

Myriad-Keystone

Value-based assessments for complex, adaptive systems



Modeling and simulation of complex systems has traditionally focused on assessing effectiveness through-metrics such as mission product quantity, quality and timeliness. While useful, these metrics tell an incomplete story as they do not inherently reveal true value.

In order to uncover the true value of these metrics, they need to be assessed in the context of their contribution to achieving mission objectives. For example, for a complex intelligence system, the value of these metrics is best determined by their contribution to the ability to successfully detect key activities that are high priority strategic objectives.

To assess the value of the mission products generated by a given system architecture, the modeling and simulation environment must include capabilities for:

- Simulating ground truth scenarios
- Performing observation modeling
- Simulating sensemaking approaches and activity based intelligence methods to enable simulation of tipping and cueing approaches
- Maintaining an evolving belief state of observations and hypotheses over the course of the simulation

A trusted modeling and simulation partner

Perspecta is a trusted mission partner with a more than four decades of experience in the intelligence and defense mission domains. Perspecta's unique blend of systems engineering, technical expertise and mission domain experience, coupled with world-class modeling, simulation and analysis capabilities, has resulted in the development

of the Myriad-Keystone framework for value-based assessments of complex adaptive systems.

Myriad-Keystone's flexible design

Myriad-Keystone is comprised of a platform, a framework and a set of applications. The platform is the foundation upon which the data flows are managed and orchestrated. It is designed with an innovative data and time management approach that enables a highly scalable number of interdependent simulation threads to run in parallel while maintaining synchronization.

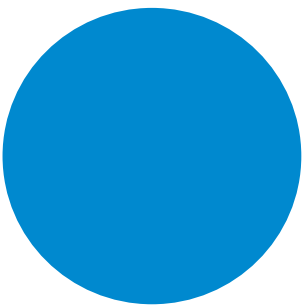
The framework defines a cognitive cycle in terms of modular functions with defined interfaces. These modular functions define what must be done within the cognitive cycle but not the way that it is done. Applications, that represent the alternative ways in which modular functions could be performed, are integrated within the cognitive cycle through standard application programming interfaces (API). Existing models / applications may be adapted for integration via these APIs or new models / applications may be developed, allowing a myriad of possible alternatives to be evaluated for effectiveness comparison.

Scenario builder

Myriad-Keystone's scenario builder enables the creation of customizable use cases. A given use case represents the ground truth or real state of objects engaged in activities. Throughout the simulation, the ground truth scenario executes and progresses independently and segregated from all other simulation threads.

Simulation start up and multi threading

As the simulation begins executing the cognitive cycle, the applications that model the mission system(s) under assessment



begin to execute as independent threads based upon their own input configuration data. Furthermore, each application is able to subscribe to mission relevant data, available within the framework, but constrained by access rules consistent with the real-world mission ecosystem. For example, for a space-based remote sensing system, the applications that represent the different system assets, would be initialized with baseline orbit and payload configurations, and the applications that represent the ground architectures would have an initial set of planning and scheduling data to begin simulating the tasking of each system in parallel.

As the cognitive cycle begins to execute, the parallel simulation threads generate mission data and the observation modeling produces observations.

Observations feed into the sensemaking function which produces outputs representing:

- **Objects** that are believed to exist
- **Activities** in which those objects are believed to be engaged

As the cycle continues to be executed, an evolving belief state is formed based on the maturation of sensemaking output and all the while, the parallel mission system simulation threads are able to subscribe to data that may, as in the case of activity based intelligence systems, interact with the planning and scheduling function to influence the tasking of the systems in a

tipping and cueing manner.

Measuring value

By comparing the belief state to the ground truth, the simulation reveals answers to the questions: what did the enterprise know and when did it know it? The level to which this knowledge would enable detection and response to the ground truth scenario becomes a measure of the true value of that system implementation for a given scenario. The metrics that will define real value will vary for different ground truth scenarios. As such, Myriad-Keystone allows customization of metrics for value-based assessments of alternative architectures and their associated sensemaking and tasking methodologies.

