

Network Aware ISR Nodes

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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.

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Problem

UAV platforms equipped with sensor payloads play a critical role in gathering intelligence and engaging the enemy. These ISR resources need to function as network-capable edge nodes; however, recent communications initiatives continue to identify them as being connected via dedicated point-to-point links. These sensor systems do not have IP-based network interfaces, and cannot dynamically adapt their outputs to changes in network state.

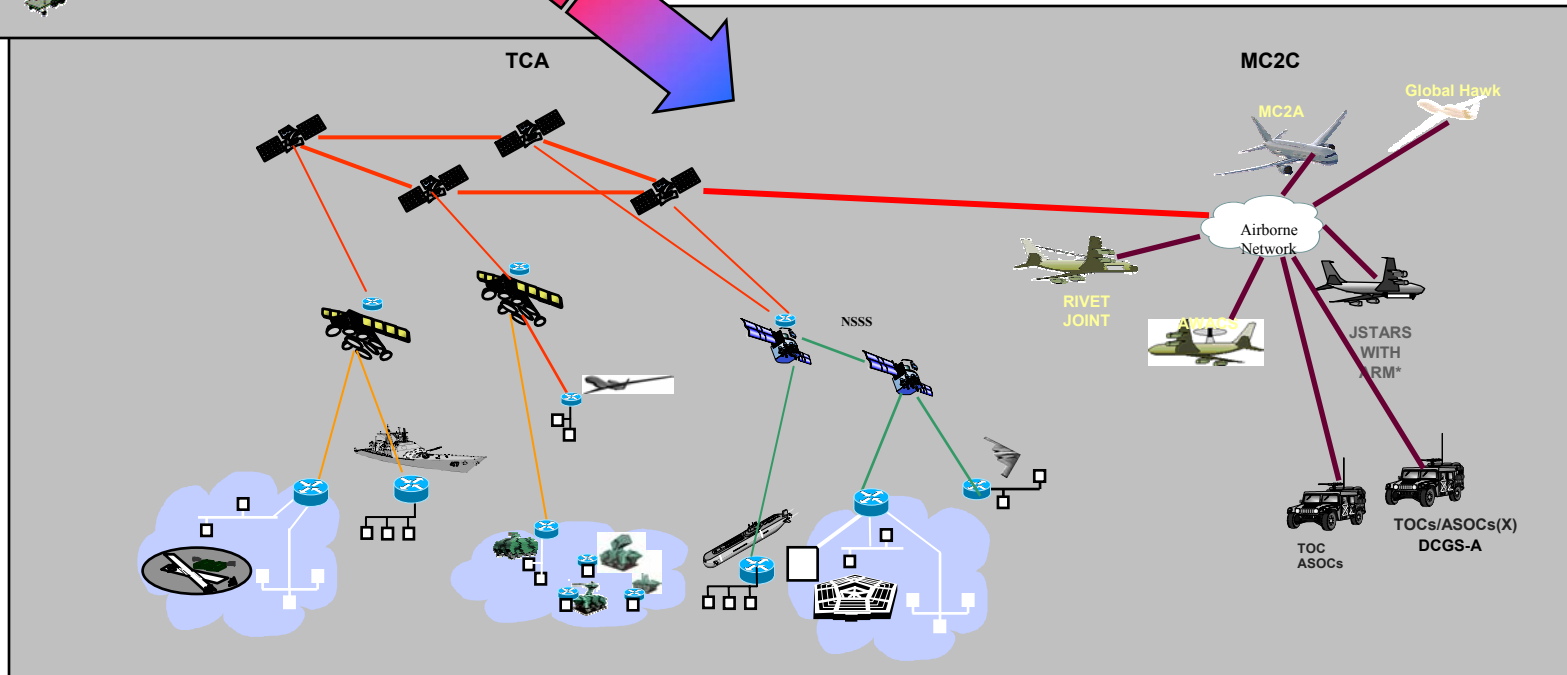
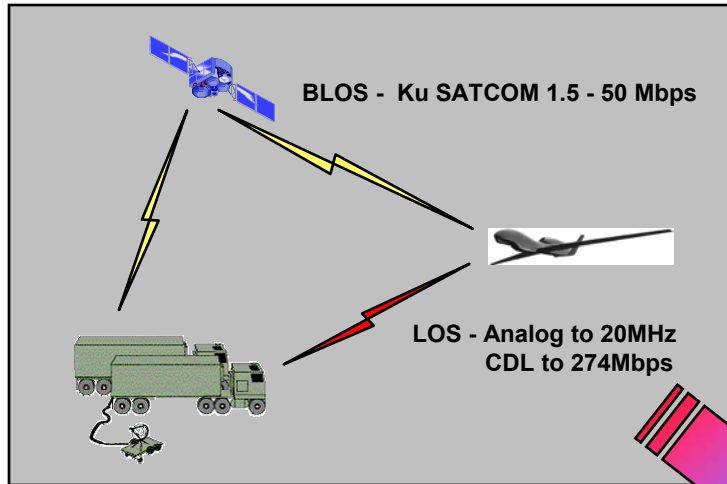
Background

TODAY'S ISR COMMUNICATIONS

- Pre-planned Circuits
- Pre-planned Services
- Centralized Processing, Exploitation, and Dissemination

NETWORK-CENTRIC ISR

- Networks follow the Internet Model
- Dynamic Topology and Resource Allocation
- Efficient Bandwidth Utilization - Packet (IP) Based
- Flexible, Extensible



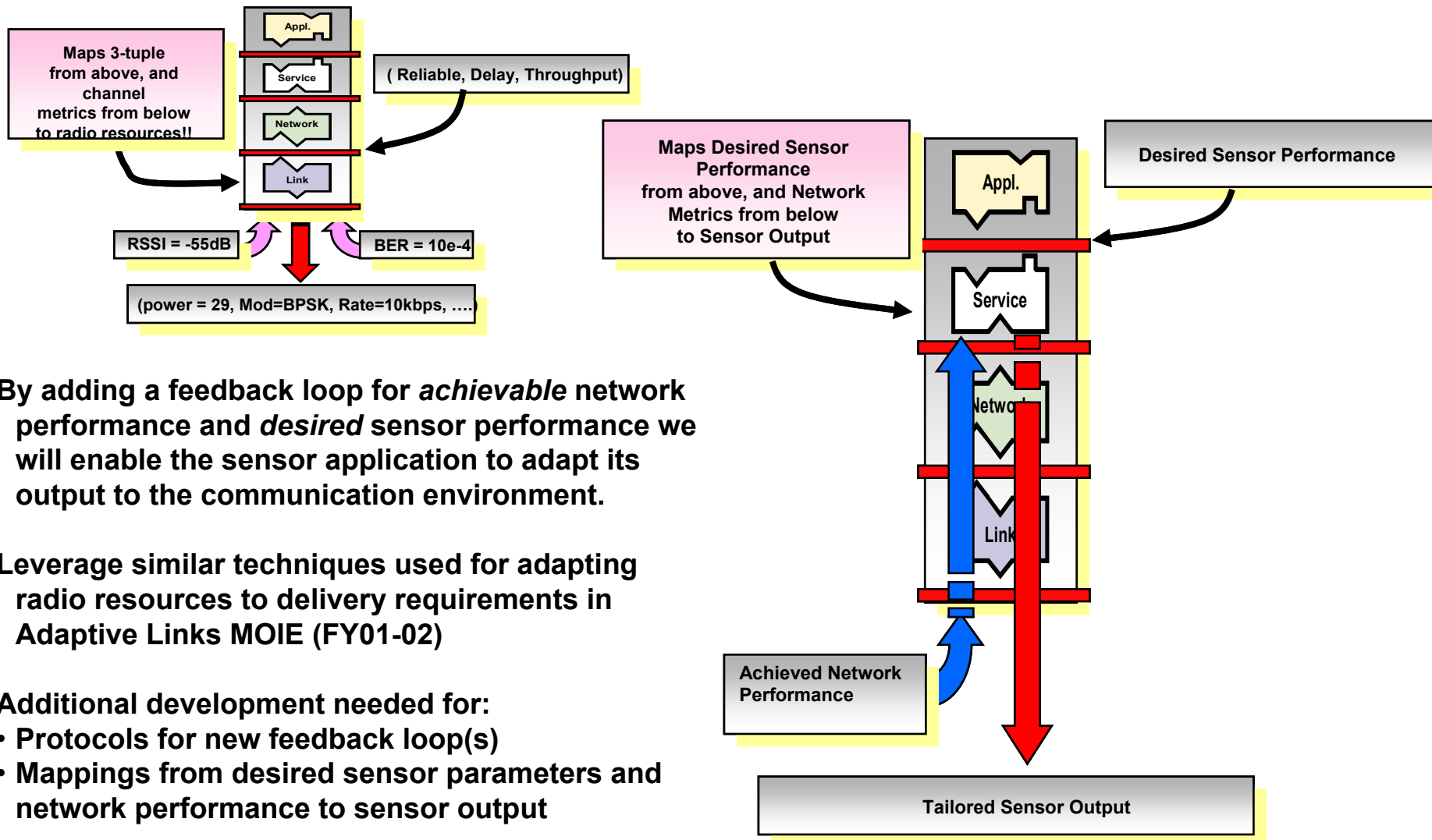
Objective

- **The objective of this project is to demonstrate the feasibility of, and the benefits derived from, developing a class of network-aware sensor services that are capable of interfacing with, and adapting to, any link-layer network that supports IP transport, including tactical networks and networks employing adaptive links.**

Activities

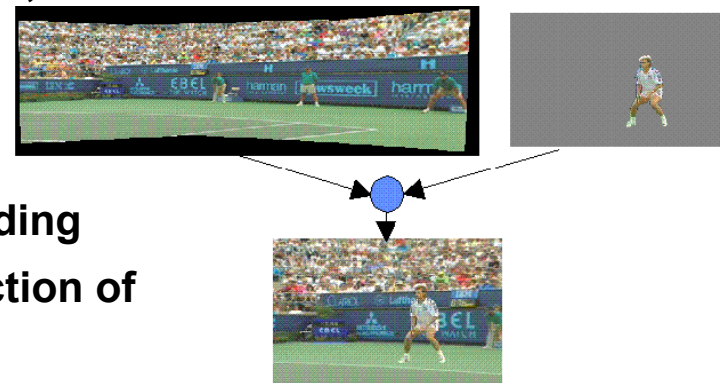
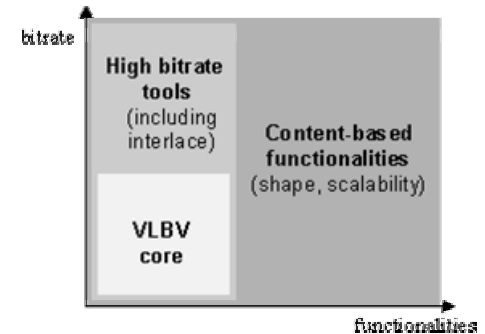
- **Establish network interface(s) for the ISR platform**
 - Establish prototype network interfaces on a Linux router
 - Leverage Adaptive Link Interface (FY01/02 MOIE)
- **Procure suitable sensor application**
 - Evaluate and acquire MPEG-4 CODECs and camera
- **Develop a methodology for network characterization**
 - Analyze existing network protocol suitability
 - Develop a common expression of, and interface specification for, network status
- **Develop network-to-sensor control code**
 - Include sensor application-specific control loop
 - Identify external influences on sensor reactions to network conditions

Highlight



Highlight

- Streaming video is a good candidate for adaptation
 - Frame rate
 - Frame size
 - Encoding method, picture quality
- We hope to leverage commercial MPEG-4 CODECs designed for mobile and wireless environment
 - Scalable (1s of Kbps to 100s of Mbps)
 - complexity, spatial, temporal, quality
 - Interactive
 - Designed to use heterogeneous networks between interactive peers: IP, ATM, mobile, PSTN, narrowband ISDN
 - User commands with acknowledgment messages
 - Advanced features such as content-based coding
 - Allows separate decoding and reconstruction of video objects
 - Could be used in conjunction with ATR to send only video of interest to users



Impacts

- **This MOIE will impact the ability of future ISR platforms to scale and evolve to operate effectively with new communications and operational architectures.**
- **We have a unique window of opportunity with transformation occurring in both the airborne (MC2C/MC2A) and space-based (TCA) communications environments.**
- **We will provide an important proof of concept that can be used to demonstrate the utility of network interfaces and network-aware capabilities on next-generation ISR platforms.**
- **We will provide a basis for solid specifications that can be used in the acquisition of these capabilities.**

Future Plans

- **Expand ability of network characterization tools to deal with general case architectures. Look at full range of multi-hop, multi-port, multi-cast problems.**
- **Work with ISR community to develop methodology for determining appropriate sensor adaptation response under various network conditions. We need more than Least Common Denominator adaptation.**
- **Work with ISR community to develop middleware for adaptation of additional sensor types. Video is “easy” compared to some other sensor types.**
- **Work with ISR community to incorporate these design principles into the acquisition cycle**