

Adaptive Architecture in the Ballistic Missile Defense System of Systems

1 Introduction

In a System of Systems (SoS), an architecture defines how systems interact through non-physical communication [1], 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 Ballistic Missile Defense System (BMDS), system interaction is handled by Command and Control, Battle Management, and Communications (C2BMC) [2]. Under Maier's architecting principles, C2BMC would classify the BMDS as a directed architecture, in which individual systems are able to operate independently, but are centrally controlled by a master decision maker [1]. However, if the BMDS were to experience network outages or be the target of cyber warfare, a decentralized collaborative architecture may prove advantageous in reaction to the new operating environment. 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.

2 Background

Adaptability of an SoS has largely been focused on the evolution of an SoS over time.

3 Objectives

1. Characterize the costs and risks associated with switching between architectures
2. Identify when and where adaptive architectures in the BMDS may be useful
3. Create a notional test scenario and train a SODA model to act as a surrogate predictor of system performance under different architectures
4. Identify performance thresholds in which alternative architectures are more advantageous
5. Demonstrate improved BMDS performance

4 Work Plan

References Cited

- [1] M. W. Maier, “Architecting Principles for Systems-of-Systems,” *INCOSE International Symposium*, vol. 6, no. 1, pp. 565–573, 1996.
- [2] “Command and control, battle management, and communications (c2bmc).”