L-band Digital Aeronautical Communications System (LDACS)

draft-ietf-raw-ldacs-11

Nils Mäurer, Thomas Gräupl, Corinna Schmitt

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N. Mäurer, Ed.
T. Gräupl, Ed.
German Aerospace Center (DLR)
C. Schmitt, Ed.
Research Institute CODE, UniBwM

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Abstract

This document gives an overview of the architecture of the L-band Digital Aeronautical Communications System (LDACS), which provides a secure, scalable and spectrum efficient terrestrial data link for civil aviation. LDACS is a scheduled, reliable multi-application cellular broadband system with support for IPv6. It is part of a larger shift of flight guidance communication moving to IP-based communication. High reliability and availability of IP connectivity over LDACS, as well as security, are therefore essential. The intent of this document is to introduce LDACS to the IETF community, raise awareness on related activities inside and outside of the IETF, and to seek expertise in shaping the shift of aeronautics to IP.

draft-ietf-raw-10 (IETF 113)

Changes

draft-ietf-raw-11 (IETF 114)

Overall changes

- Adressed feedback from IESG
  - Gen-ART:
    - How is LDACS interacting with IPv6?
    - Please provide more details on frame structure and protocol.
  - INT:
    - Please provide more information how IPv6 over LDACS is handled.
    - Please provide more information on handover and FCI multilink interactions.
  - RTG:
    - What is the purpose of the draft and can it pass consensus bar set by RFC 8789?
    - Is it intended that LDACS is standardized within IETF?
  - SEC:
    - How are IPv6 and LDACS security considerations intertwined?
- Overall issue in aeronautical communications:
  - Many standards behind paywall

Addressing main issues

1. LDACS is an aeronautical datalink (layer two) that is standardized at the International Civil Aviation Organization (ICAO).
   The intent of this draft is to introduce that IP supporting datalink to the IETF community.

2. LDACS is intended to be exchanging Aeronautical Traffic Network (ATN)/Internet Protocol Suite (IPS) data between aircraft and ground.
   This means that air traffic management shall be done via IPv6 in the future.

Addressing main issues (con’t)

3. LDACS defines 1536 B user-data packets, in which IPv6 (via UDP) traffic is encapsulated.

4. LDACS handovers between ground stations are seamless and transparent to the IP layer. This has been demonstrated during flight trials in July 2022.

5. LDACS is part of the Future Communications Infrastructure (FCI). The term refers to a family of different layer two technologies such as other terrestrial or satellite datalinks. Its purpose is to deliver aeronautical traffic safely and timely to the aircraft by situationally switching between datalinks.

Addressing main issues (con’t)

6. LDACS offers integrity and authenticity protection of its user- and control data. Rate-limiting, adapted to the capacity of the current connection, is performed prior to user data actually reaching the LDACS radios. Certain traffic is filtered out by the Access Router (AC-R).

7. We can provide any aeronautical standard behind paywalls for internal review only.

Abstract and Chapter 1 – Introduction

- Clarified purpose of LDACS at IETF:

1. Raise awareness for aeronautical communications going digital and via IP(v6)
2. Raise awareness for new datalinks (layer two technologies) transporting IP traffic

Chapter 2 – Acronyms

- Renamed chapter „Terminology“ → „Acronyms“
- Streamlined acronyms

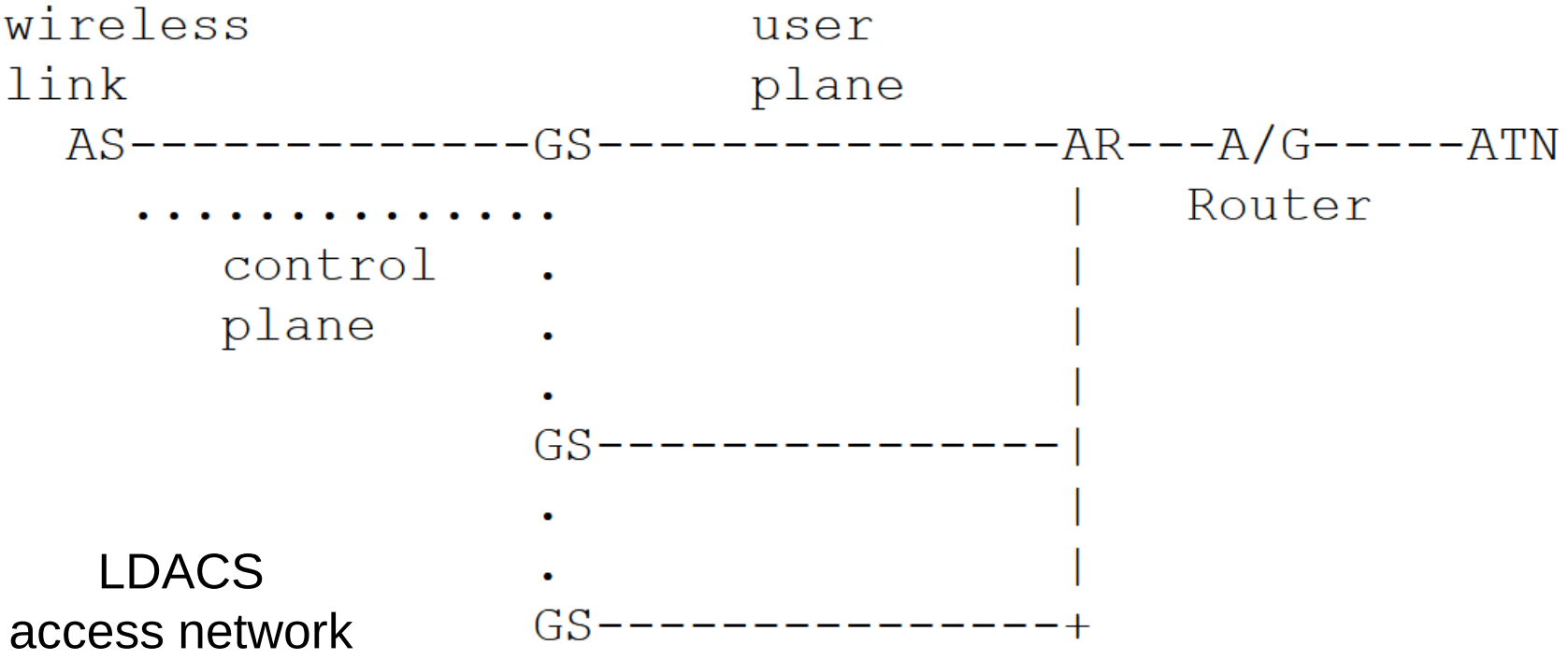
Chapter 4 – Provenance and Documents

- Pointed out sources to IPv6 over LDACS (where applicable) and to the FCI and its datalinks

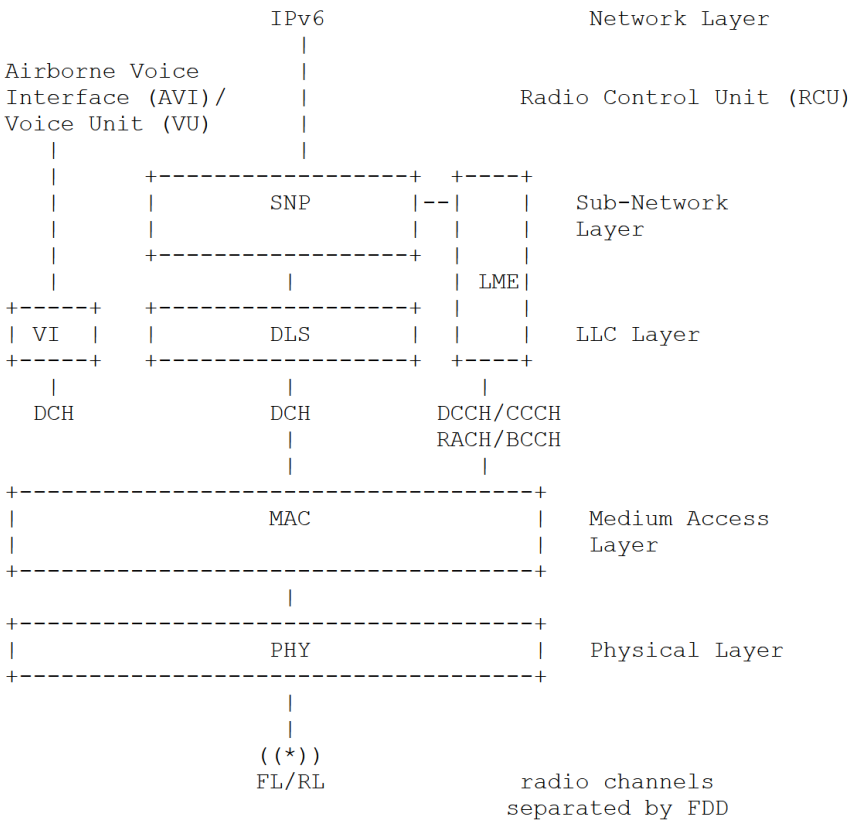
Chapter 5 – Applicability

- Within LDACS access network, local mobility solution will be PMIPv6
- Within FCI, global mobility solution will be implemented on top of LISP
- LDACS Alternative Positioning Navigation and Timing (APNT):
  - Performed via (1) receiving multiple ground stations signals and via (2) knowing the exact positions of these and (3) having a good channel estimation
  - Measuring signal propagation times from and to each GS
  - 171m accuracy demonstrated with 4 GS at flight trials 2019

Chapter 7 – Characteristics



Chapter 7 – Characteristics



LDACS protocol stack

- BCCH/CCCH control channels ground→aircraft
- RACH/DCCH control channels aircraft→ground
- DCH bidirectional (user) data channel

Chapter 8 – Reliability and Availability

- Priorities managed via DiffServ classes
  - CS01 – lowest priority
  - CS07 – highest priority
- Multiple LDACS ground stations visible to aircraft at same time

Chapter 9 – Security

- LDACS security requirements in a nutshell:

[Provide] „a secure channel between the airborne radio systems and the peer radio access endpoints on the ground [...] to ensure authentication and integrity of air-ground message exchanges“ [ARINC 858, 2021]

- LDACS control message protection helps ensuring e.g., IPv6 Neighbor Discovery Protocol (NDP) works as intended

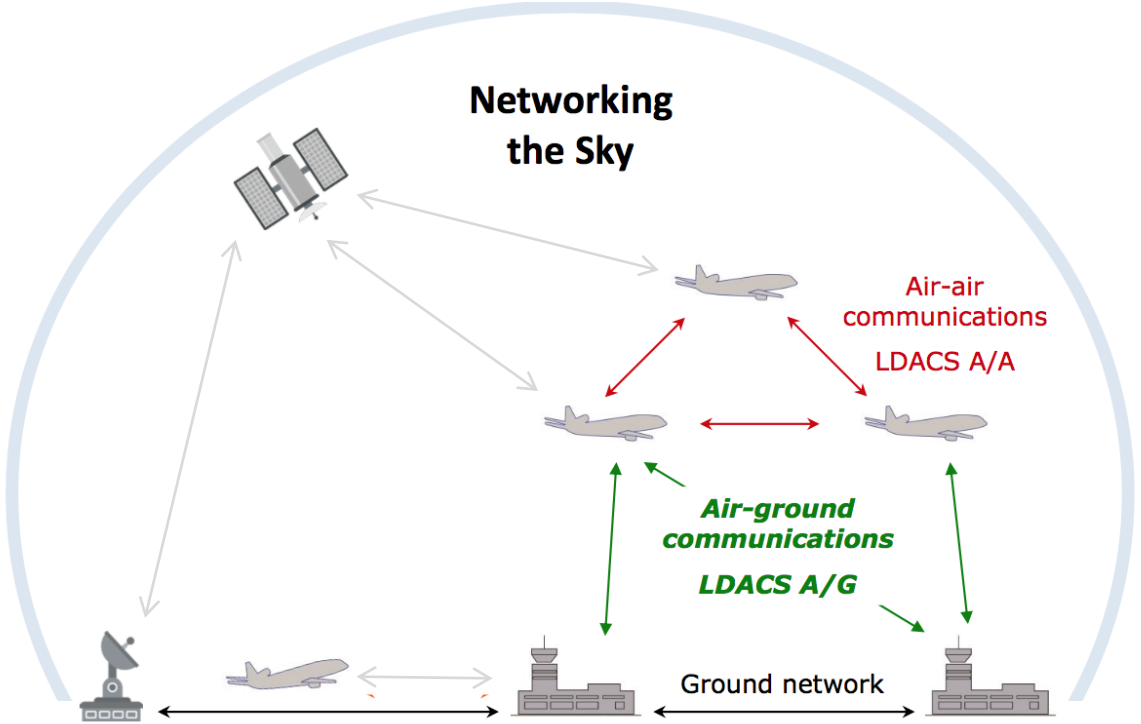
Next Steps

- `draft-ietf-raw-ldacs11`
  - Addressed feedback by IESG

- We can provide necessary aeronautical standards for necessary review of draft version 11!

→ What are next steps now?

Thanks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Ground network