IPv6 in Aviation

35,000 ft view

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SITA

WHO WE ARE

US$1.7BN
Revenue
2018

100%
Owned by and dedicated to air transport

>135
Countries have a SITA presence

2,800
Customers
airlines, airports, services and governments

70
years industry experience

WE CONNECT
13,500
air transport industry sites

1,000
Airports – presence

70%
of the world's Top 20 airports use SITA services

200
Countries and territories served

55,000
workstations and
5,500 kiosks supported at 500 CUTE airports

3.5BN
Baggage portfolio messages

1BN border transactions support

PRODUCT PORTFOLIO

Airline

Airline communications,
data collaboration
& business solutions

Airport

Passenger, baggage, operations

Government

Border management

Passenger

Passenger management
and distribution

SITAONAIR

Aircraft: In-flight connectivity
Air-ground, operations,
Connected aircraft

CHAMP Cargosystems

Cargo management, community
integration, eCargo

Airport & Airline

A Typical Airport Network

Multiple VRFs

- Passenger Management
- Border Control
- Airline Operations
- Ground Operations
- Voice & Video
- CCTV
- Building Management
- Retail
- Public Wi-Fi
- Gatelink
- Etc…

Huge scale, e.g. LHR:

- 80 airlines
- 150,000 LAN ports
- 3,500 Wi-Fi APs
- 1,900 radios
- 12,000 VoIP handsets

IPv6 Drivers: Smart Airports

- Self-service check-in and unassisted bag drop
- 92% of passengers want to receive disruption notifications on their smartphone
- Beacon services allow sharing of metadata such as queuing time, gate numbers, time to gate, etc.
- Self-service boarding gates allow for faster boarding
- RFID readers for baggage tags

All of these require more devices connected to the airport network

IPv6 Drivers: Border Control

- 69% of passengers would like an improvement in border control procedures
- 60% reduction in wait times using border automation kiosks
- 7 travellers per minute can be processed by an automatic border control gate

Each kiosk and gate requires at least one IP address

IPv6 Drivers: Cloud and AI

- Airports and airlines increasingly using cloud hosted services and AI to assist operations
- NAT44 at the airport perimeter is becoming unfeasible!

Challenges

- WAN partner is not ready for IPv6 dual stack yet
- Many legacy applications:
  - Use of DNS is not pervasive
  - Hard-coded IPv4 addresses
- Typical 7-10 year tech refresh cycle
- IPv6 seen as risky by some
- Mindset change
  - Airport networks viewed as ‘private’ and ‘isolated’
  - Globally routable addresses are ‘scary’
  - NAT44 is not a security measure

Aircraft

Aircraft Connectivity

Aircraft Communications Addressing & Reporting System (ACARS)

- Air traffic control (ATC)
- Dispatch services
- Aircraft Operations (AOC)
- Maintenance / fault data
- Engine & fuel data
- Catering requests
- Customer services

Passenger In-Flight Systems

- In-flight Entertainment (IFE)
- Live TV channels
- Cabin Wi-Fi and 3G / 3.5G cellular service

Aircraft Connectivity

Automatic Dependent Surveillance

- Broadcast (ADS-B) for aircraft position tracking
- ICAO 24-bit address issued to each aircraft, aka ‘Mode-S address’ or ‘Mode-S hex code’

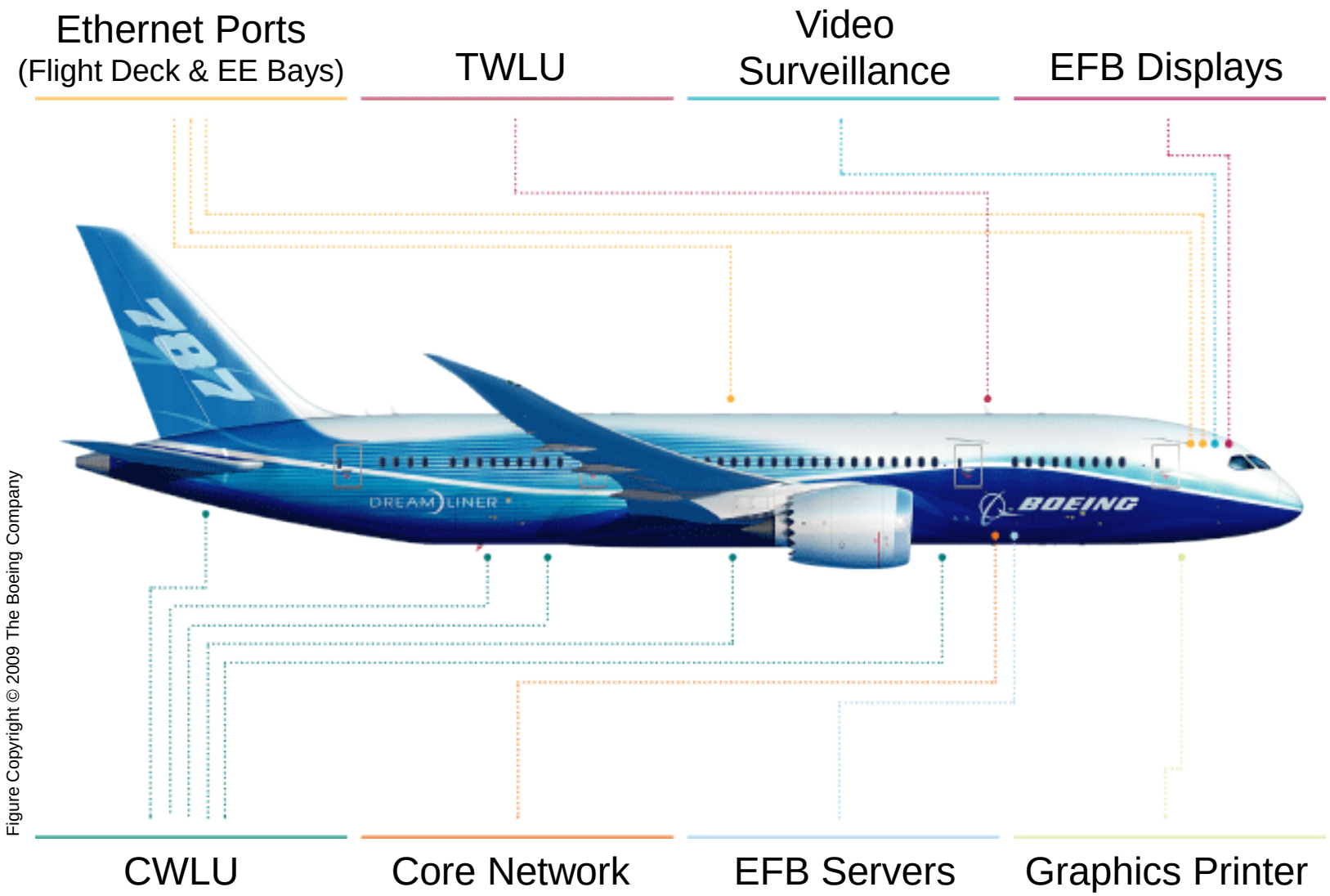
Aeronautical Telecommunications Network

- OSI-based, but migrating to IPv6 (ATN/IPS)

Aircraft Connectivity: Bearers

- VHF Digital Link
- HF Data Link
- SATCOM
- 3G / 4G Networks
- Wi-Fi at gates
- Inmarsat I-4
- Inmarsat GX
- Iridium

e-Enabled Aircraft



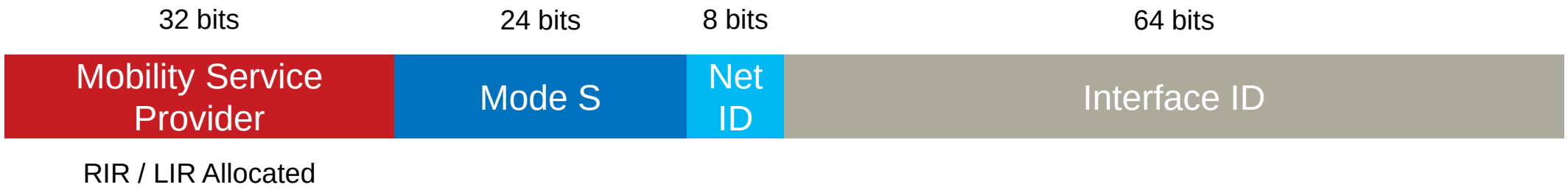
- A350 / A380
- B787 / 747-8

TWLU: Terminal Wireless LAN Unit

EFB: Electronic Flight Bag

CWLU: Crew Wireless LAN Unit

IPv6 Addressing of Aircraft for Mobility



Each aircraft constitutes a /56 IPv6 end site, based on the Mode S address

- E.g. 2001:0DB8:AC82:EC00::/56 for Shuttle Carrier Aircraft N905NA

For onboard services (ATS, AOC, IFE, etc.), an aircraft may use:

- Multiple subnets connected to a mobile router
- Multiple mobility service providers
- A combination of both

Photo by redlegsfan21 from Vandalia, OH, United States

Mobility Challenges for IPv6 in aircraft

1. An aircraft is essentially multiple networks travelling at 620mph at 37,000 ft
2. Multiple ground-to-air VDL providers
3. Uplinks can vary significantly in bandwidth and approved uses
4. Same provider can use multiple uplink technologies
5. Handoff between ground stations or satellites while maintaining addressing

IPv6 Mobility for Air-to-Ground Links

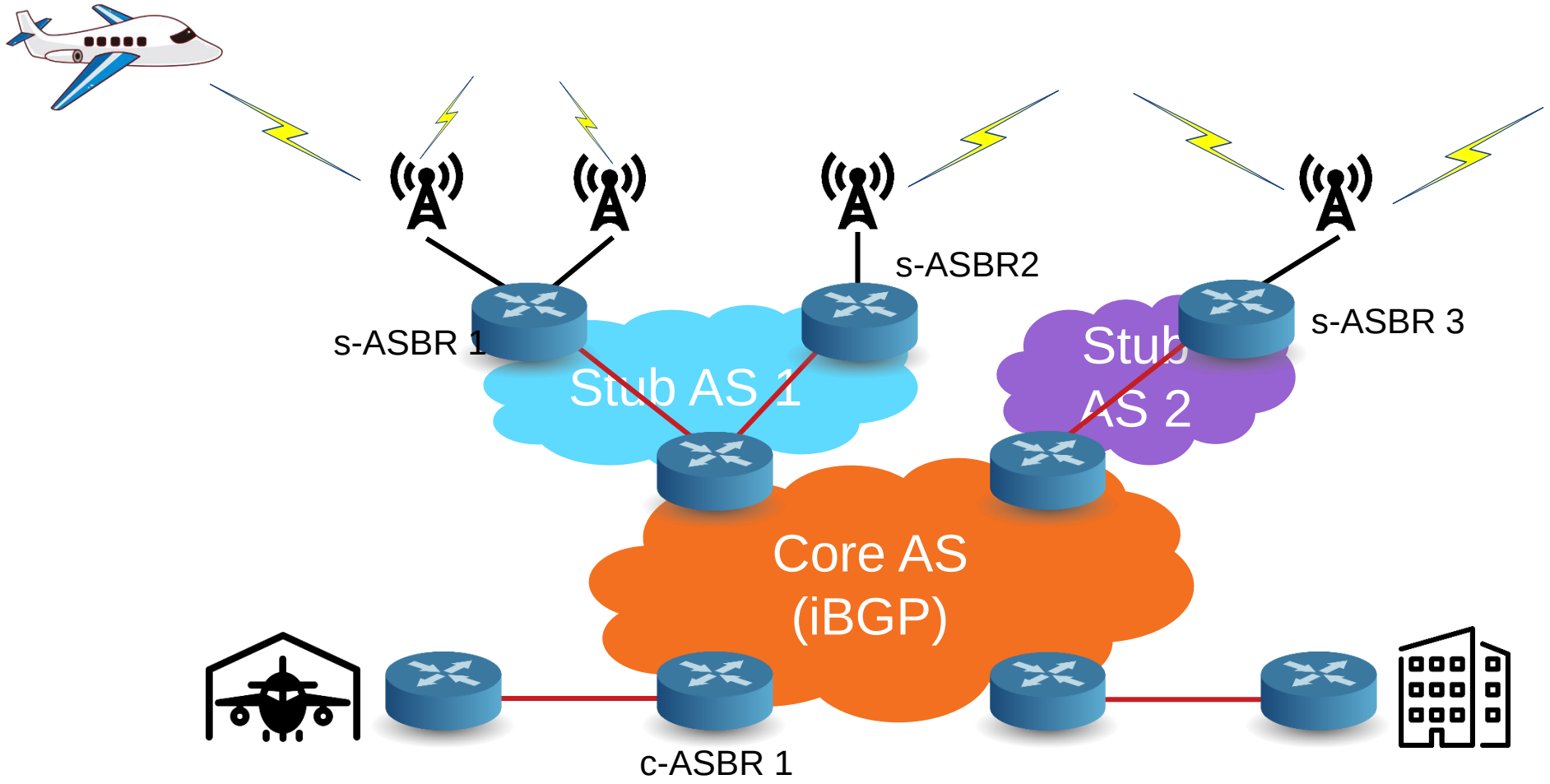
Collaboration with multiple IETF working groups:

- MIP6 Mobile IPv6
- MIPSHOP MIPv6 Signalling & Handoff Optimisation
- NEMO Network Mobility
- MONAMI6 Mobile Nodes & Multiple Interfaces in IPv6
- SHIM6 Site Multi-Homing by IPv6 Intermediation
- MOBIKE IKEv2 Mobility & Multihoming

BGP-Based Mobile Routing System for ATN/IPS

- IETF Draft: draft-ietf-rtgwg-atn-bgp-04
- Collaboration between:
  - Boeing (F. Templin, G. Saccone)
  - LinkedIn (G. Dawra)
  - Cisco (A. Lindem, V. Moreno)

BGP-Based Mobile Routing System for ATN/IPS



Air-to-Ground Security

Defined in ICAO Doc 9896

- Mobile nodes (aircraft) shall implement security provisions of the access network, e.g. auth and autz via WiMax, 3GPP, 3GPP2
- Nodes shall implement Mobile IPv6 Operation with IKEv2 (RFC4877):
  - SHA-256 pseudo-random function
  - ECDSA with SHA-256 using P-256 curve
  - AES-CBC-128 with HMAC-SHA-256 or AES-GCM-128

Thank You!

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