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Master’s Thesis Proposal

**Topic:** Adaptive Architectures in the Ballistic Missile Defense System (BMDS)

**Research Question:** *In what cases are adaptive architectures beneficial to the BMDS, and how can possible architectures be characterized and utilized?*

**Motivation:** In a System of Systems (SoS), an architecture defines how systems interact, which impacts SoS performance. The ability to adapt between various architectures might allow for an SoS to optimize its performance for a given situation. In the BMDS, the main operating architectures revolves around centralized data fusion, command, and control, while distributed data fusion and decision making could be greatly beneficial if the BMDS were to encounter network outages or varied incoming threats. This research aims to identify possible scenarios in which an alternate architecture would benefit BMDS performance and propose a method to optimize the BMDS architecture as a situation develops.

**Main Tasks:**

1. Characterize the costs and risks associated with switching between architectures
2. Identify when and where adaptive architectures may be beneficial
   1. Intercept capability vs. incoming threats
   2. Control distribution vs. network health
3. Propose and demonstrate a basic method for characterizing architecture switching conditions for optimal system performance given adaptive situations (Possibly use SODA as a surrogate models of the available architectures, updating self-effectiveness as the situation develops and system operability as a predictor);