L-band Digital Aeronautical Communications System (LDACS)

draft-ietf-raw-ldacs-07

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Abstract

This document provides 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. LDACS SHALL provide a data link for IP network-based aircraft guidance. High reliability and availability for IP connectivity over LDACS are therefore essential.

draft-ietf-raw-05 (IETF 109)

Table of Contents

Changes

draft-ietf-raw-07 (IETF 110)

Chapter 10 – Security Considerations (1)

- Problem: Changing Threat-Landscape

- Historically Communication Navigation Surveillance (CNS) wireless technology emerged from military
- PHY layer security feasible for military due to financial and spectrum abundance
- But: Civil applications have significantly lower spectrum
- Today: Software Defined Radios and aeronautical open source software make CNS technologies relatively easily accessible

- Consequences:
  - Future digital aeronautical wireless communications require security features
  - Security features require sufficient bandwidth
  - Most important due to progress of digitalization

→ Strong cybersecurity measures are a **MUST** for LDACS ←

Chapter 10 – Security Considerations (2)

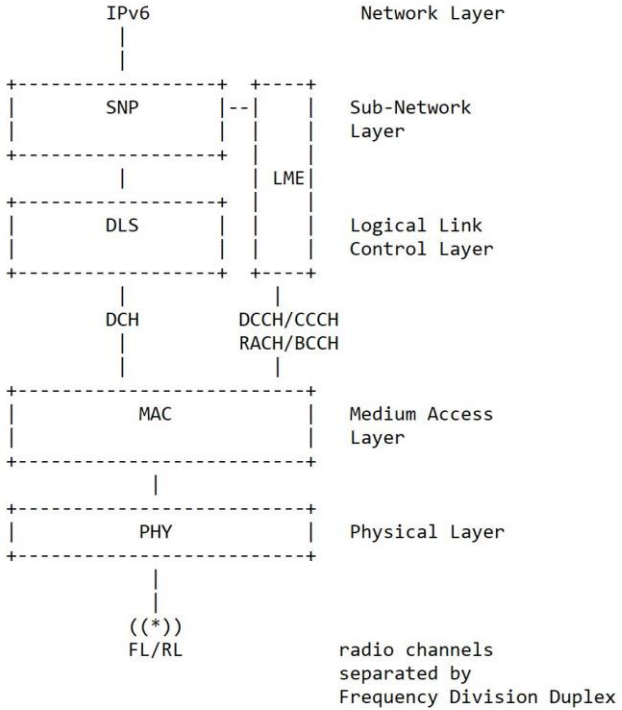
- LDACS's Security:
  - **SHALL** protect availability & continuity
  - **SHALL** protect the integrity of messages in transit
  - **SHALL** provide authenticity of messages in transit
  - **SHOULD** provide confidentiality of messages in transit
  - **SHOULD** provide non-repudiation for necessary messages in transit
  - **SHALL** provide mutual authentication
  - **SHALL** authorize the permitted actions of users & deny actions else
  - **SHALL** provide capability preventing the propagation of intrusions within LDACS domains & towards external domains

Chapter 10 – Security Considerations (3)

Scope of Security

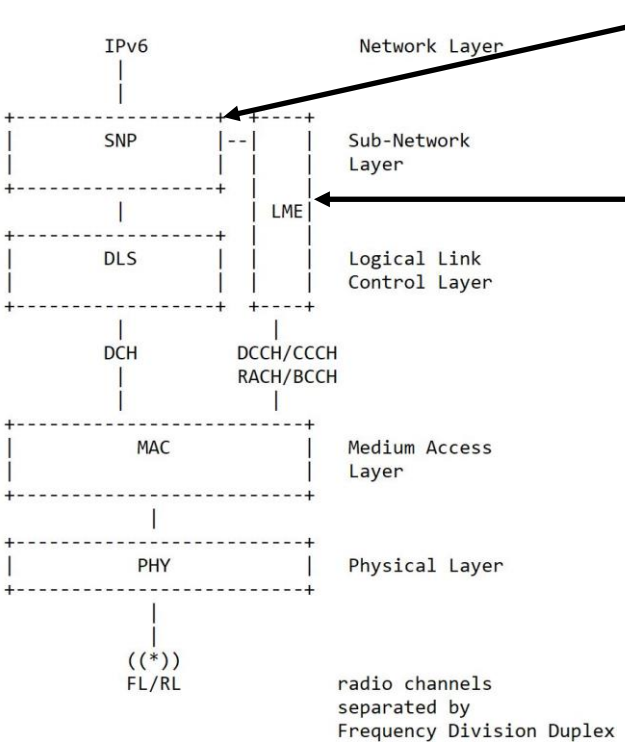
- LDACS security located on the Link Layer
- LDACS security secures connection between Aircraft Station (AS) and Ground Station (GS)

LDACS Protocol Stack



Chapter 10 – Security Considerations (4)

Security Functionality in Protocol Stack



- Handles User Plane Security (DCH) (Confidentiality + Integrity Protection)
- Manages Certificates
- Handles Mutual Authentication and Key Agreement
  - Entity Authentication
  - Key Negotiation
  - Key Derivation
  - Key Management
- Security Logging
- Control Channel (BCCH/CCCH/DCCH) Protection

Chapter 10 – Security Considerations (5)

Trust

- All entities in an LDACS network must authenticate to each other
- LDACS will follow AeroMACS lead and also use an FCI specific PKI [RFC5280]
- LDACS will use X.509 certificates for each end-entity

Mutual Authentication and Key Agreement

Prerequisites: Unique identities at AS/GS and digital certificates pre-deployed during maintenance at the respective end-entities

1. Identity-based Station-to-Station (STS) protocol
2. Identity-based SIGn and Mac (SIGMA) protocol

Chapter 10 – Security Considerations (6)

DHKE Choice

- Considered ephemeral DHKE with 3072bit keys
- Elliptic Curve DHKE with 256bit keys
- Supersingular Isogeny DHKE with 2640bit keys

→ Current choice: ECDH with 256bit keys

Key Derivation

- KDF: Hash-based Message Authentication Code (HMAC) (KDF) – HKDF [RFC5869]

Chapter 10 – Security Considerations (7)

User Data Security

- AES-128-GCM, AES-256-GCM [RFC5288] for confidentiality/integrity protection
- HMAC-SHA3-128 for integrity protection only
- Key $K_{AS,GS}$ agreed upon via STS/SIGMA and derived via HKDF

Control Data Security

- Challenges:
  - Control channels of LDACS very small
  - Control channels must be accessible and verifiable by all members in an LDACS cell

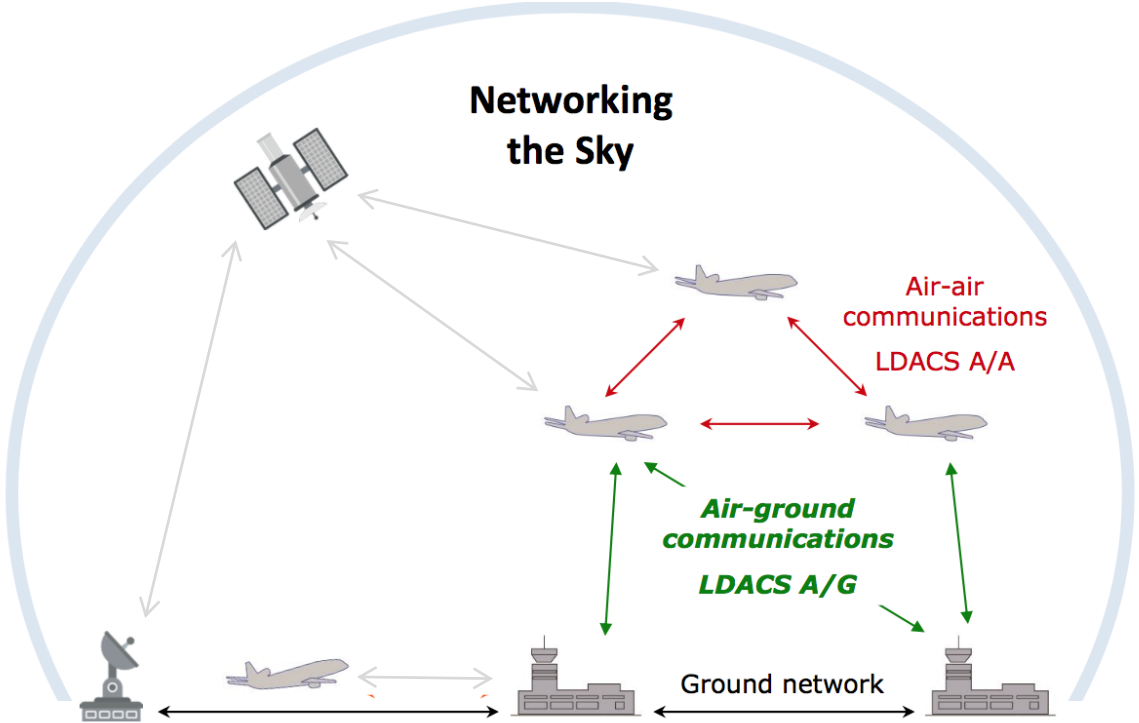
→ Solution: LDACS Cell Group Keys via One-Way Function Trees (OFT)

→ Time-bound Signature in BCCH

→ CRC+MAC in CCCH

→ Encryption+CRC+MAC in DCCH

Thanks


Networking
the Sky
Air-air
communications
LDACS A/A
Air-ground
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LDACS A/G
Ground network