Simulating LISP-Based Multilink Communications in Aeronautical Networks

Chiara Caiazza, Antonio Virdis, Giovanni Stea

University of Pisa
Outline

• Overview of aeronautical communications
• Handover and Multilink
• LISP protocol
• Performance evaluation
• Conclusions
Aeronautical communications

• Future Communication Infrastructure (FCI)

- Aircraft Mobile network
- LDACS Network
- Satcom network
- Core network
- Ground end system
• How do we select the link?
• How do we enforce this selection from a communication standpoint?
Locator/Identifier Separation Protocol (LISP)
Registration: EID to RLOC

<table>
<thead>
<tr>
<th>EID</th>
<th>RLOC</th>
<th>Prio</th>
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</thead>
<tbody>
<tr>
<td>X</td>
<td>Y</td>
<td>11</td>
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</tbody>
</table>

Aircraft Mobile network

Satcom network

LDACS Network

Core network

Mapping Server

Ground end system
Map Request

- EID: Aircraft Mobile network
- LDACS Network
- Satcom network
- Core network
- Mapping Server
- EID Request EID X

Table:

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Ground end system

Mapping EID X -> RLOC Y
Data Transmission

Core network

LDACS Network

Satcom network

Aircraft Mobile network

Mapping Server

EID X

EID

RLOC

Prio

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Ground end system
Motivation

• Studying Aeronautical communications in a Multilink environment

• Evaluating the impact of communication protocols in terms of:
  • System overhead (number of additional messages)
  • System load (computation at critical nodes, storage capacity)

• Extensible to:
  • Multiple DataLinks
  • Multiple Applications and Communication Services
SAPIENT Simulator: Modeling the Communication Network

Terrestrial DL Service Provider
Satellite DL Service Provider
Airborne Application
Multi-link Connection Manager
ATN/IPS (SWIM based)
Core Network Domain
Application Domain
RPAS pilot (e.g. C2)
Ground Application (e.g. ATN)
ATM/AOC
A/C Domain
DL Domain
SAPIENT Simulator

A/C

SATCOM Network

Core Network

Ground Node

Terrestrial Network
Example: Terrestrial DL (LDACCS)
Core network

LDACS network

Ground end system
Simulation Scenario
System Load: stored entries

![Bar chart showing system load with different modes: Indirect mode, Direct mode, Direct mode with push messages. The x-axis represents AC values (10, 30, 50), and the y-axis shows the number of entries.]
System Load: # of messages

Aircraft Mobile network

Satcom network

LDACS Network

Mapping Server

Core network

Ground end system
System Load: # of messages (2)

Number of LISP MapRequest

- Indirect mode
- Direct Mode

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Conclusions and Future Work

• SAPIENT + LISP: system-level simulator for FCI and Multilink
• Arbitrarily increase the complexity of domains, keeping the same Router Architecture
• Evaluation of the system LOAD

• Move everything to IPv6
• Testing using realistic traffic models and mobility patterns