L-band Digital Aeronautical Communications System (LDACS)

draft-ietf-raw-ldacs-09

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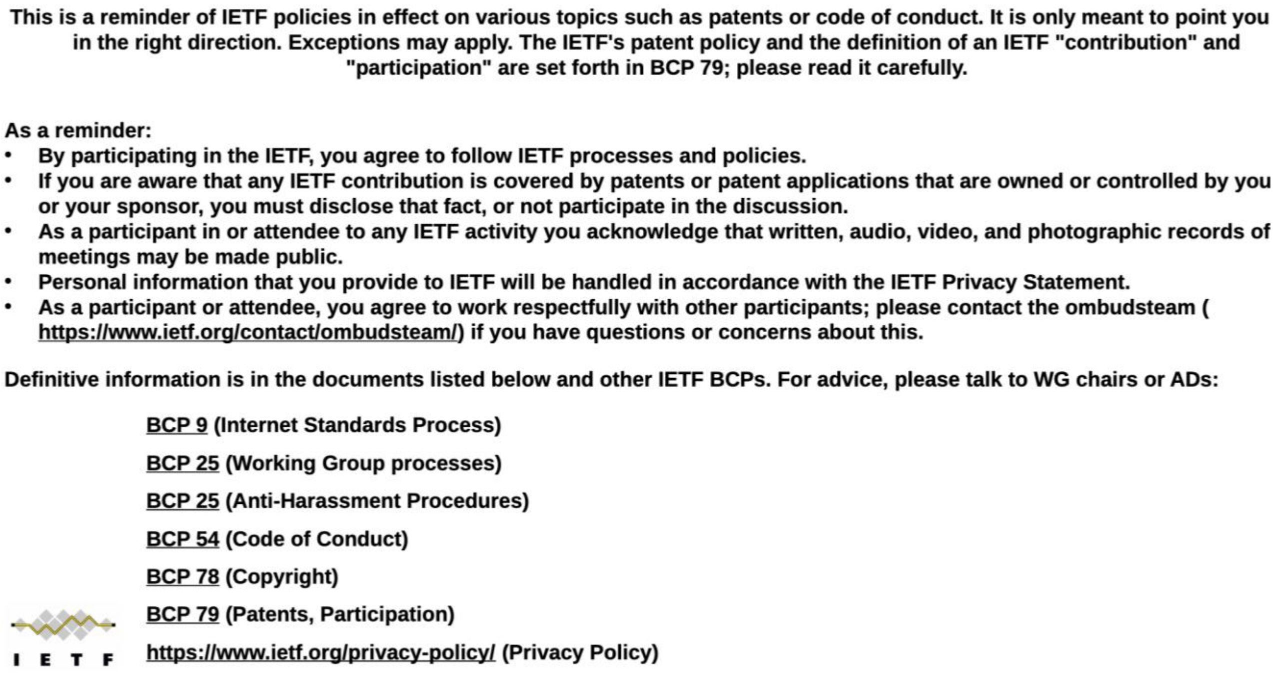

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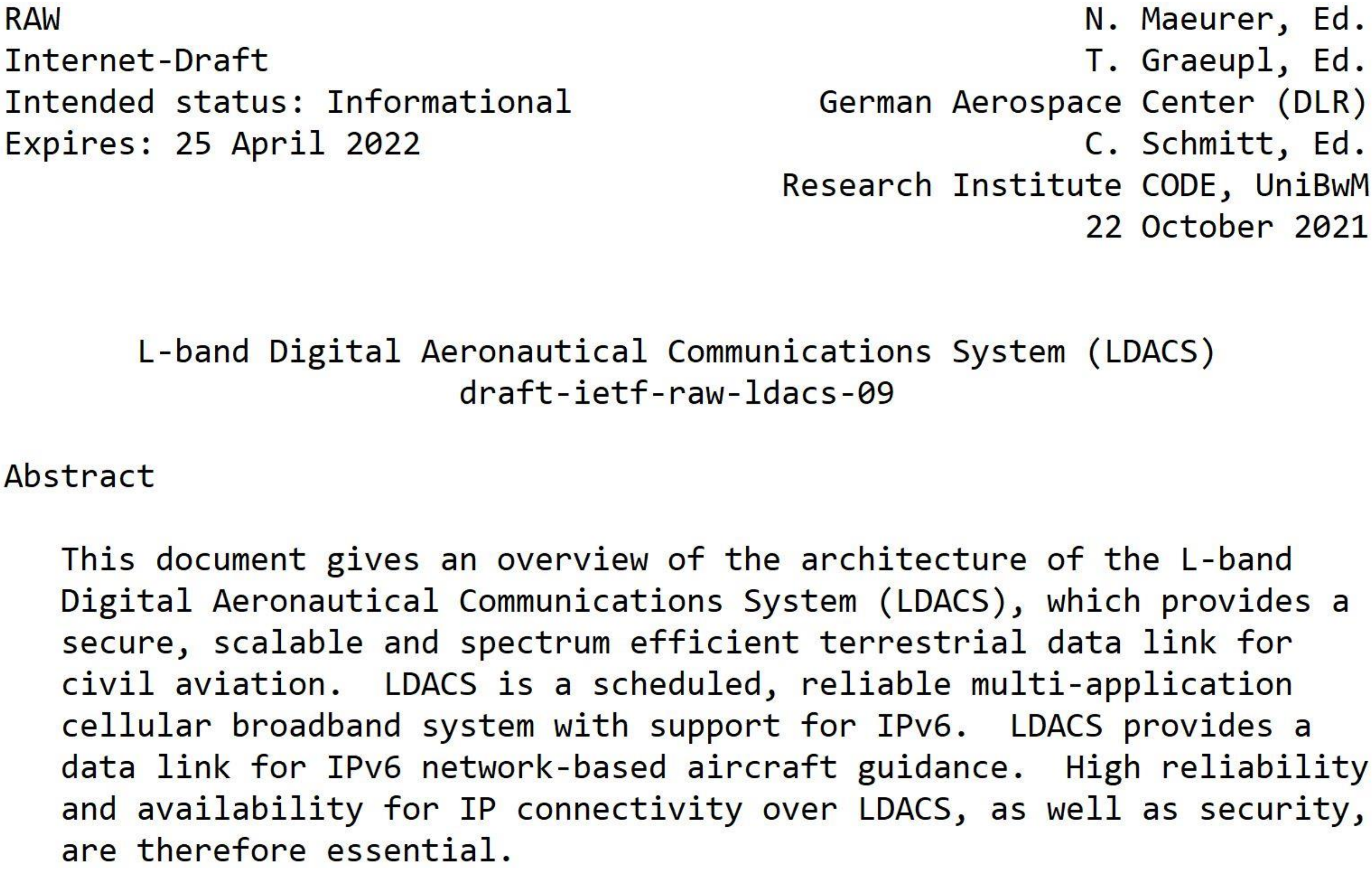

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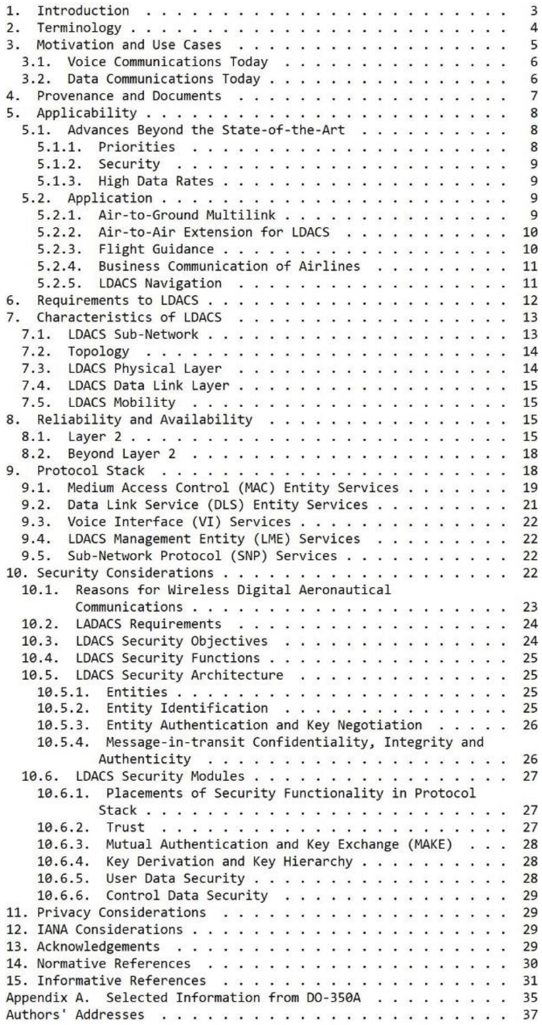
L-band Digital Aeronautical Communications System (LDACS)

draft-ietf-raw-ldacs-09

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. LDACS provides a data link for IPv6 network-based aircraft guidance. High reliability and availability for IP connectivity over LDACS, as well as security, are therefore essential.

draft-ietf-raw-08 (IETF 111)



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Changes

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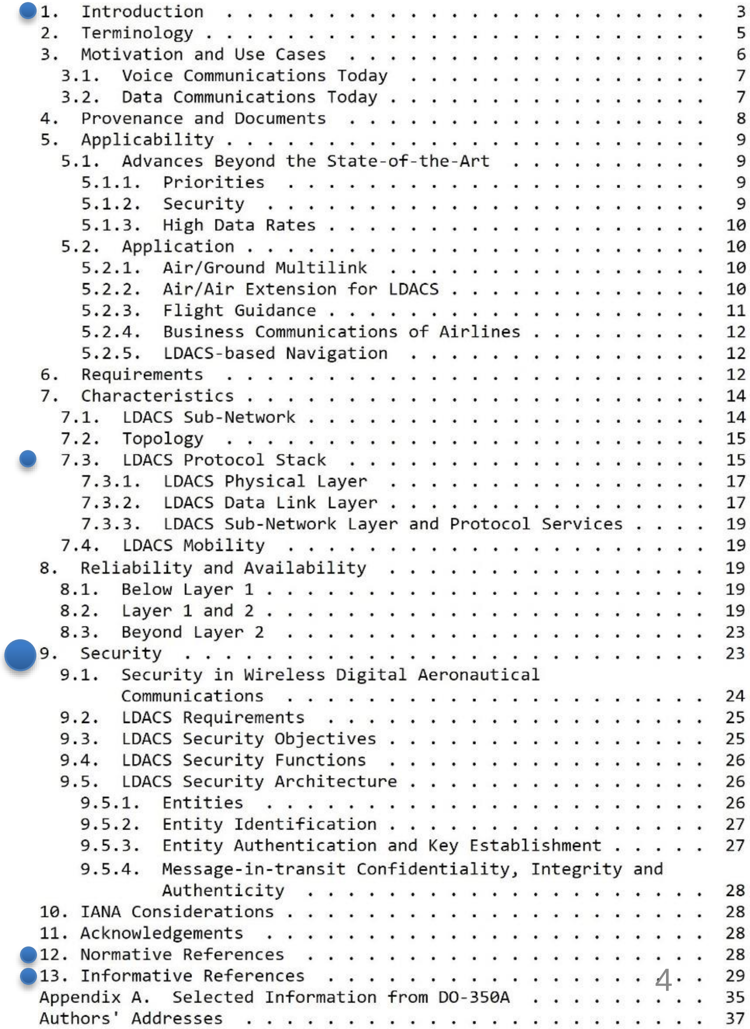

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Overall changes

- Adressed entire feedback from the Routing Directorate
- Clarified normative and informative references
- Streamlined work
- (Re-)Moved chapters to better fitting location in text
- Reworked LDACS security section
- Added post-quantum security to LDACS security

Chapter 1 – Introductions

- Transition from analogue to digital in aeronautical communications
  - Analogue to digital datalinks
  - Introduction of IPv6 based networking protocols

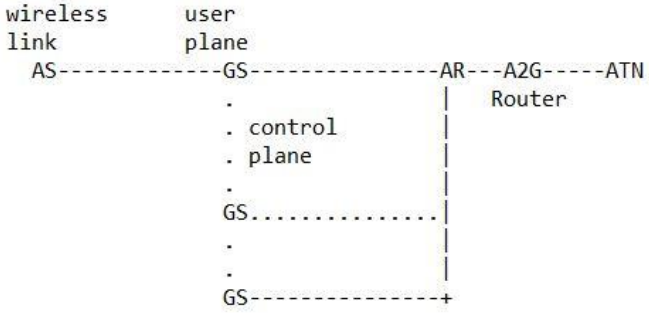
- Regulatory documents:
  - ICAO 9896 v03
  - RTCA DO-379
  - ARINC P-858
  - EUROCAE ED-262

- LDACS regarded as „access network“ in larger Aeronautical Telecommunications Network (ATN)/Internet Protocol Suite(IPS) framework

- Initial LDACS rollout in Europe

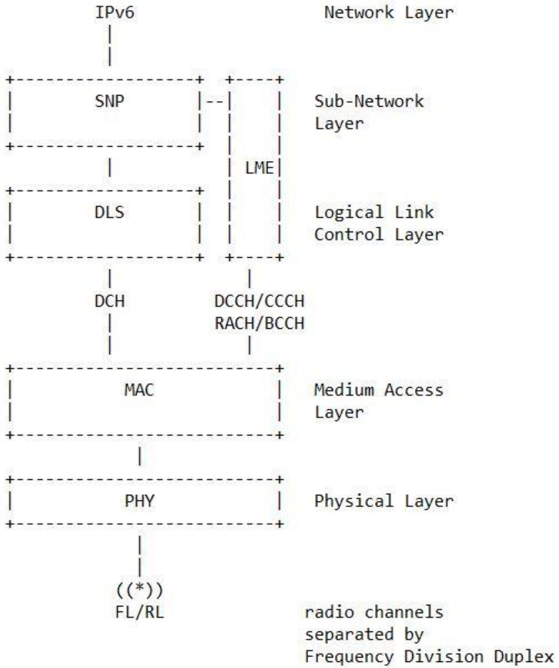
Chapter 7 – Characteristics

- Moved LDACS protocol stack details here



```
wireless      user
link          plane
  AS-------------GS---------------AR---A2G-----ATN
                 .                |    Router
                 .  control       |
                 .  plane         |
                 .                |
                 GS...............|
                 .                |
                 .                |
                 GS---------------+
```

LDACS sub-network



```
        IPv6                   Network Layer
         |
         |
+------------------+  +----+
|       SNP        |--|    |  Sub-Network
|                  |  |    |  Layer
+------------------+  |    |
         |            | LME|
+------------------+  |    |
|       DLS        |  |    |  Logical Link
|                  |  |    |  Control Layer
+------------------+  +----+
         |               |
        DCH         DCCH/CCCH
         |          RACH/BCCH
         |               |
+--------------------------+
|           MAC            |  Medium Access
|                          |  Layer
+--------------------------+
              |
+--------------------------+
|           PHY            |  Physical Layer
+--------------------------+
              |
              |
            ((*))
            FL/RL            radio channels
                             separated by
                             Frequency Division Duplex
```

LDACS protocol stack

Chapter 9 – Security

- Clarified view from regulatory documents:
  - LDACS is network access technology in ATN/IPS
  - RTCA DO-350A specifies 10s for RCP 130/A1 message types

- Presented user-/control data protection of LDACS

- LDACS PKI with corresponding certificates
  - AS certificates valid 3 years
  - GS certificates valid 1 day (sent via LDACS)
  - OCSP for certification revocation
  - CSP for certificate roll-out

Chapter 9 – Security

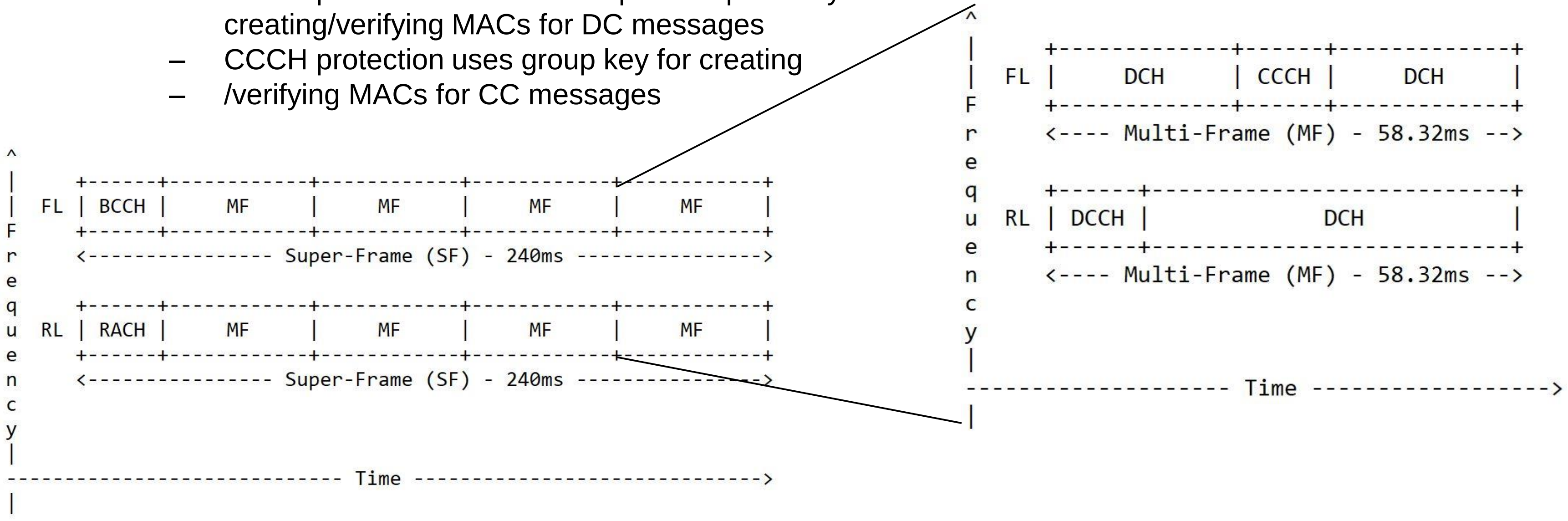
- LDACS cell-attachment procedure:
  - LDACS cell-entry procedure: basic communications enabled, security protocols and algorithms negotiated
  - LDACS Mutual Authentication and Key Establishment (MAKE) procedure: mutual authentication, key establishment derivation, group key establishment

- LDACS security levels
  - Pre-Quantum: Elliptic-curve based
  - Post-Quantum:
    - Supersingular Isogeny Key Encapsulation (SIKE) KEM
    - FALCON signature

- LDACS user-data protection
  - AES-CMAC for data integrity/authenticity only
  - AES-CCM for Authenticated Encryption with Associated Data (AEAD)

Chapter 9 – Security

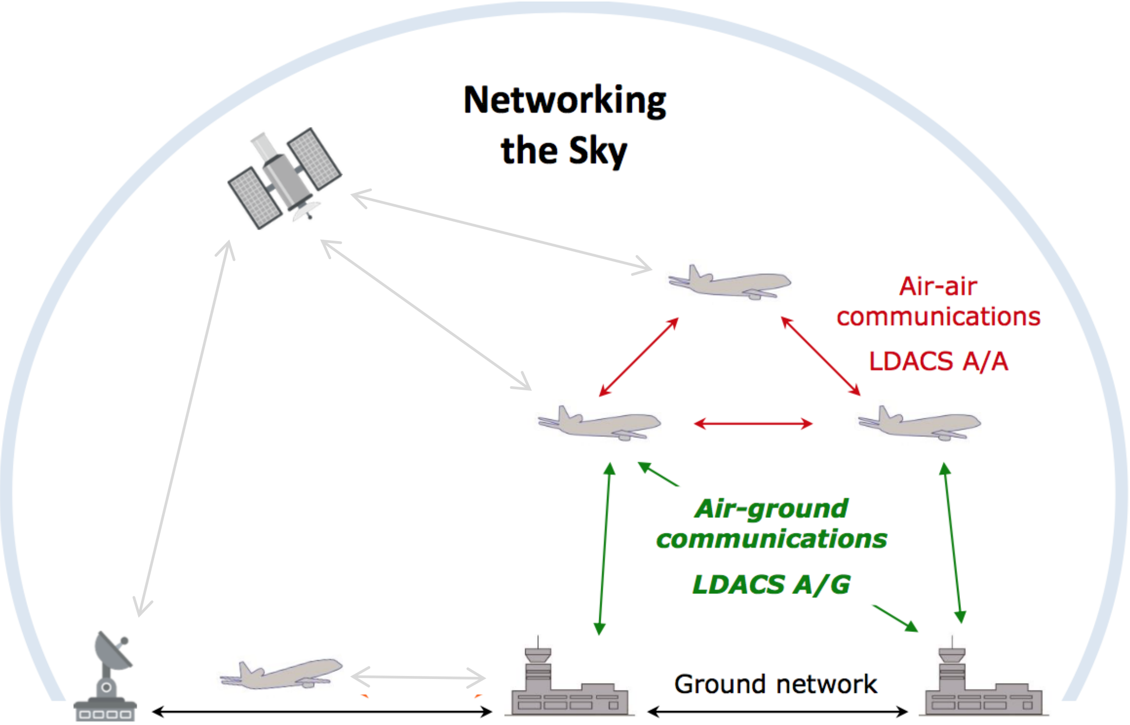
- LDACS control-channel protection:
  - No protection at RACH, BCCH
  - DCCH protection uses AS-GS point-to-point key for creating/verifying MACs for DC messages
  - CCCH protection uses group key for creating
  - /verifying MACs for CC messages



```
^
|     +-----+-----------+-----------+-----------+-----------+
|  FL | BCCH |    MF     |    MF     |    MF     |    MF     |
F     +-----+-----------+-----------+-----------+-----------+
r     <--------------- Super-Frame (SF) - 240ms --------------->
e
q     +-----+-----------+-----------+-----------+-----------+
u  RL | RACH |    MF     |    MF     |    MF     |    MF     |
e     +-----+-----------+-----------+-----------+-----------+
n     <--------------- Super-Frame (SF) - 240ms --------------->
c
y
|
-------------------------- Time ------------------------------>
|
```

```
^
|     +-------------+------+-------------+
|  FL |     DCH     | CCCH |     DCH     |
F     +-------------+------+-------------+
r     <---- Multi-Frame (MF) - 58.32ms -->
e
q     +------+---------------------------+
u  RL | DCCH |            DCH            |
e     +------+---------------------------+
n     <---- Multi-Frame (MF) - 58.32ms -->
c
y
|
------------------- Time ------------------>
|
```

Thanks


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