



# Functional Building Blocks for an Integrated Aeronautical IP-Network

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# Outline

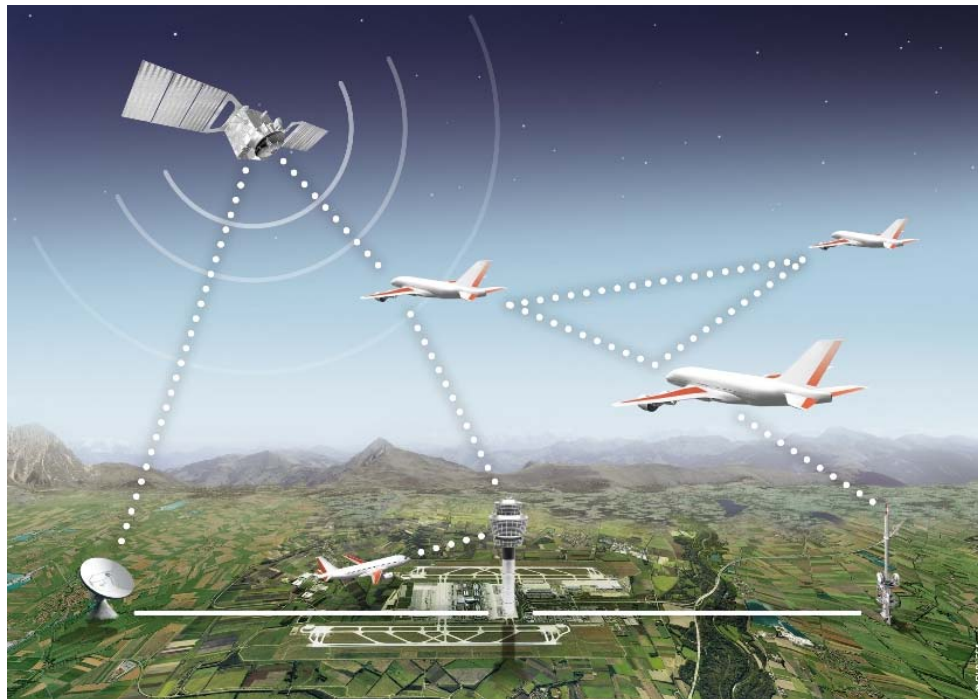
- Major challenges addressed
- NEWSKY project and relation to SESAR
- NEWSKY functional building blocks
  - Traffic Management Functionality
  - Mobility Functionality
  - End-to-End Data Transport Functionality
  - Security Functionality
- Conclusions

## Major Challenges Addressed

- Development of communication systems for **global information availability and sharing** and the resulting global situation awareness will be a **key enabler** for the implementation of new services and SESAR ATM ConOps.
- **Interoperability** and **modularity** of communication systems are of major importance due to the **heterogeneous deployment** of **data link** and **networking technologies**.
- Several services with highly diverse requirements shall coexist:
  - **ATS** will be primarily based on highly safety-related data communication and voice communication will be mostly used as fallback solution.
  - **AOC** data traffic will strongly increase for efficient airline operations.
  - **APC** is foreseen to be further developed to meet passengers' expectations of on-board communication services.

## Vision of NEWSKY Project: “Networking the Sky”

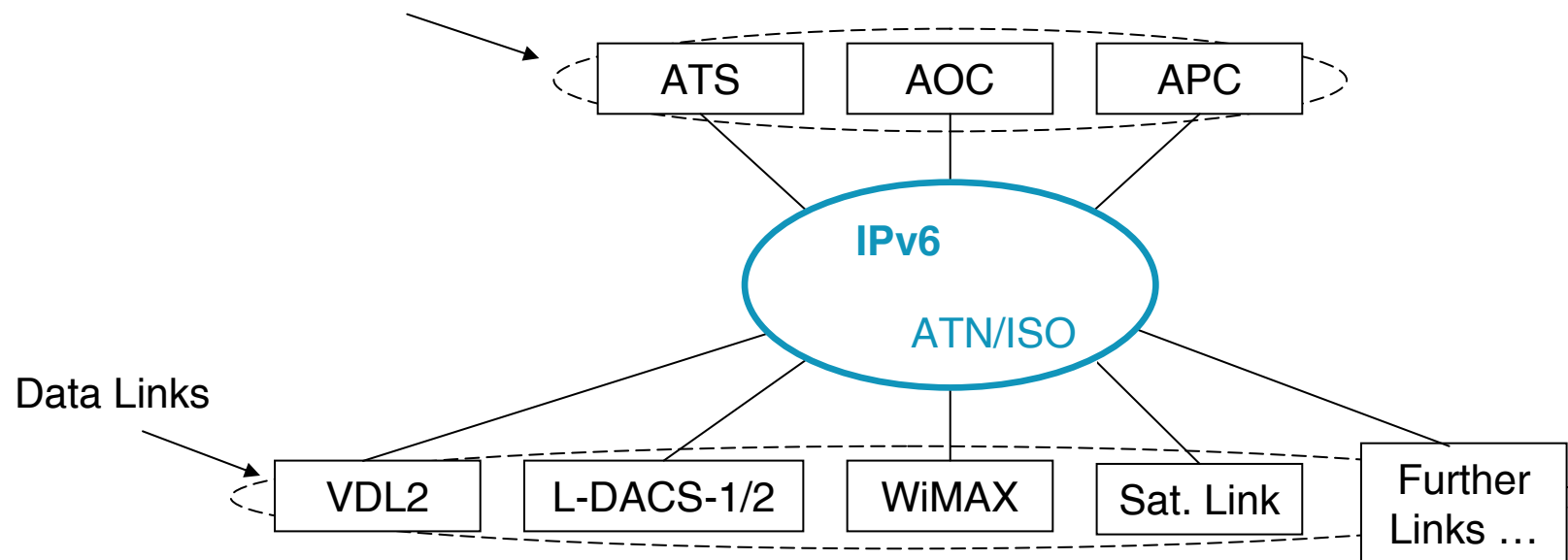
- Development of a concept and preliminary design of a **global, seamless aeronautical communication network** with focus on air-ground communications and IPv6 technologies



# NEWSKY Integrated Approach

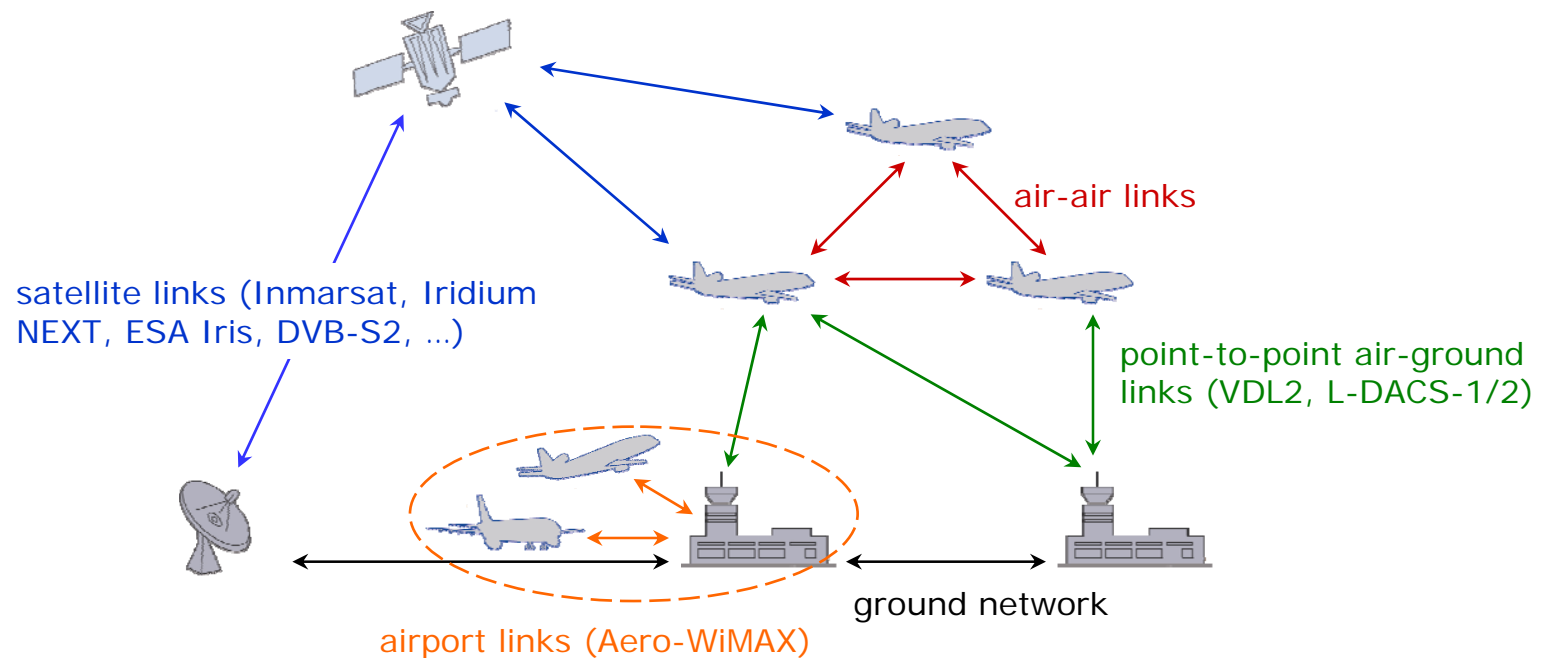
- NEWSKY specifies **networking solutions** and **common interfaces** for the integration and interoperability of **different services** and **different data links**.

Applications and Services



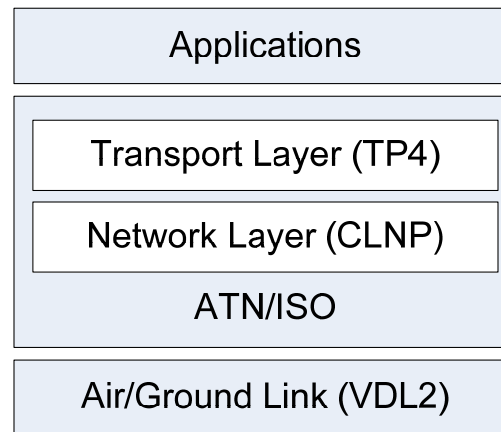
# Integration of Different Data Links

- According to AP17 – Future Communications Study (Eurocontrol/FAA) and SESAR, several data links are required to fulfil the ATM communication requirements; Further data links are foreseen for APC



## Networking Solutions: State-of-the-Art

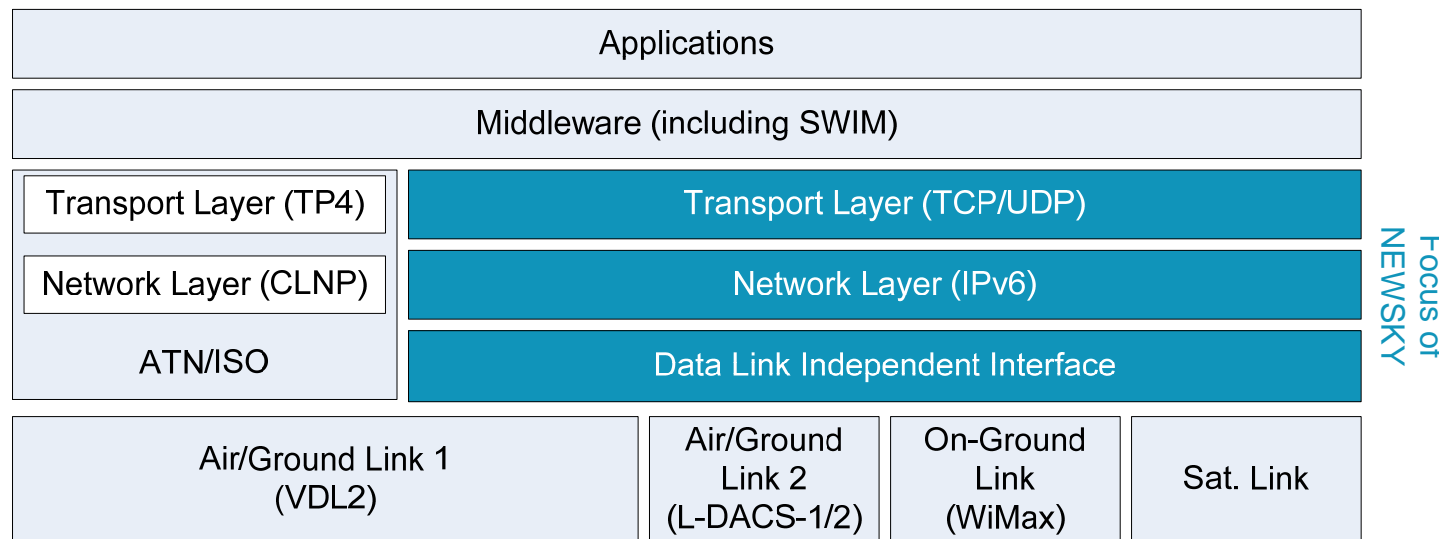
- ATN/ISO is being deployed in combination with VDL2 through e.g. the Link2000+ programme (VDL2/ATN):



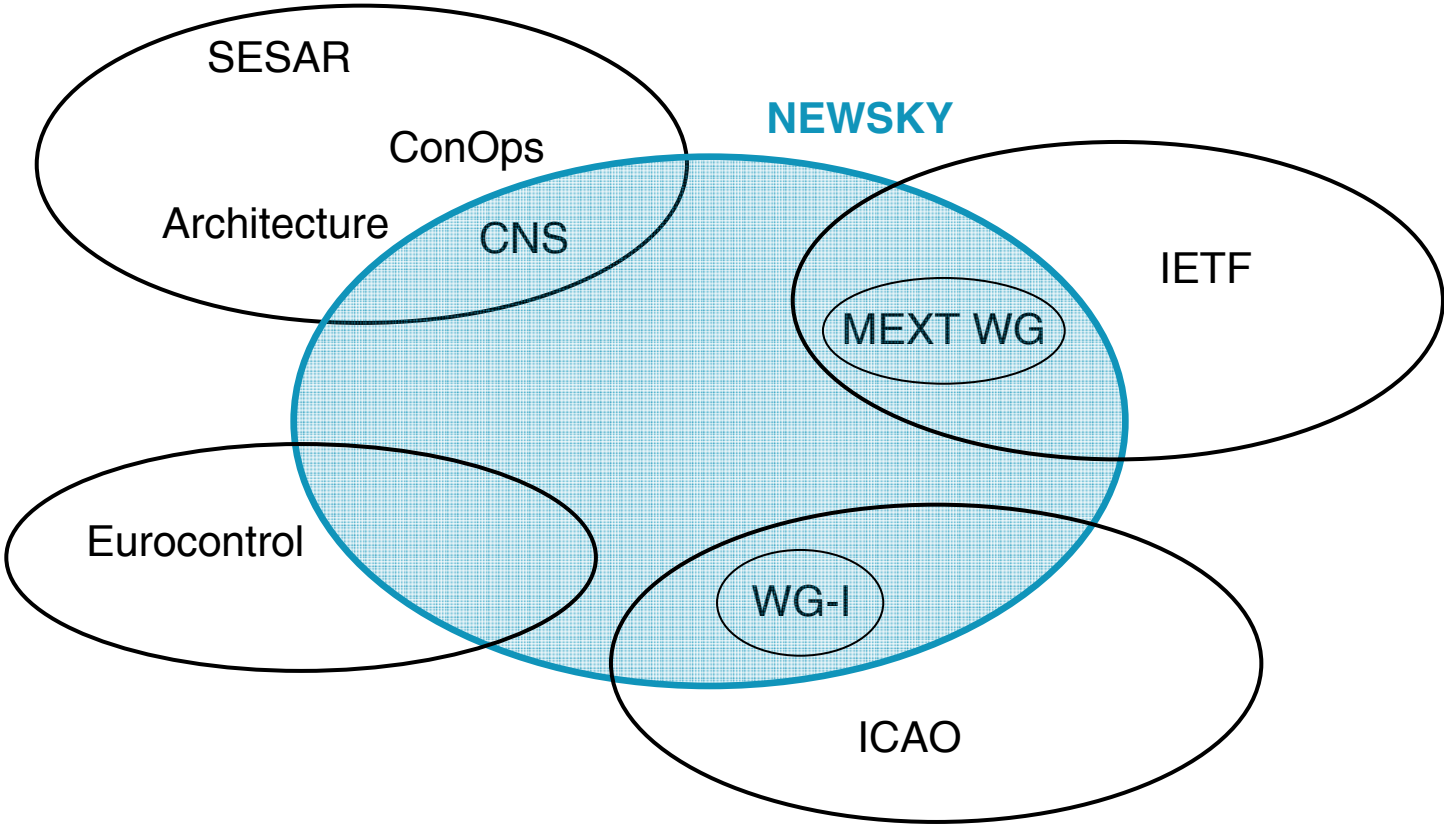
- Commercial networking solutions based on the widely deployed IETF Internet Protocol Suite (IPS) have diverged significantly from the aeronautical networking solutions based on ISO protocols.

# Networking Solutions: Trend Towards IPv6

- Trend towards **IP-based networking solutions** for A/G communication for **cost savings, high reliability** and an **optimal alignment** with the evolution of communication and security technologies.
- NEWSKY **focus is on IPv6**, considering **interoperability** and the **transition** from ATN/ISO:

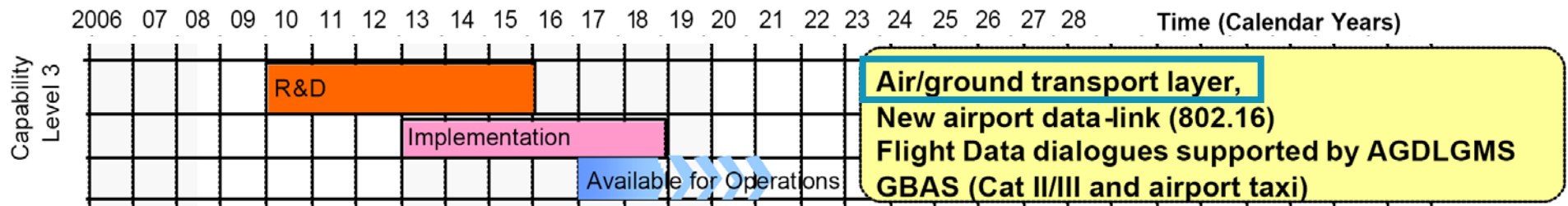


# NEWSKY Positioning



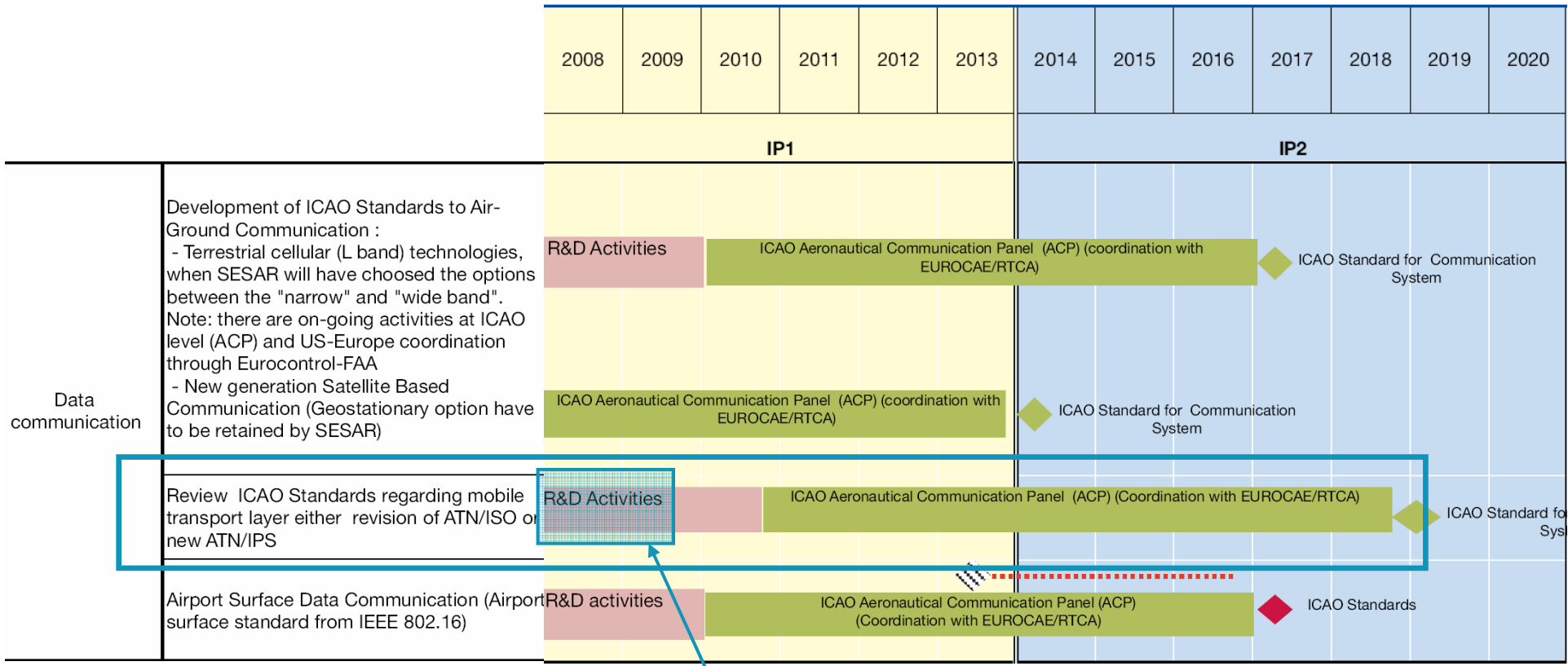
# NEWSKY and SESAR

- NEWSKY provides supporting CNS technology and is a system enabler for SESAR operational improvements
- SESAR networking technologies:
  - Ground-ground network: Pan-European IP Network (PENS)
  - Air-ground network: No clear statement regarding roadmap for networking technology (ATN/ISO vs. ATN/IPS):



Source: SESAR D5

# NEWSKY R&D Activities towards SESAR Standardization

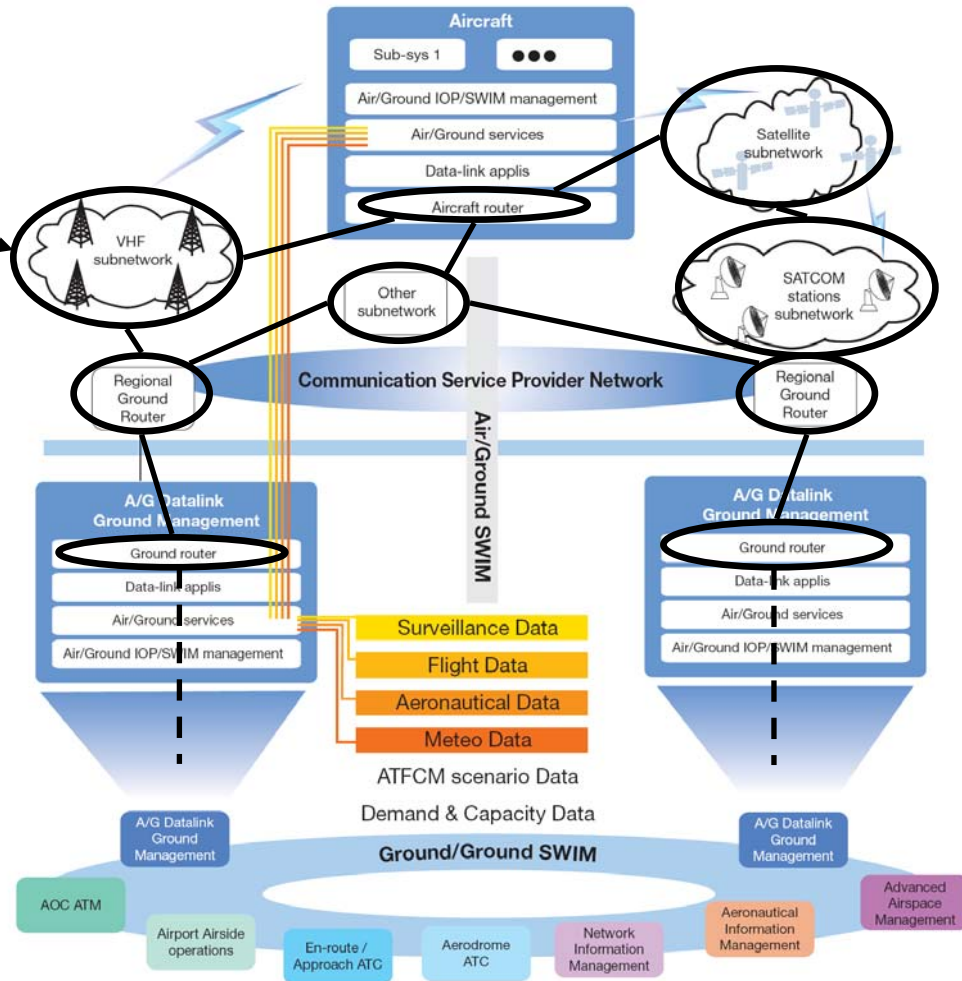


## NEWSKY R&D Activities and ICAO WG-I Contributions

Source: SESAR D4



# Aircraft Participation in SWIM

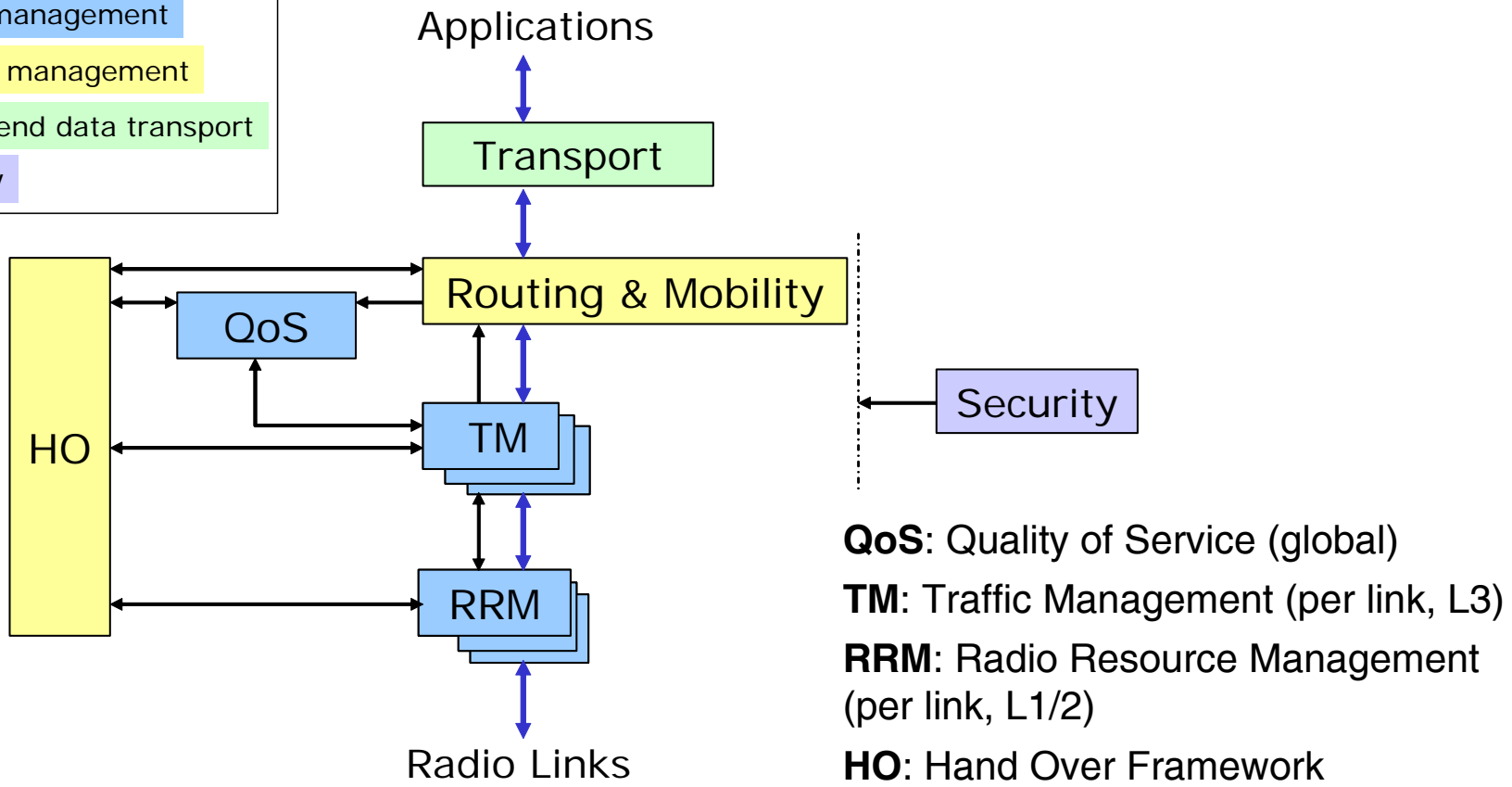
**NEWSKY network as enabler**



Source: SESAR D3

# NEWSKY Functional Building Blocks

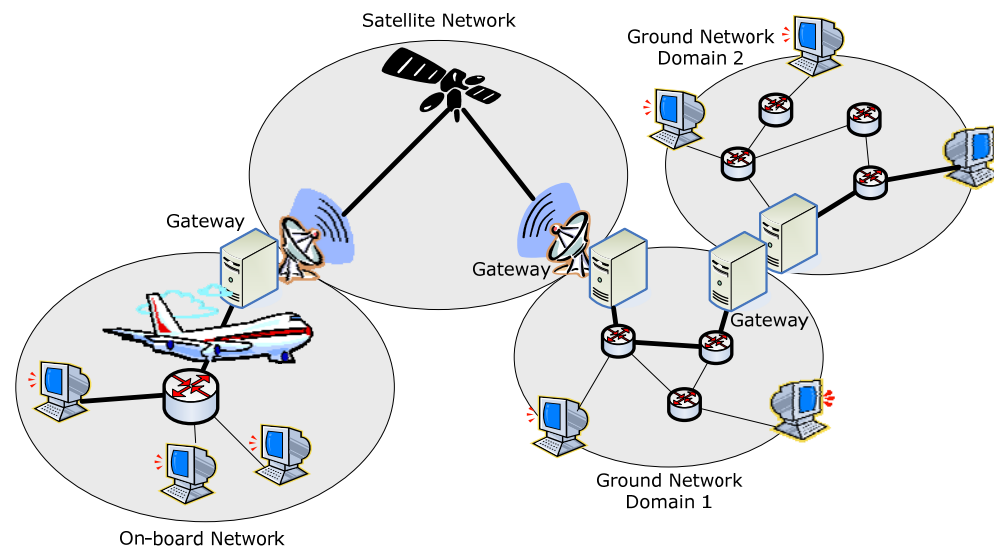
User Data:   
 Control Data:   
 Key Functionalities:  
Traffic management  
Mobility management  
End-to-end data transport  
Security



**QoS:** Quality of Service (global)  
**TM:** Traffic Management (per link, L3)  
**RRM:** Radio Resource Management (per link, L1/2)  
**HO:** Hand Over Framework

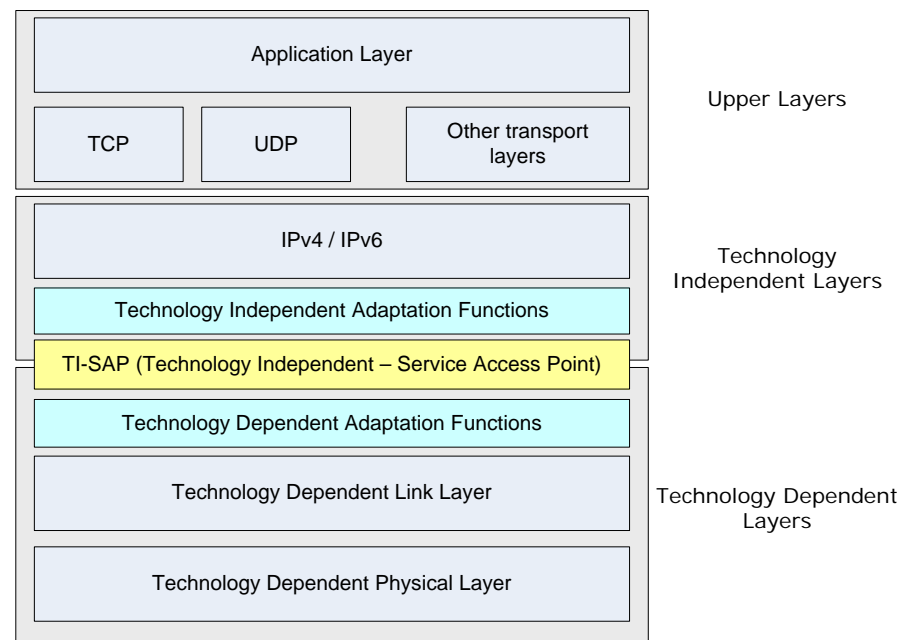
## Horizontal QoS Mapping

- **Horizontal QoS mapping:** QoS interoperability among the different network portions through which the data is transmitted (IntServ, DiffServ, derivatives from both and hybrid solutions)
- If separated airborne routers for ATS/AOC and APC are used, requirements could already be met with a simple **static trunk DiffServ** architecture (static amount of resources assigned to each traffic class)



# Vertical QoS Mapping

- **Vertical QoS mapping:** Common mapping of QoS requirements from applications to the various data link technologies
- Common QoS interface between network and data link layers: Broadband Satellite Multimedia (BSM) standard of ETSI could be adapted to aeronautical data links



## Routing

- Route the data traffic on the correct path depending on the selected links.
- **Mobile ad hoc network** (MANET) and **inter-satellite link** (ISL) routing tasks as well, if applicable.

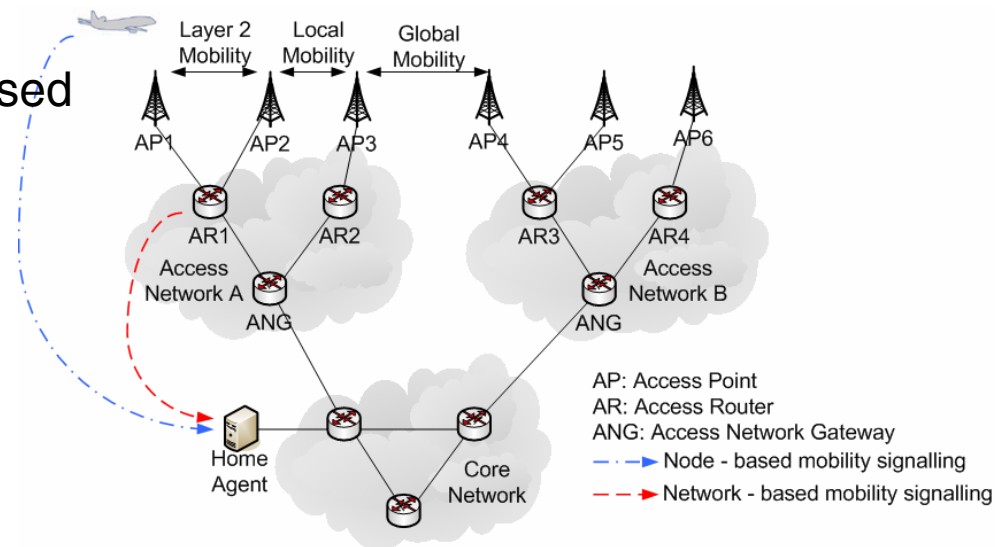


Aeronautical MANET in the north Atlantic corridor, complementary solution to satellite communications

# Mobility solutions

➤ Focus on Mobile IPv6 (MIPv6) and extensions:

- global vs. local mobility
- node-based vs. network-based mobility signalling
- host vs. network mobility
- route optimization

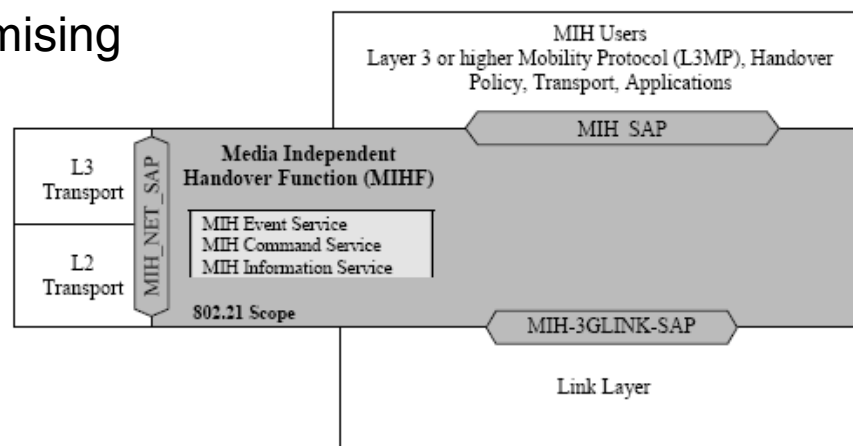


➤ Promising solutions:

- **NEMO** for network mobility, route optimization solutions to be defined
- **PMIPv6** (Proxy MIPv6): network-based local mobility, network performs the required signaling on behalf of the mobile node to reduce the signaling on the wireless link

# Inter-Technology Handover

- **Common signaling interface** between network and data link layers: IEEE 802.21 “Media Independent Handover Services” for inter-technology handover
  - provide lower layer information in generic form to network layer (e.g. available data links, link quality, further QoS and security related information ...)
  - send higher layer commands to lower layers (e.g. power control, L2 connection establishment ...)
- Application to aeronautics seems promising



## End-to-End Data Transport Functionality

- Transport functionality to ensure end-to-end data delivery, with (e.g. TCP) or without (e.g. UDP) reliability.
- **Adaptations of TCP** are necessary depending on the technology used, as TCP performance is highly impacted by wireless technologies due to higher delays, error rates or profiles.
- Architectures investigated:
  - Access technology independent architecture (no TCP adaptations)
  - Performance Enhancement Proxies (PEP, TCP splitting and adaptation)
  - TCP selection in the end systems

## Conclusions

- NEWSKY provides supporting CNS technology and is a system enabler for SESAR operational improvements
- NEWSKY develops a concept and performs a preliminary system design of a **global, seamless aeronautical communication network** with focus on air-ground communications and IPv6 technologies
- NEWSKY specifies aeronautical networking solutions enabling **interoperability, modularity, optimized communications performance, increased availability** and **cost efficient operations**

## Further Information and Contact

➤ Further information: [www.newskey-fp6.eu](http://www.newskey-fp6.eu)

➤ NEWSKY project partners:



➤ NEWSKY Contact:

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