

LDACS –Webinar 2

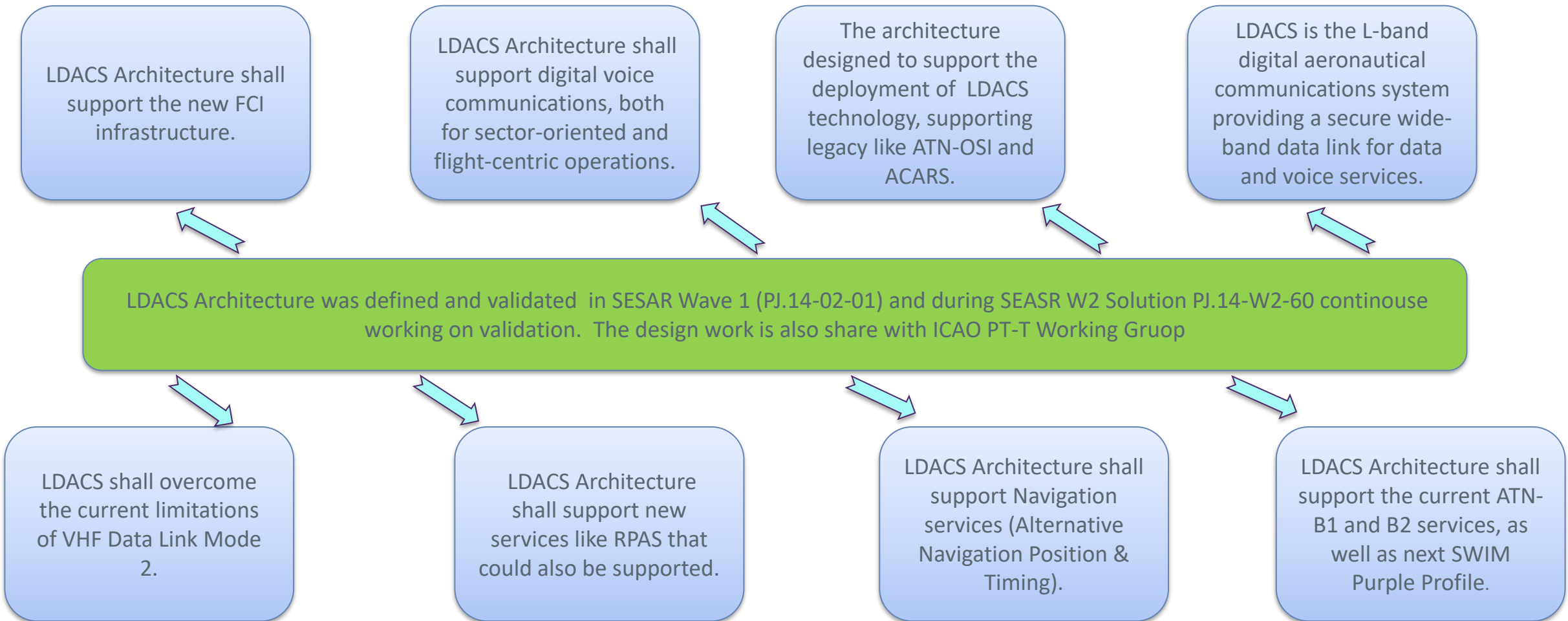
LDACS Architecture Overview

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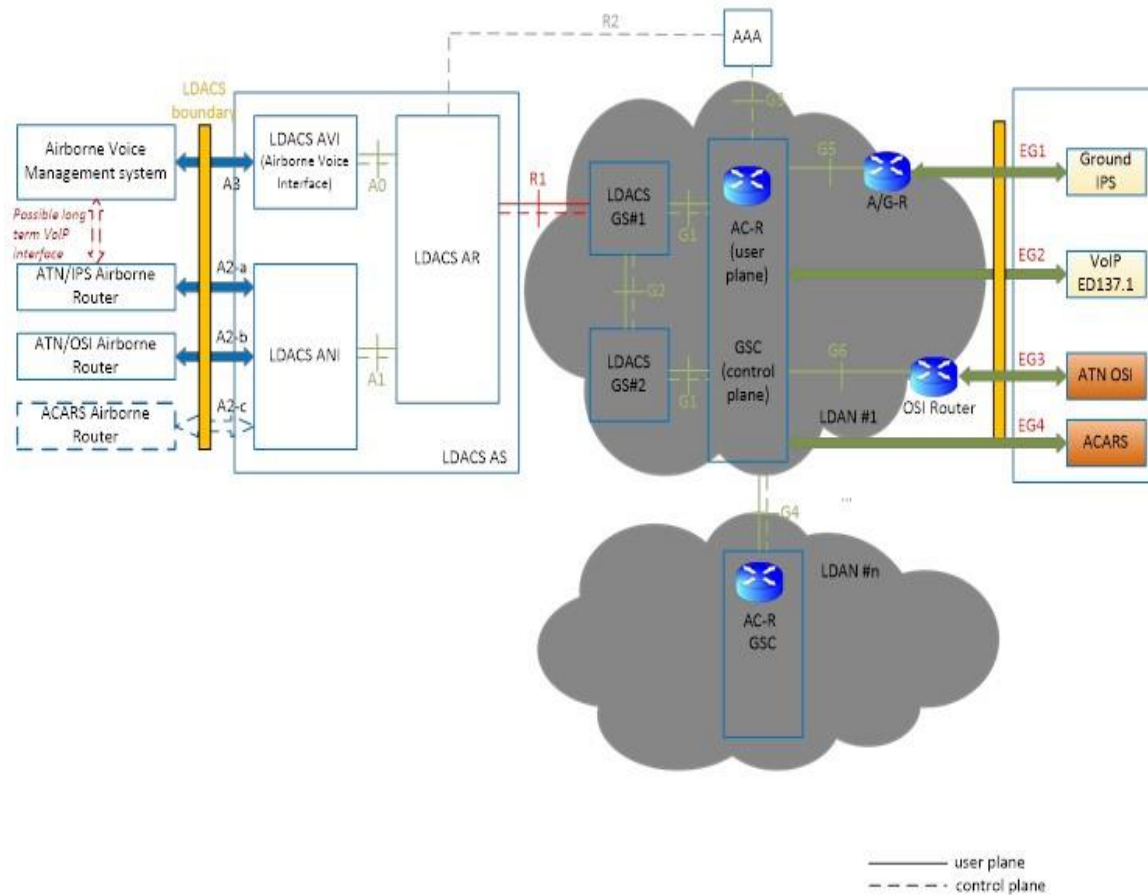


LDACS Architecture Principles





LDACS External Interfaces



GROUND EXTERNAL INTERFACE

EG1: The reference point EG1 consists of the set of messages related to ATN-IPS services

EG2: The reference point EG2 consists of the set of messages related to VoIP

EG3: The reference point EG3 consists of the set of messages related to ATN-OSI services

EG4: The reference point EG4 consists of the set of messages related to ACARS services

AIRBORNE EXTERNAL INTERFACE

A2-a: The reference point A2-a consists of the set of messages related to ATN-IPS services

A3: The reference point A3 consists of the set of messages related to VoIP

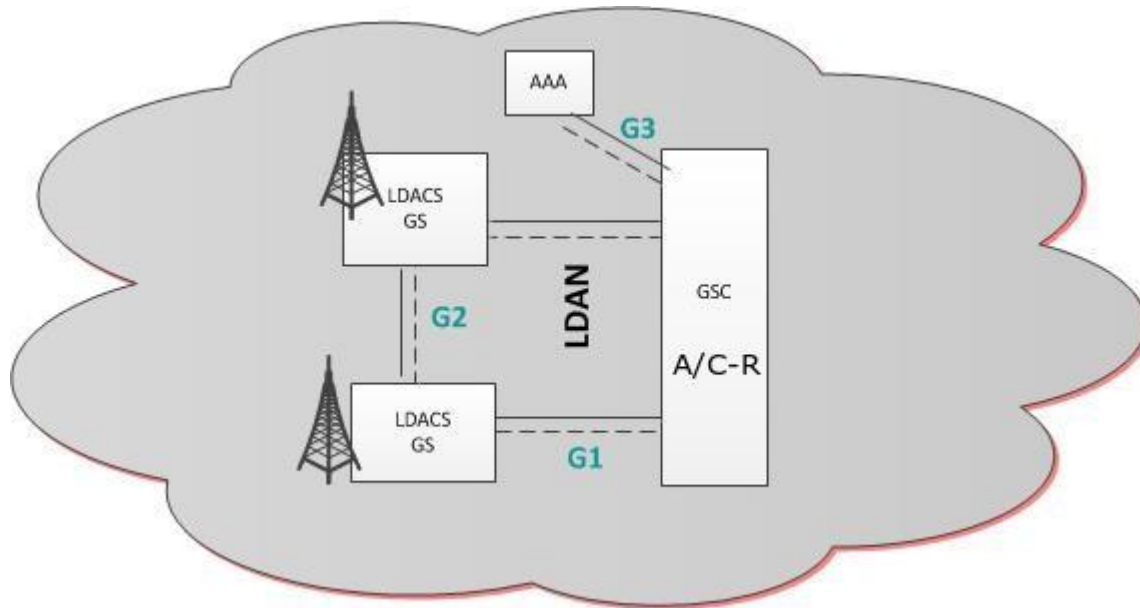
A2-b: The reference point EG3 consists of the set of messages related to ATN-OSI services

A2-c: The reference point EG4 consists of the set of messages related to ACARS services

LDACS ARCHITECTURE

GROUND SIDE

LDAN Network Reference Model



LDACS Access Service Network (LDAN) is defined as a complete set of network functions needed to provide radio access to an LDACS subscriber.

The LDAN provides the following mandatory functions:

- ☐ LDACS connectivity with LDACS AS
- ☐ Transfer of AAA messages to LDACS subscriber's Home Network Service Provider (H-NSP) for authentication, authorization and session accounting for subscriber sessions
- ☐ Network discovery and selection of the LDACS subscriber's preferred NSP
- ☐ Radio Resource Management.

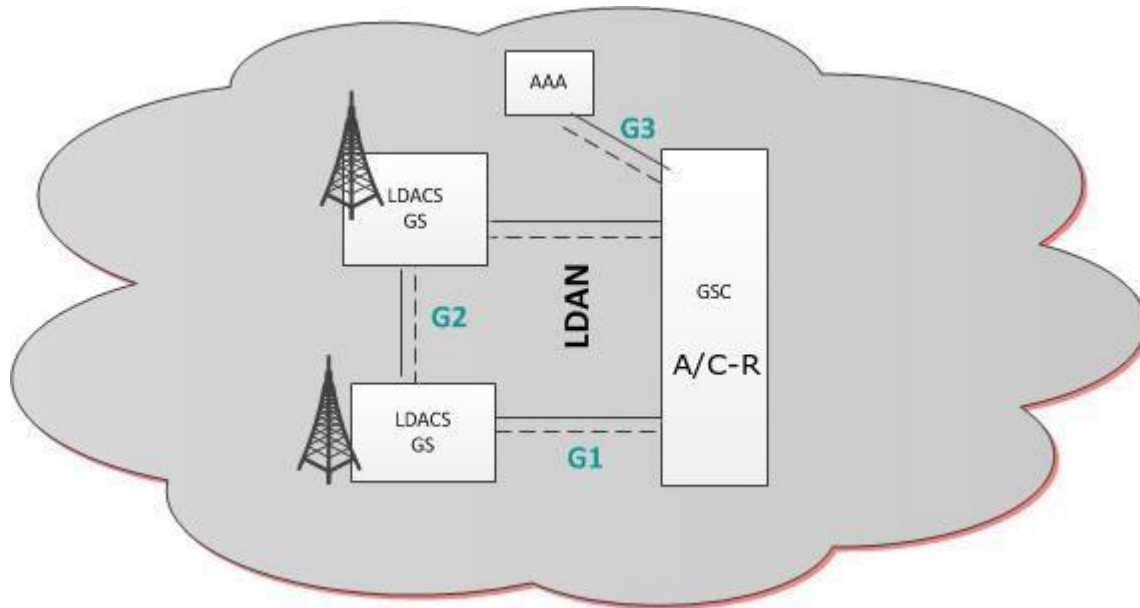
In addition to the above mandatory functions, for a portable and mobile environment, an GSC shall support the following functions:

- ☐ LDAN anchored mobility
- ☐ Location Register

LDACS ARCHITECTURE

INTERFACE GROUND SIDE

LDAN Network Reference Model



G1: Reference Point G1 consists of the set of Control and User Plane protocols for communication between the GS and the GSC (control plane) / AC-R (user plane).

- The user plane consists of intra-LDAN data path between the GS and AC-R.
- The control plane includes protocols for data path establishment, modification, and release control in accordance with the AS mobility events.

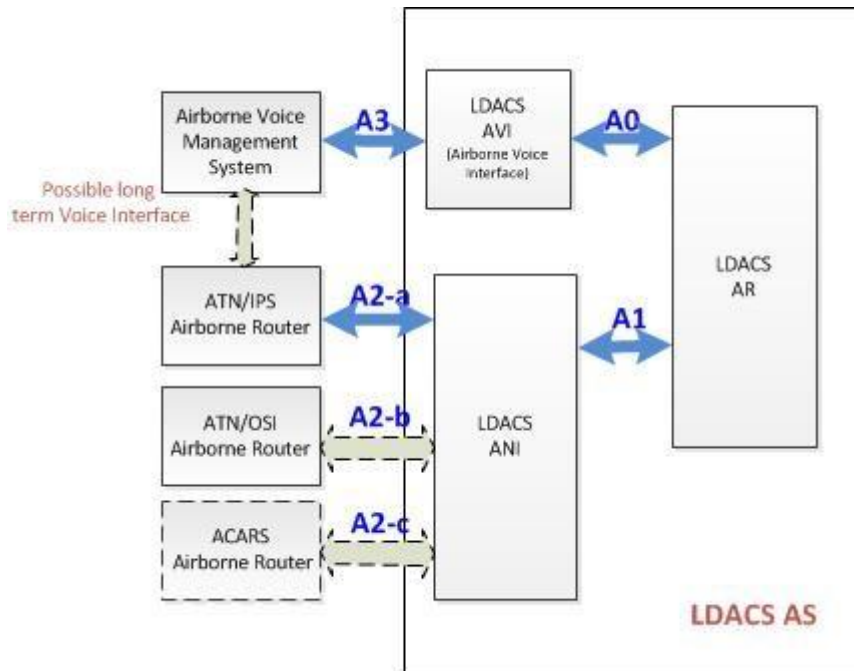
G2: Reference Point G2 consists of the set of Control Plane protocols originating/terminating in a GS of an LDAN that coordinate AS mobility between GS.

G3: Reference Point G3 is a physical connection and consists of protocols and procedures between AAA Server and GSC associated with Authentication, Services Authorization management.

LDACS ARCHITECTURE

AIRBORNE SIDE

AIRBORNE REFERENCE MODEL



LDACS Airborne Reference Model is defined as a complete set of network functions needed to provide radio access towards LDACS GS. The Airborne Reference Model provides the following mandatory functions:

- ❑ LDACS connectivity with LDACS GS
- ❑ Network discovery and selection of the LDACS GS's of preferred NSP
- ❑ Relay functionality for establishing Layer-3 (L3) connectivity with a LDACS GSC (i.e. IP address allocation)
- ❑ Radio Resource Management

LDACS Airborne Reference Model comprises three modules:

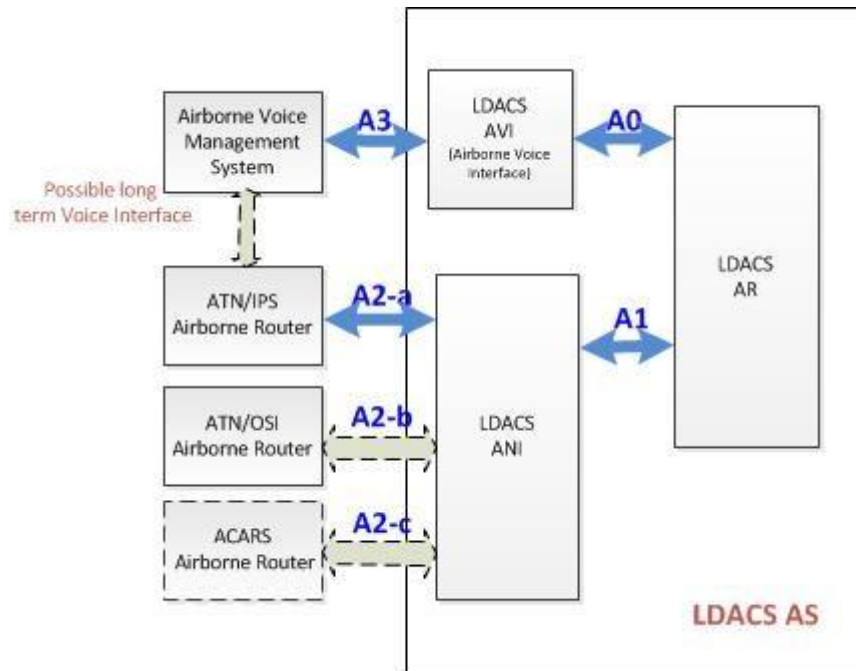
- ❑ LDACS AR;
- ❑ LDACS ANI;
- ❑ LDACS AVI.



LDACS ARCHITECTURE

INTERFACE AIRBORNE SIDE

AIRBORNE REFERENCE MODEL



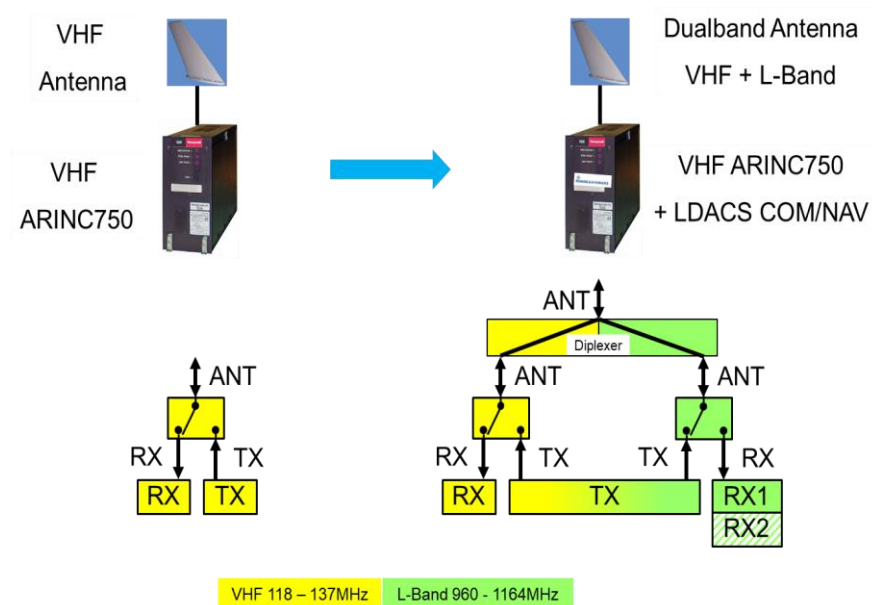
A1: Reference Point A1 consists of the set of protocol message that manage the connection between ANI and AR.

A0: Reference Point A2 consists of the set of Control and Bearer protocols that manages Airborne Router(s) communication (ATN IPS, ATN OSI, ACARS communications).

How to integrate LDACS into aircrafts

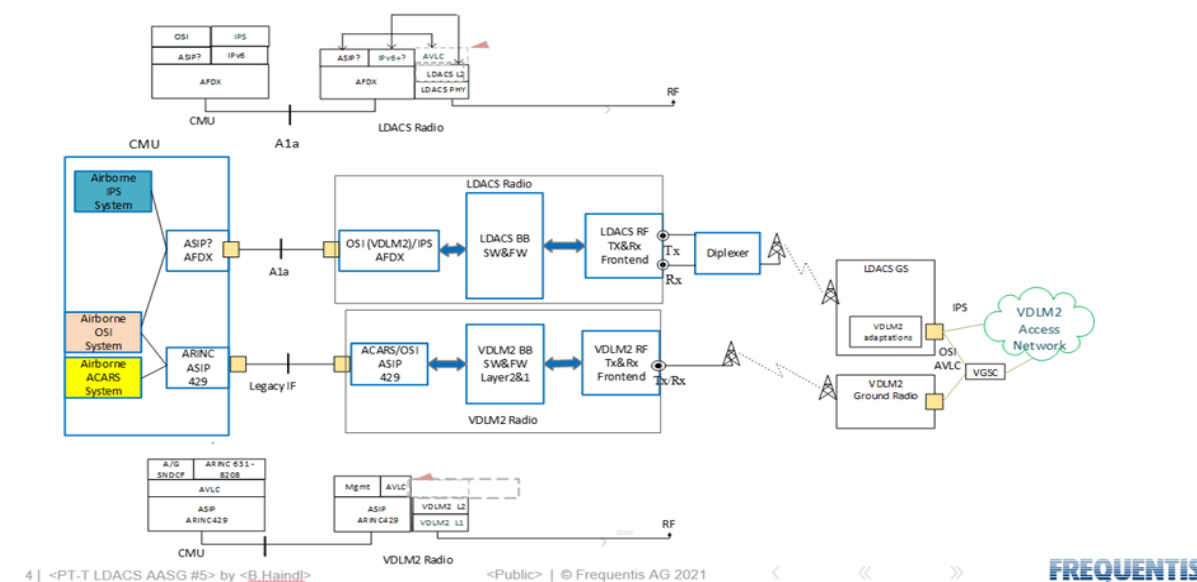
- The working group AATF (Avionics Architecture Taskforce) is collecting the requirements for the LDACS system from point of easy installation/integration into various aircraft systems.
- General goal is to have minimum changes on aircrafts (at least in first deployment phases of LDACS).
- New ARINC standards may need to be developed as consequence.

First Option - Enhancing VDL Mode 2 with LDACS in Aircrafts



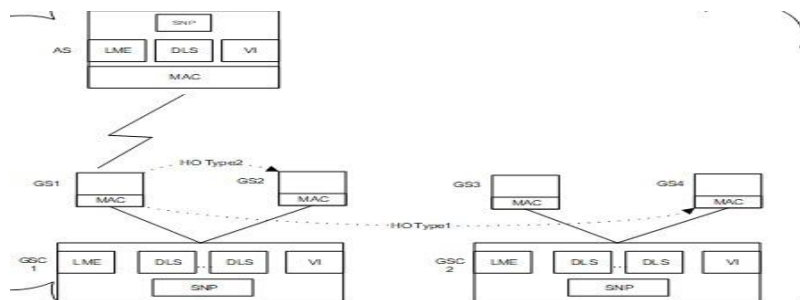
Second Option - Enhancing VDL Mode 2 with LDACS in Aircrafts

Separated LDACS VDR Airborne Context Diagram

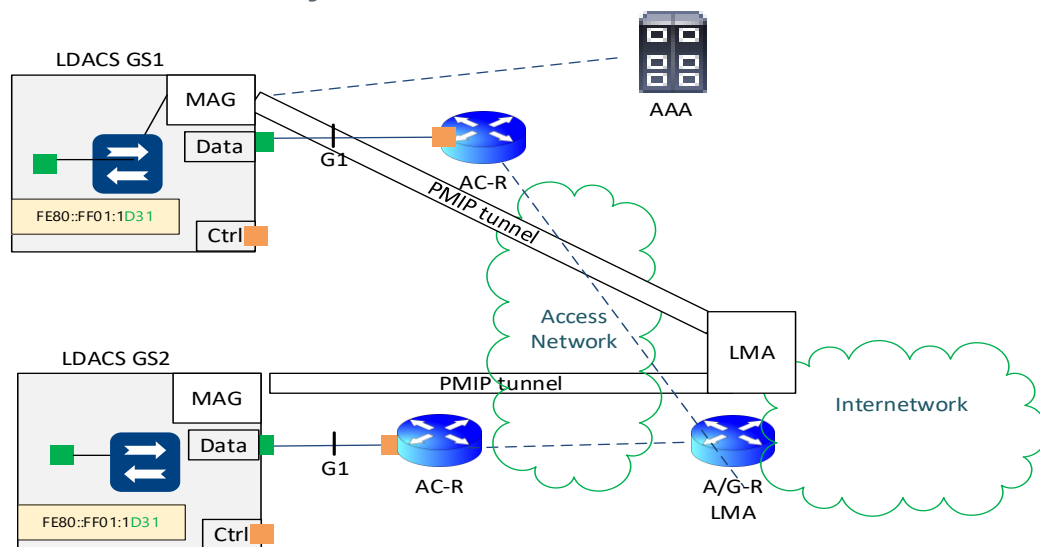


LDACS Mobility Architecture

HANDOFF



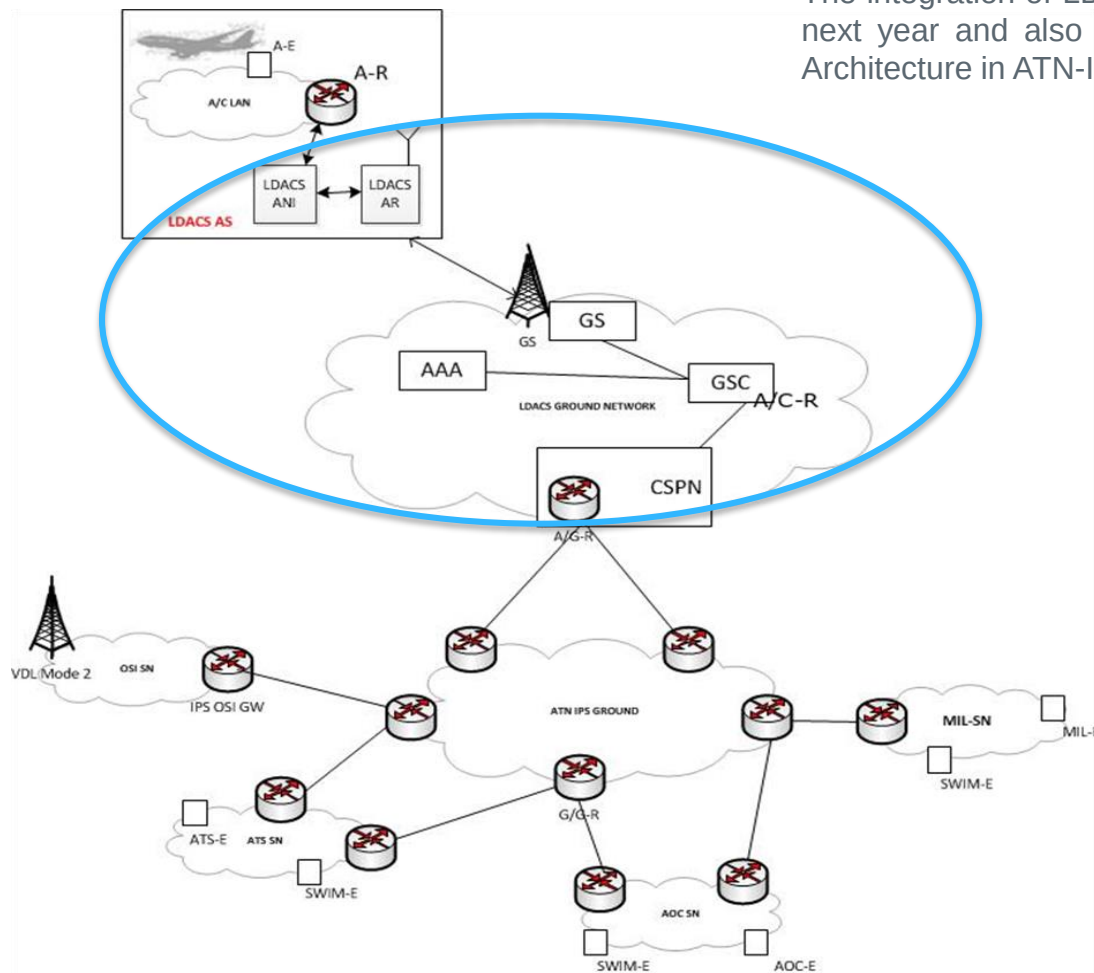
Network Mobility



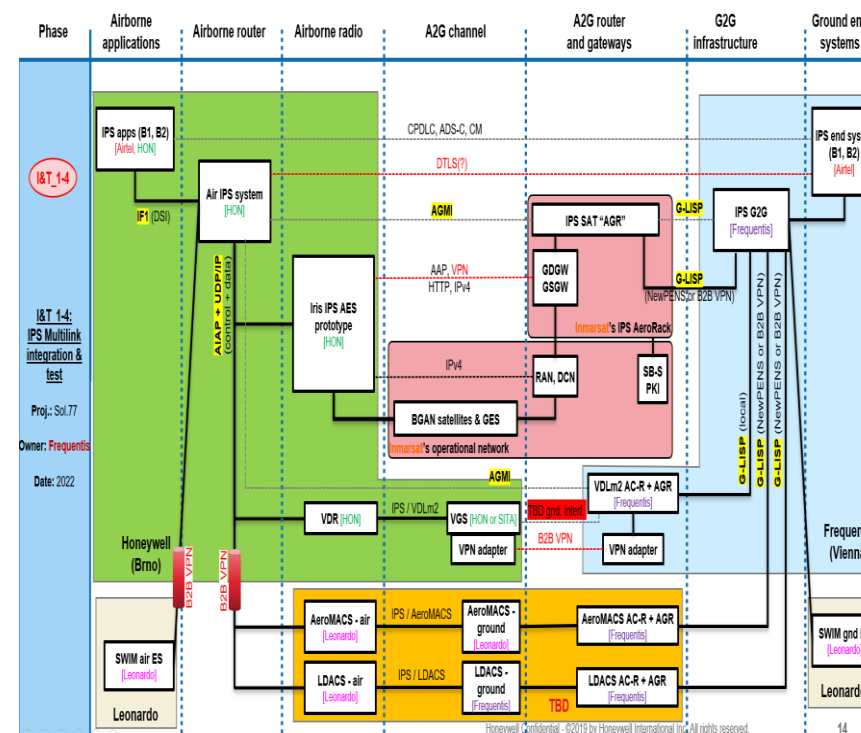
- Handover between GS of different GSC - Handover Type 1:
If GS1 announces a handover type 1 to the AS, the AS shall shut down the connection to GS1. Thereby the DLS of the AS has to be reset in the AS. The associated DLS instance in the GS is deleted. The AS shall hand over to GS4 of GSC2 using the handover type 1 procedure.
- Handover between GS of the same GSC - Handover Type 2:
GS1 announces a handover to GS2 to the AS. As GS1 and GS2 are connected to the same GSC, the handover can be prepared by the ground-stations and the AS shall thus use the handover type 2 procedure. The DLS state of the AS may be preserved in this case as the DLS is for all GSs implemented in the GSC. That, is a handover type 2 between GS of the same GSC is seamless.
- During authentication of the LDACS airborne radio, the LDACS ground infrastructure obtains the MNP assigned to the aircraft.
- The MNP is distributed in the LDACS ground infrastructure, so that the aircraft is reachable via the LDACS network.
- The LDACS A/G router (border router) announces the MNP via the external interface to the core IP network, according the used global mobility solution.
- LDACS provides within the access network a local mobility solution (e.g. PMIPv6) transparent for the global mobility solution.
- LDACS ground radios can detect link errors as reliably and quickly as airplanes, thus avoiding faulty link conditions on the ground.

LDACS & FCI Infrastructure

The integration of LDACS subnet in FCI Infrastructure will be validate in SESAR Wave2 by PJ.14-W2-77 next year and also Flight Trial will be on Q3 2022 conducted by PJ.33-W3-Sol2 to validate LDACS Architecture in ATN-IPS Environment



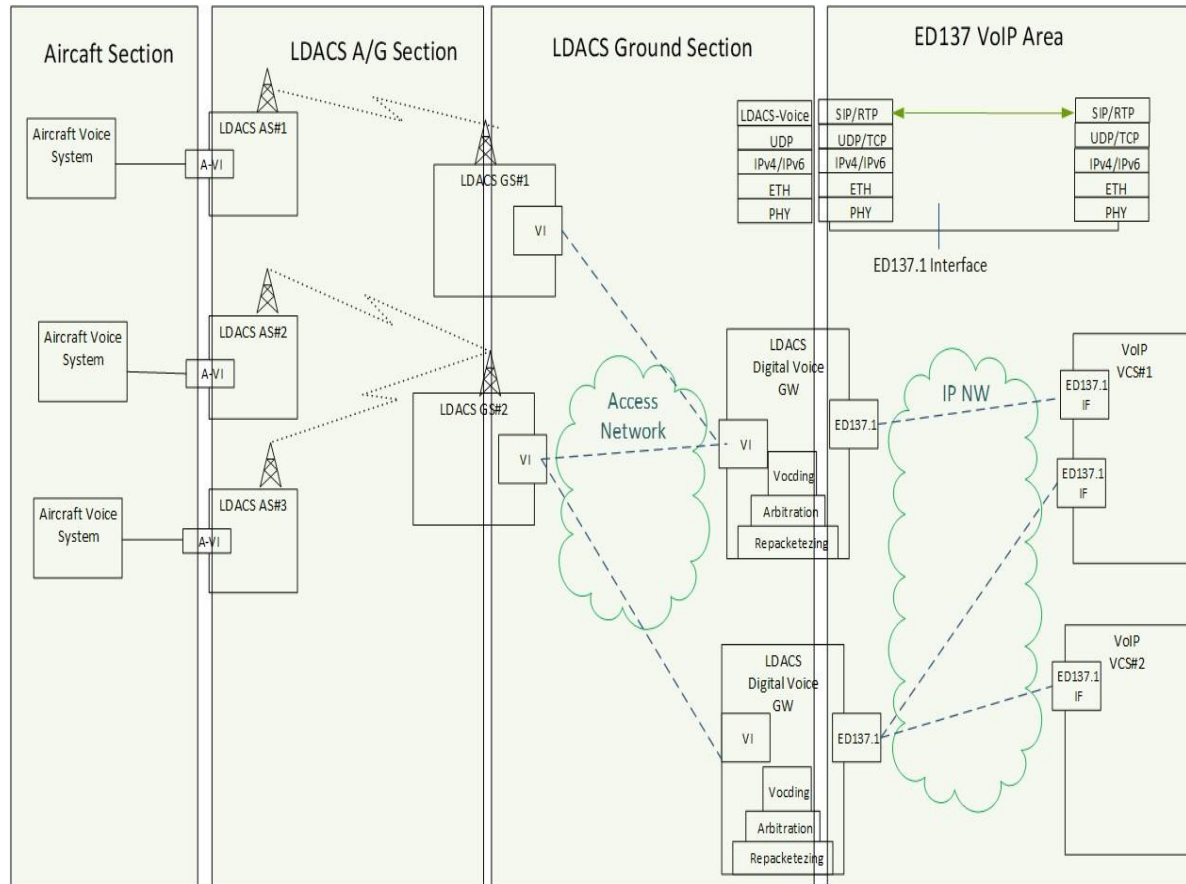
I&T_1-4: IPS MULTILINK INTEGRATION & TEST (SOL.77)





LDACS VOICE TRANSMISSION

OBJECTIVE



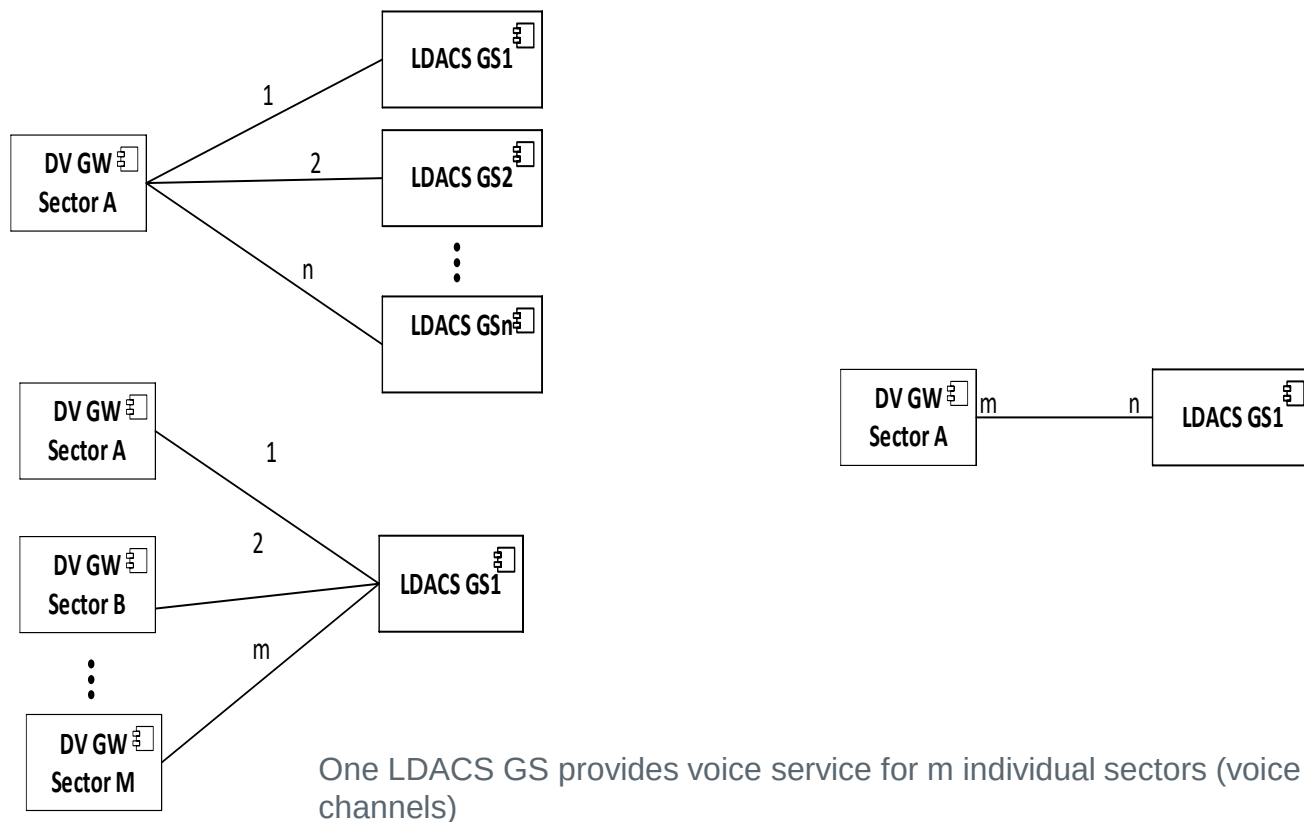
- SESAR PJ33-W3-Sol2 is working on developing operational and functional requirements supporting the currently available operational methods and procedures that are using in the current VHF technology.
- Baseline is the operational concept of the current analogue VHF A/G voice service
- LDACS Digital Voice concept should be integrated into the existing voice infrastructure.
- The ED-137 VoIP area should remain unchanged.
- The LDACS digital voice solution should benefit from the features of a modern digital A/G datalink (e.g. security means, voice quality, point-to-point, etc.).
- A voice service for flight-centric operations should be proposed.



LDACS ARCHITECTURE

Relationship DV Gateways-LDACS GS

One Voice Sector is covered by n LDACS GS



- Digital Voice (DV) Gateway is permanently assigned to a voice sector and provides the digital voice service for this sector for the various VCS.
- The Interface to the VCS is according to EUROCAE VOIP Ed137.1C radio standard.
- The DV gateway has a list of LDACS ground stations covering the voice sector (Sector A).
- The DV gateway starts the R2S communication to all ground stations.
- The LDACS ground stations reserving the bandwidth for the voice channel on the A/G link and confirms the R2S start message.
- The connection between ground stations and DV gateway is monitored by using R2S keepalive.
- LDACS ground stations announcing the voice service over the A/G link
- Options for the behavior of the aircraft
 - Option 1: aircraft which want to use the voice service register at the LDACS ground station with a confirmation from the ground station
 - Option 2: No registration by the aircraft. It simply uses the appropriate voice channel



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ELECTRONICS DIVISION



THANK **YOU**
FOR YOUR ATTENTION

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