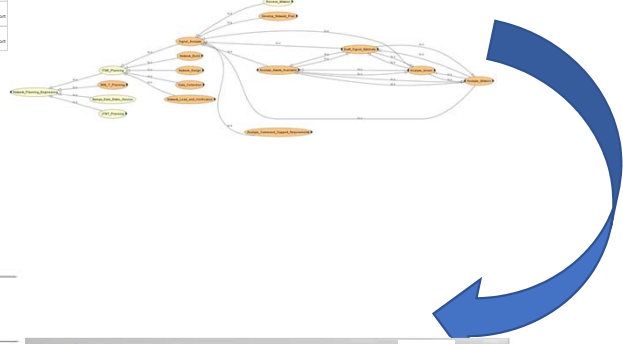
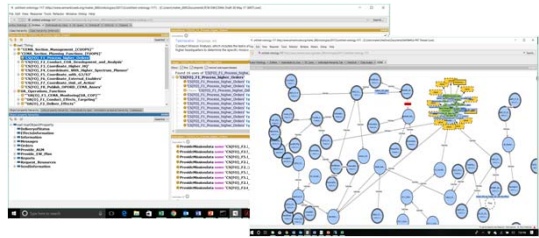
Logical model = Preparation

Logical Task to Function Alignment

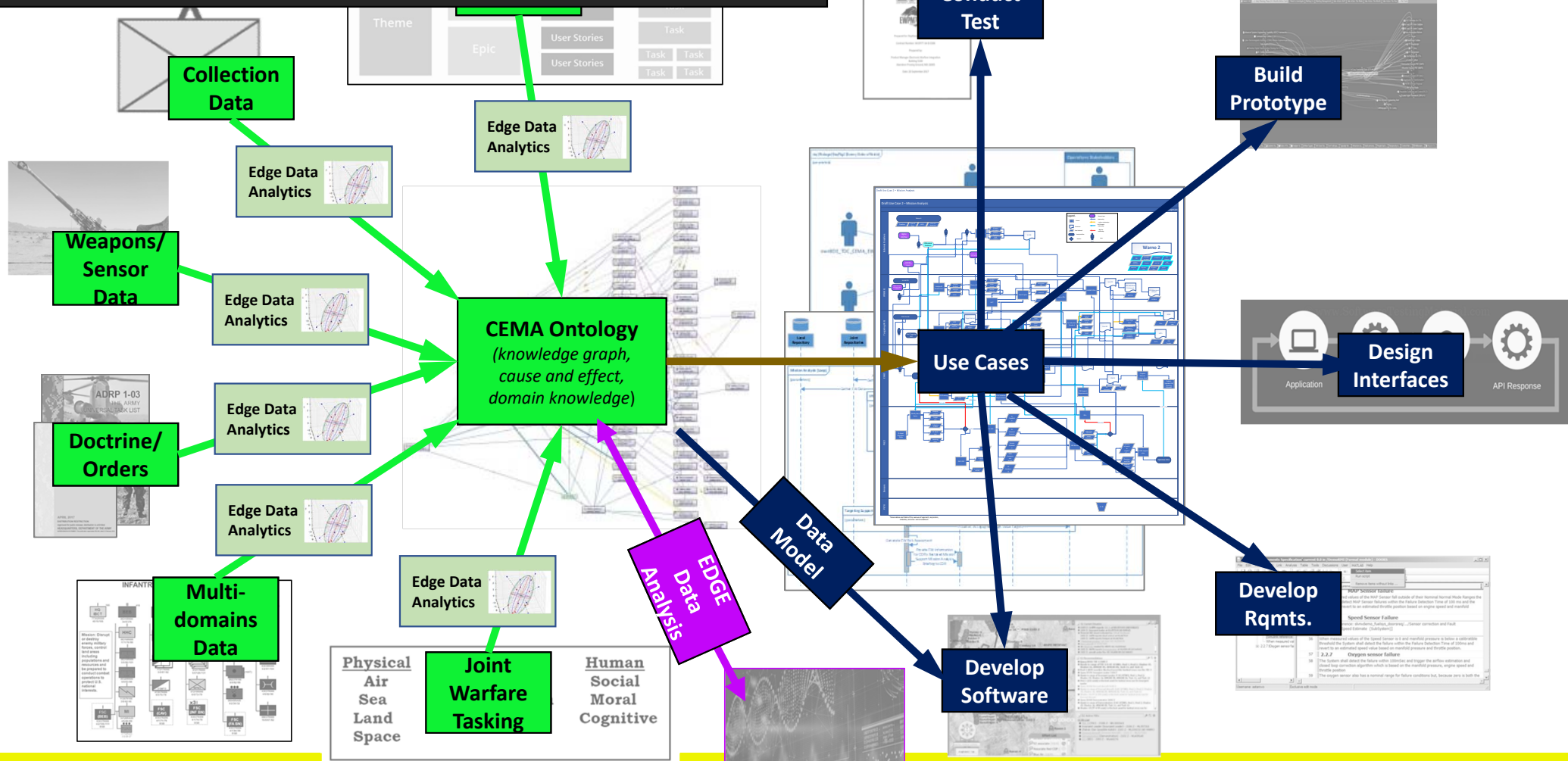
| Task ID | Task Name | Description | Function |
|----------|-----------|-----------------------|------------|
| 10000001 | Task 1 | Description of task 1 | Function 1 |
| 10000002 | Task 2 | Description of task 2 | Function 2 |
| 10000003 | Task 3 | Description of task 3 | Function 3 |
| 10000004 | Task 4 | Description of task 4 | Function 4 |
| 10000005 | Task 5 | Description of task 5 | Function 5 |

Data model = Execution

Interface and Data exchange



DOTMLPF-P in a KG: CEMA Use Case Development Example

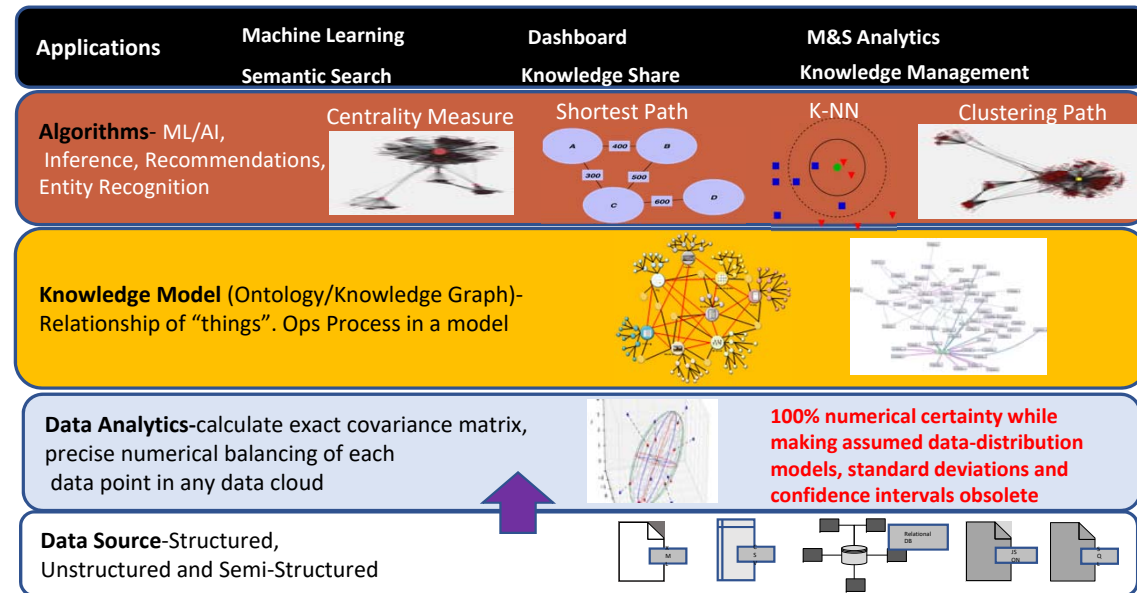


data | knowledge | understanding

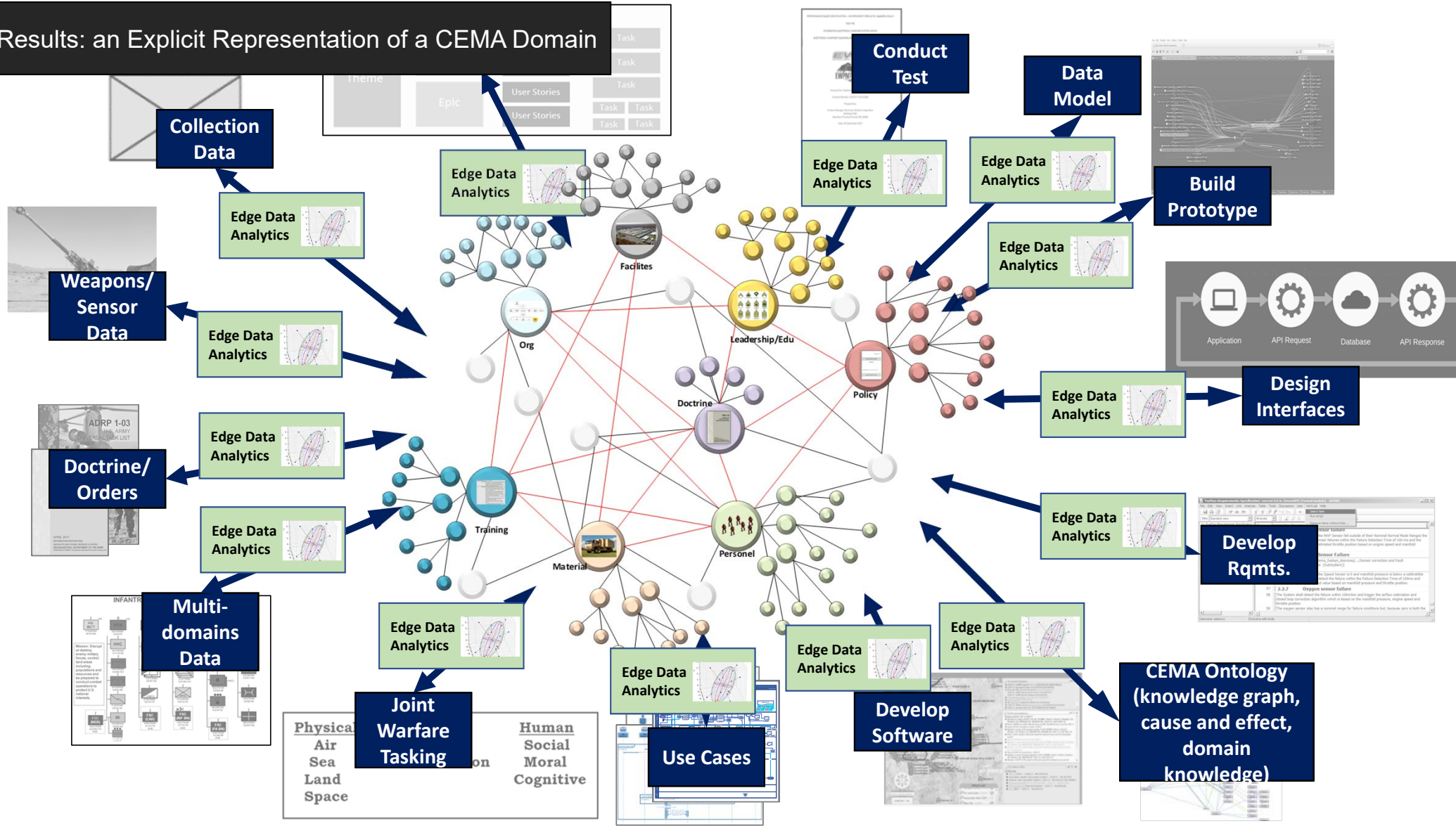
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Summary of DOTMLPF-P in Knowledge Graphs

- The Why-** To combine data with knowledge resulting in understanding. Understanding that allows Non-Experts to Make Expert Decisions.
 - Data + Knowledge = Understanding, Understanding leads to faster and more accurate decision making
- The How-** Through the linking of Data Science to Operational and Doctrinal knowledge.
 - Using Semantic driven modeling, graph data structures and deterministic Mathematics that defines the inter-relationships of how DOTMLPF-P connect.
- The What-** We created Ontologies/Knowledge Graphs that mapped the relationship of data and knowledge to information up and down DOTMLPF-P capabilities development for CEMA Optimization.
 - Creating a dynamic knowledge base of how each layer of DOTMLPF-P connects to every other layer.
- The Results-** create a scientific modeling techniques, that includes advance data query through SPARQL, Deterministic data analytics, Graph based mathematical validation all in World Wide Web Consortium International Standard.
 - Defining an explicate representation of a Domain that is now the creation of a machine and human readable knowledge base that can be used to support supervised learning
 - Decreases expenses through operational cost efficiencies



Results: an Explicit Representation of a CEMA Domain

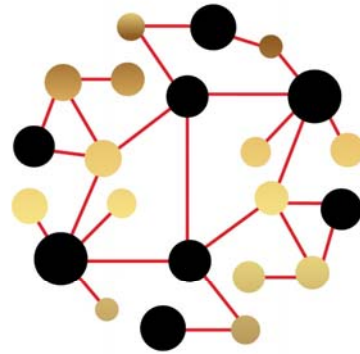


Questions?

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