

An Emulation Facility for Networking and Distributed Application Development

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Air Force MOIE

The logo for the MITRE Technology Program, featuring a stylized graphic of stacked, colorful blocks (yellow, orange, and blue) to the left of the text. The text "MITRE Technology Program" is written in a bold, sans-serif font, with "MITRE" in yellow, "Technology" in orange, and "Program" in blue.

MITRE
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Problem

- **Applications developed for commercial networks typically do not work well in the DoD environment (limited bandwidth, variable latency, high packet loss rate).**
- **Network protocol performance needs to be evaluated on a link-by-link basis for TCS, FCS & MC2C initiatives.**
 - **Communication system interoperability and robustness are keys to facilitate network centric warfare.**

Background

- **Existing applications must be evaluated in DoD networks under development.**
 - Network Emulator ensures consistent end-to-end application performance and facilitates a smooth transition path.
- **Network protocols/applications must be developed in the absence of the underlying communication systems.**
 - Both real and emulated system components can be integrated in the Network Emulator environment.
 - As the real components become available, they can replace their emulated counterparts.
- **Simultaneous execution of TCS, FCS, and MC2C initiatives requires parallel development of space, airborne and ground networks.**
 - Network Emulator allows flexibility in network development.

Objective

- **Mission Statement:**

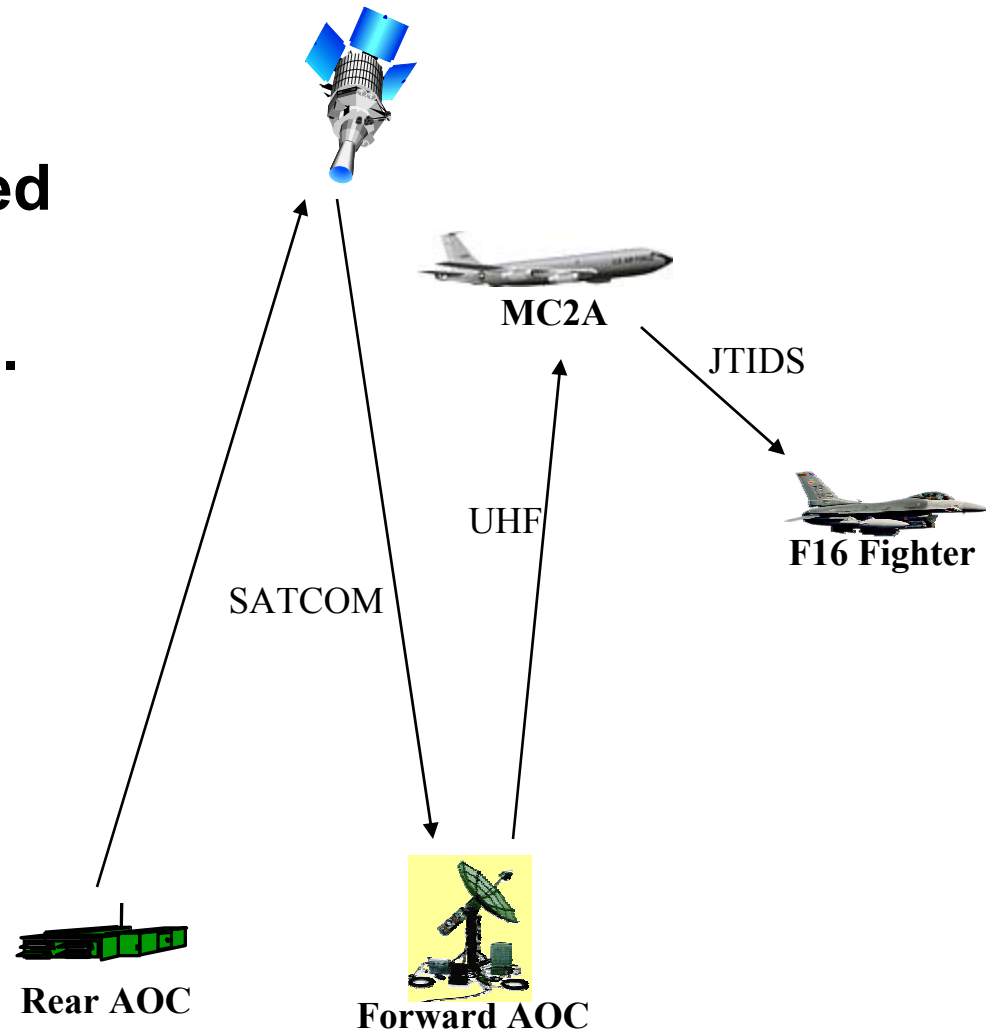
- **“Develop network emulation technology to facilitate application and protocol development”**

Activities

- **Define the system architectural building blocks for the emulator**
 - **Ensure flexibility and scalability**
 - **Identify technical requirements**
 - **Determine what emulator software components are needed**
- **Develop a modeling and analysis framework**
 - **Used in describing background network traffic, data-link and network protocols, and analyzing their impacts on perceived latency, throughput, and reliability for user traffic**
- **Build an HLA interface to utilize federated data from other simulations or human-in-the-loop facilities**
 - **Set up the Run Time Infrastructure (RTI) to ensure simulations can share entity data with Network Emulator**
- **Software implementation of emulator components**
 - **Develop system design diagrams to ensure feasibility and integrity of the architecture**
 - **Coding/software development; testing/debugging**

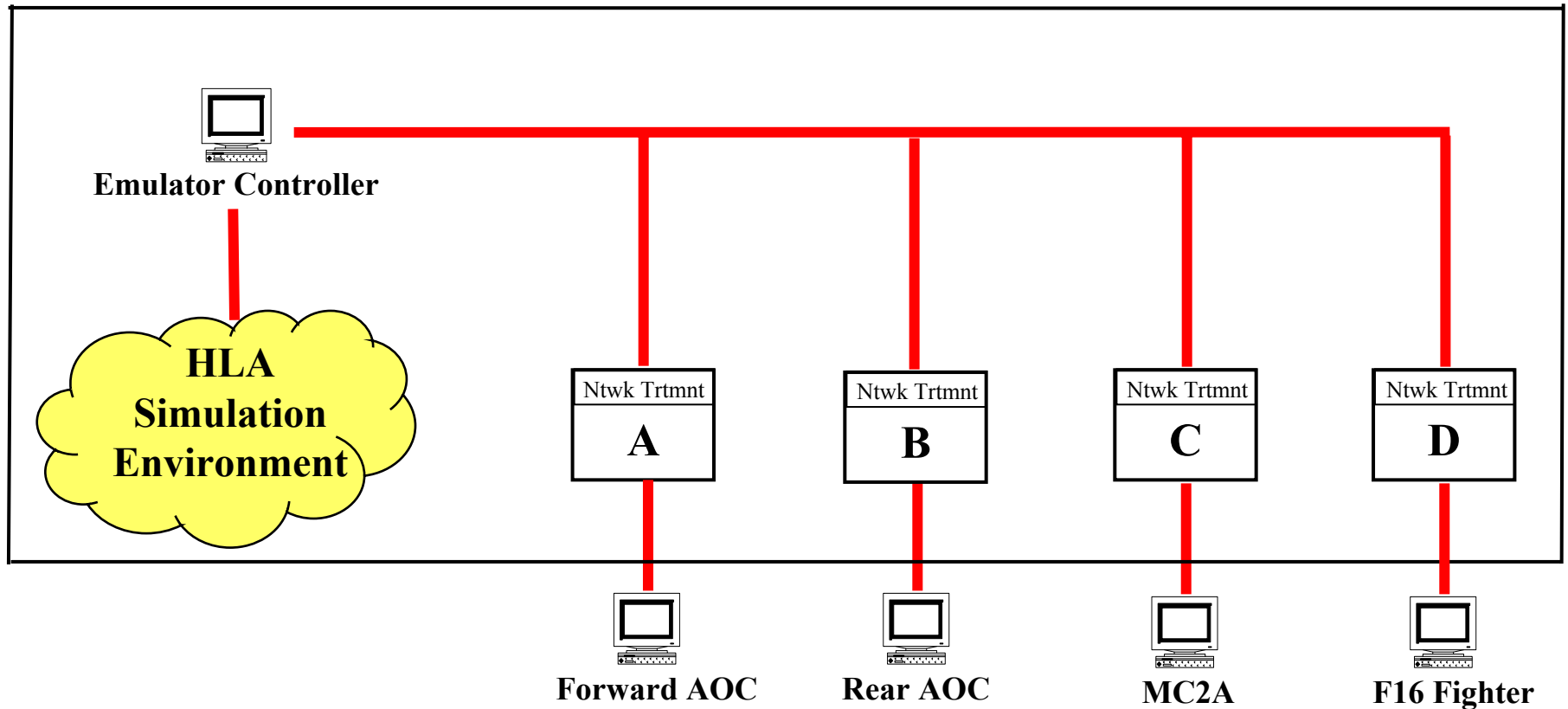
Highlight

- Communication link characteristics are modeled in terms of throughput, delay and packet loss rate.
- Each radio system is individually modeled to reflect real-world system performance.
- Network Emulator uses external simulations to model the physical movement and state of each entity.



Highlight

Network Emulator Boundary



Impacts

- **Engage application developers to design for constrained network resources proactively rather than reactively**
 - Foster development of network-aware applications which operate on the base *and* in the field
 - Facilitate a smooth transition path for existing applications to emerging networks
- **Engage network protocol developers to begin the development of protocols without having to wait for future communication systems (radios, antennas, etc.) to be developed**
- **Enable network planners to execute “what-if” scenarios to economically and quickly determine where network investments should be made**

Future Plans

- **Refine communication link characteristic models**
- **Improve emulation speed to accommodate gigabit laser communication links**
- **Enhance system robustness for protocol analysis**
- **Integrate human-in-the-loop facility to the Network Emulator**