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SB 503 - Avionics Technologies
3-4 OPEN World & Electronics Flight Bag (EFB) Solutions

Professor: H. GOUTELARD (Contractor ENAC/Sup'Aéro)
Thales Avionics

Content

- Introduction

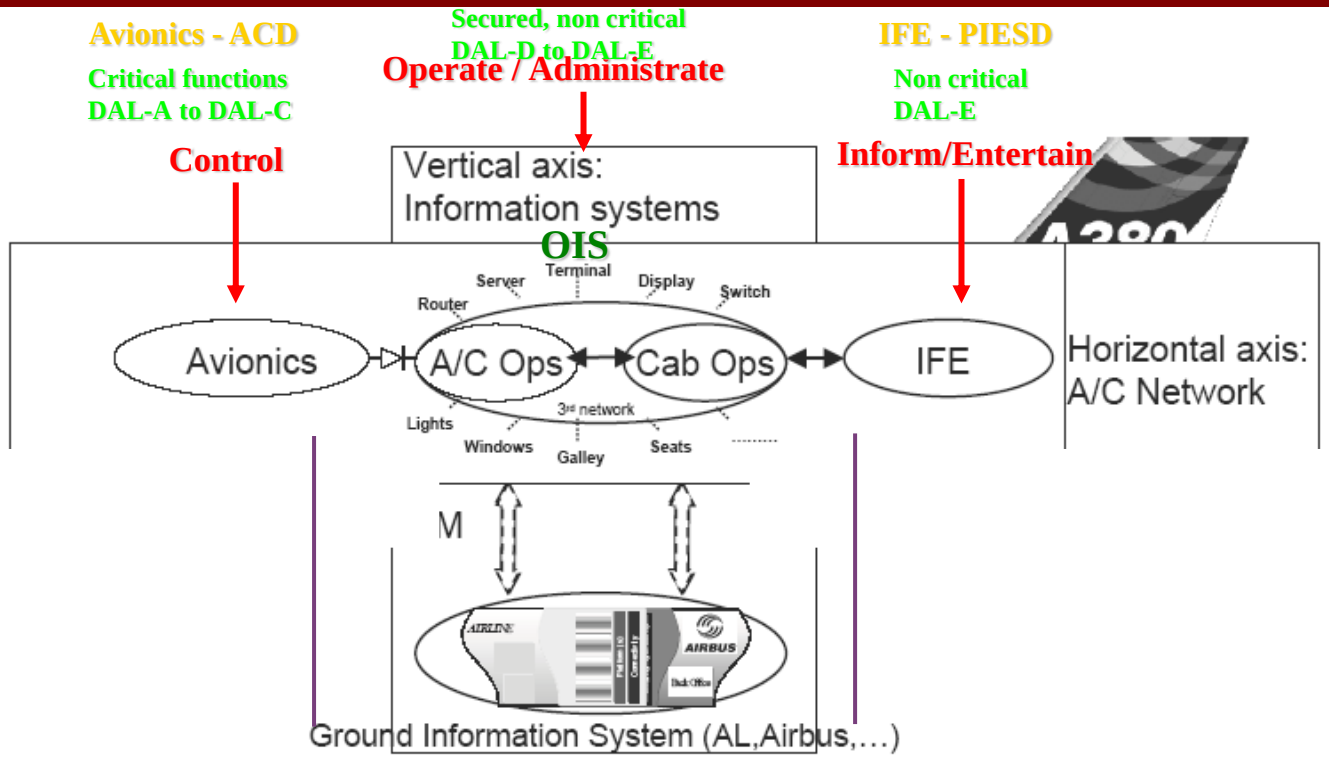
Linefit

- Onboard Information System in the aircraft
- Functions, Applications, Communication means
- Architecture and Hardware
- Thales technical approach

Retrofit

- Aircraft operations
- Operational Capacities, Functions, Applications,…
- Regulations
- Architecture & Hardware

Scope



Aircraft Overview - Avionics / OIS / IFE

OIS & IFE → Non Critical for flight
High need for communication capacity - Increased need for security

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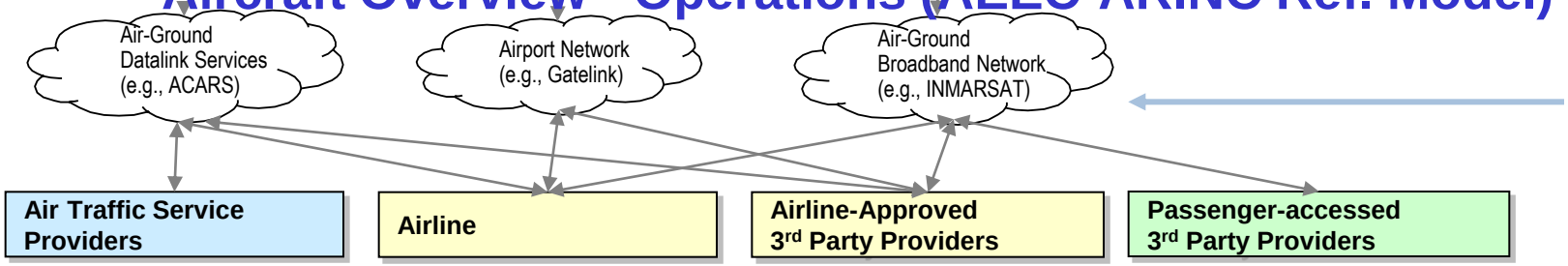
The Aircraft is becoming a node of the Airliner IT System (NOC)

Controlled		Uncontrolled	
Airframer	Airline	Passenger	Security
CLOSED	PRIVATE	PUBLIC	Responsibility
Control the Aircraft	Operate the Aircraft	Inform and Entertain the Passengers	Airline Ops
			Missions
Aircraft Control Domain (ACD)	**Airline Information Services Domain (AISD)**	**Passenger Information And Entertainment Services Domain (PIESD)**	**Passenger-owned Devices (POD)**
Flight and Embedded Control Systems	Administrative Functions	In-Flight Entertainment	Computing Devices
Cabin Core Systems	Flight Support	Passenger Internet	Wireless Devices (Cellular, PDAs)
	Cabin Support	On-board Web Access	:
	Maintenance Support	Passenger Device Interface	:
			Gaming Devices
Air-Ground Network Interface	Air-Ground Network Interface	Air-Ground Network Interface	
VHF / HF / SATCOM	Wireless LAN	Broadband / Cellular	

Domains

View Points

Aircraft Overview - Operations (AEEC-ARINC Ref. Model)



Reference

Cockpit
Autoflight
Navigation
Surveillance
Communications (AOC,ATS)
Displays
Centralized maintenance

Cabin
Air conditioning
Smoke detection
Pressure control
Ventilation control
Doors and Slides management

Utilities
Fuel Management
Landing gear extension/retraction
Braking & anti-skid
Steering

Energy
Power distribution Primary & Secundary
Remote

Avionics **/ ACD**

A/C SECURE OPERATIONS
- E-logbook
- On board Maintenance
- Data acquisition and recording
- Data loading & system configuration
- AirN@v

A/C OPERATIONS
- E Flight manuals and checklists
- E Cabin manuals and checklists
- Charts and maps
- Performance calculations

CABIN CREW OPERATIONS
Cabin Communications
Cabin logbook
Passenger database
Video surveillance
Cabin management system

PASSENGER APPLICATIONS
Moving maps
Communications services (intranet/internet)
IFE services (TV, …)

OIS / AISD / Open World

IFE / PIESD

Aircraft Overview - Functional Scope

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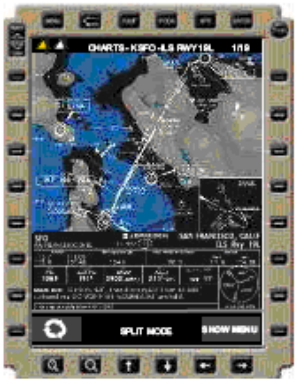
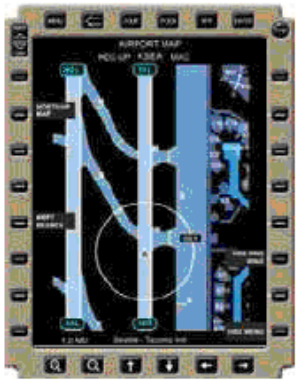
Sample applications running on OIS / EFB (Electronic Flight Bag)

Application Manager

Onboard Performance



Terminal Charts



Airport Moving Map

Enroute Moving Map
(future application)

Fault Reporting and eLogbook

eDocuments Browser

Data/Comm Manager

Video Surveillance

Electronic Flight Folder
(future application)

Electronic Reports
(future application)

Fuel Logbook
(future application)

Front-End is Electronic Flight Bag (EFB)
→ OMT, OIT, MAT, PMAT, …

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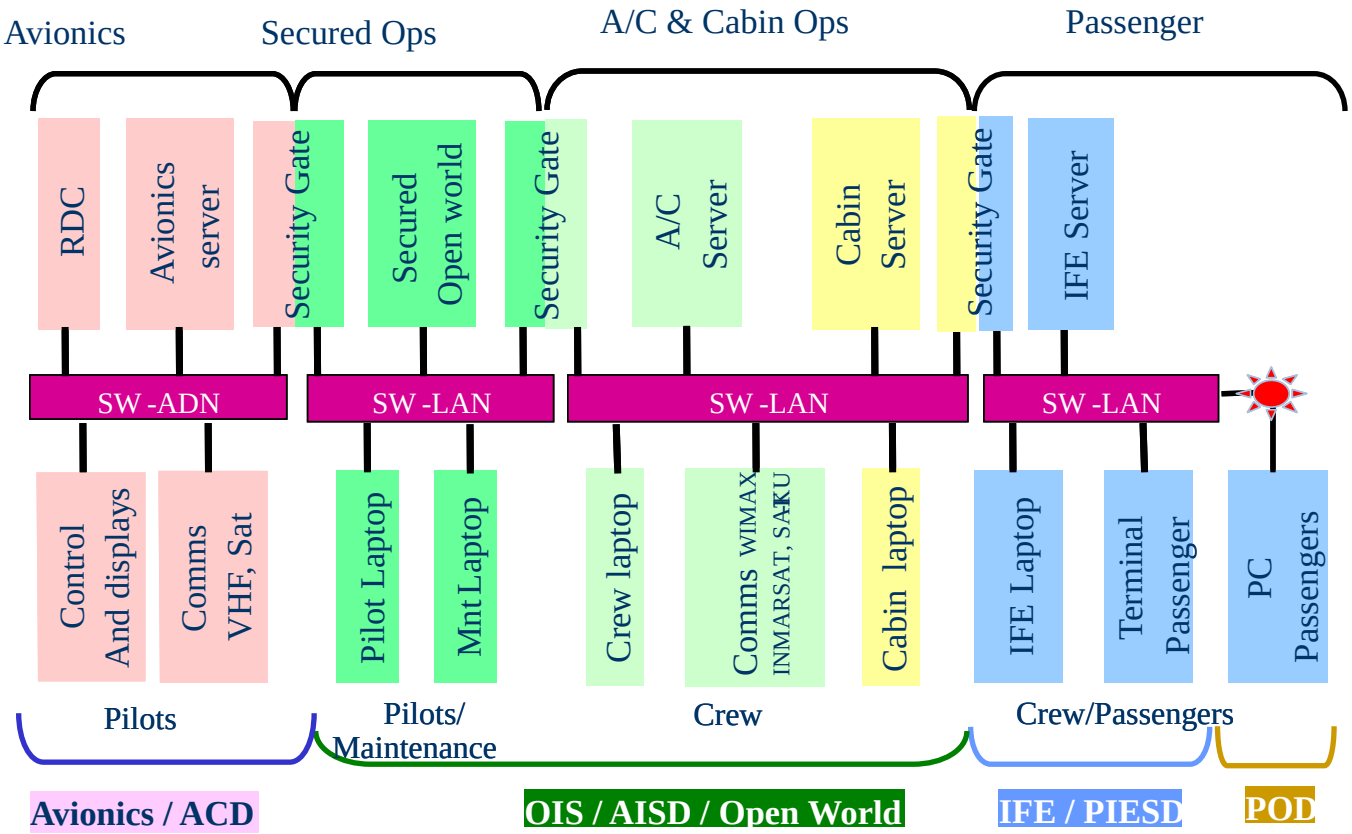
Aircraft Overview - Network Architecture



Main driver for architecture definition:
Criticality – Control, Operate, Inform
Data security – Closed, Private, Public (consistent threat management)
Communication means – Data flow consistency
Homogeneous management tools

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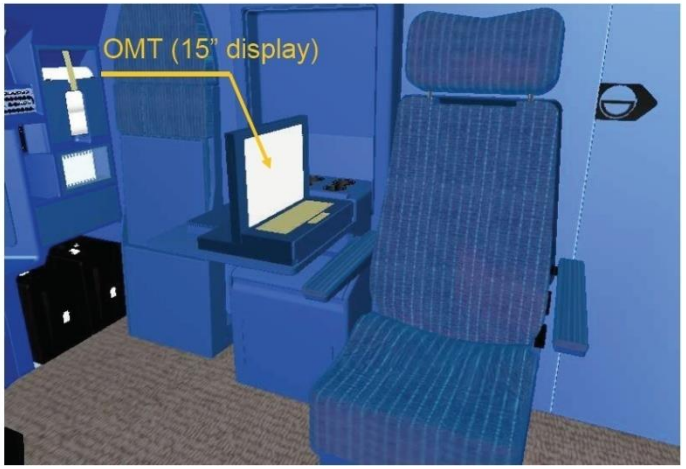
- OIT – Onboard Information Terminal – A380

OMT – Onboard Maintenance Terminal – A380



OIS Hardware

Goodrich Class 2 EFB – Display Unit - ATR

Goodrich Class 2 EFB - Processing Unit

THALES AIRBUS GROUP SAFRAN

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- Objectives for a new comer (bear in mind, OIS remains an emerging business after 10 years of hisrory…)
  - Gather operational needs and constraints
  - Deduce functional content
  - Define OIS/Open World characteristics
  - Understand each sub-domains specificities
  - Define new architecture options
  - Integrated vision and system architecture : Open World, Cabin , IFE, Communications, EFB, e-Application, Ground infrastructure
  - Propose innovations for current trade-off and challenges
  - Master critical technological bricks → Thales as Tier 1 integrator
  - Define product line

Anyone entering in such an emerging business, request a solid business case…

OIS - On-going Trade-off

- Shared / Separate communication means
- Network
  - Wired and wireless
  - On board topologies
  - Data security
- Server
  - Shared / Separate
  - CPU distribution
  - Virtualization techniques
  - Open source / Middleware specific
- Interfaces
  - Shared / Separate operator and maintenance interfaces
- Consistent industrial package definition

Solutions: Share Communication and Processing capabilities

OIS – Air/Ground Communication

- **Support for legacy systems**
  - Standard interface to ACARS
  - ATN/OSI interface ?
- **Evolution to IP communication for AOC / AAC / APC**
  - SATCOM (L-Band, Ku-Band, Iridium)
  - Cell Communication (Air cell)
  - Gatelink (Wifi, Wimax, 3G, 4G, …)
  - ACARS over IP, ATN over IP ?
- **Need for increased communication bandwidth:**
  - Content download
  - Differed personal email
  - Live TV
  - Telephony services
- **Need to be able to support new network technologies:**

Ability to share High Speed Links on Various Flight Phases

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OIS / EFB – Example: Thales Offer - TopWings

Climb & Cruise
Weather surveillance
Real-time equipment status
Obstacle surveillance
Cabin camera management

Connectivity In Flight

Descent
Approach mapping
Landing checklists
Ground mapping
Obstacle surveillance

Taxi
Taxi and track designation
Taxi mapping

Boarding
Flight file preparation
Pilot login
Access to checklists
Fuel calculations & confirmation
Performance calculations

Mission planning
Aircraft / crew scheduling
Flight preparation on electronic flight folder
Data transfer from Ops for validation
Weather forecast
Fuel status and planning
Access to electronic documents

"TopWings" aims at streamlining processes for a real optimization

Connectivity On Ground

Landing
Airport Mapping & Navigation
Logbook
FOQA MOQA data transfer
Maintenance applications
Maintenance transactions

Optimizing your operations

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OIS / EFB - TopWings – A wide range of applications

74 Cockpit Logical Functions organized in 7 Groups

Manage Flight Information

Run W&B and performance calculations

Communicate from the cockpit

Manage Charts and Maps

View & Manage Documents

Use add-ons

Ensure Security and Safety

15 Cockpit "Software" Applications

Cockpit Application Manager

Communication Application

Middleware Application

Electronic Flight Folder	Performance Calculation Application	Chart Manager	Cockpit Document Viewer	FOQA Manager
Journey Log	Weight & Balance Application	Surface Moving Map	Intelligent Library*	Cockpit Technical LogBook
Forms and Reports Application		Weather Viewer*	Movie Viewer*	

Application Interface

EFB Classes

EFB: an Airborne computer with display interface

Class 1

- Portable, mounted in cockpit
- Stowed during critical flight phases

Like a laptop PC…

Class 2 / 2+

- Portable, docked in cockpit
- Operates in all flight phases
- Requires airworthiness approval

Like a ruggedized, certified, dockable PC…

Note that class 1 & 2 do not require compliance with RTCA DO160E

Class 3

- Avionics Display, integrated into cockpit
- Part of aircraft hardware infrastructure
- Operates in all flight phases
- Requires airworthiness approval

Like an avionics display & computer system…

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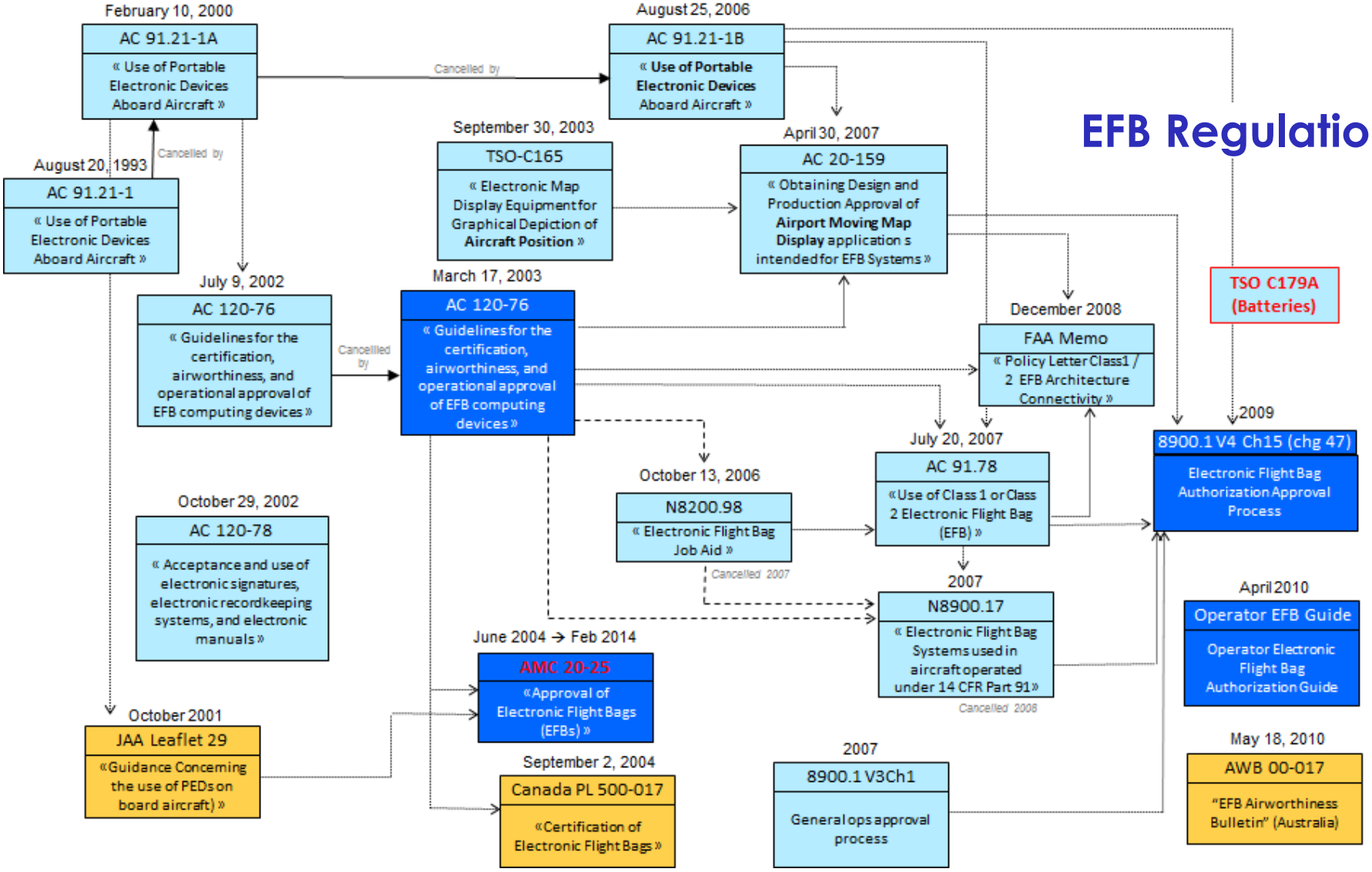
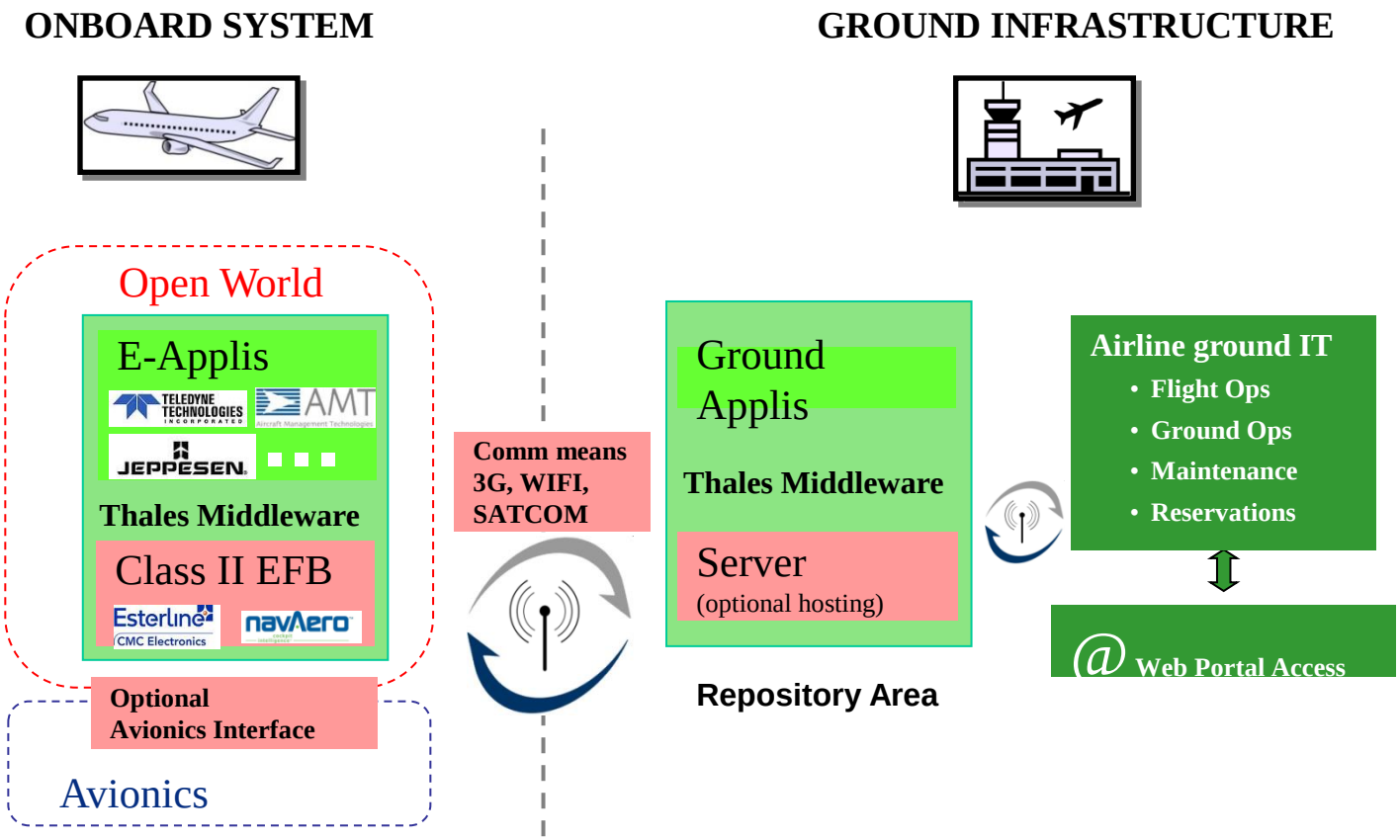
EFB Regulations



OIS / EFB - TopWings Overall Architecture – (Example: Thales offer)



A flexible architecture based on Airlines operational needs

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OIS / EFB - General Software Architecture

Avionics

Onboard solution

Avionics Interface

TopWings Starter Application

navAero CDSS application

Flightman applications

Airbus & Boeing perf module

Airbus – Ops Doc Browser (LPC)

TopWings Application Manager
- Data Management & Distribution
- Communication Management & Data security (Encryption, …)

USB/WIFI/3G

Ground solution

TopWings GAM – Distribution, Security & Synchronization

TopWings GAM - Repository

Airline IT Ops Doc

Airport runways & Obstacle Database

TopWings GAM - Applications

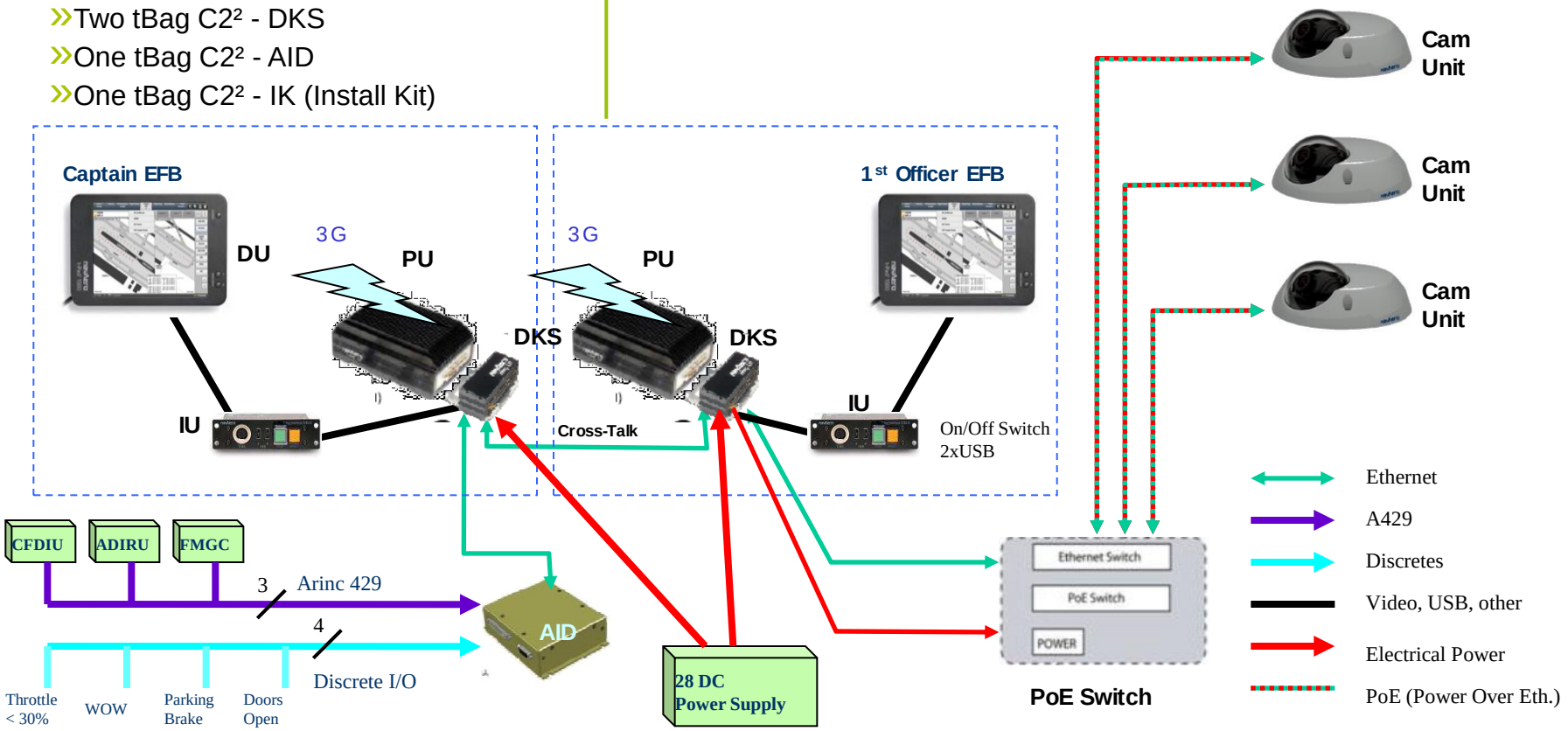
OIS / EFB - Onboard Hardware Solution (Example for an Airline customer)

Config Hardware :

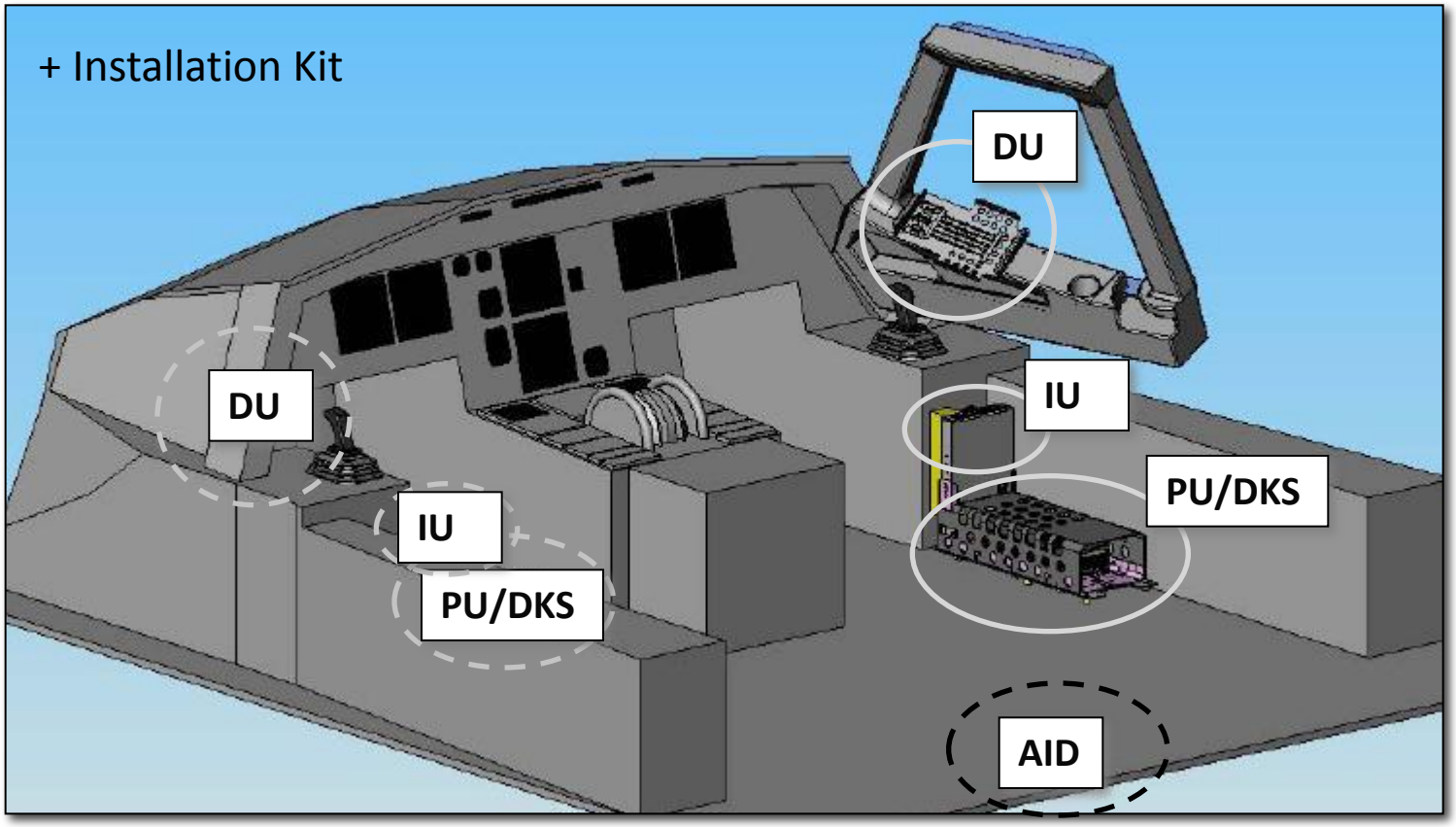
- Two tBag C2² - DU (tPad 1500)
- Two tBag C2² - PU (3G)
- Two tBag C2² - IU
- Two tBag C2² - DKS
- One tBag C2² - AID
- One tBag C2² - IK (Install Kit)

Additional items

- Three Cam – Cam units
- One Cam - PoSW (Power over Ethernet Switch)
- One Cam - IK (Installation Kit)



OIS / EFB – Cockpit installation



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OIS / EFB - TopWings Hardware (Industry Examples)

Optimization tool for operation

T-BagC2² +

T-Pad

- Aircraft attached Class II
- Processing unit and display separated

Processing: Intel Pentium M 1.6GHz, RAM 1GB DDR, 120 GB HDD or SSD

Interfaces: 4 Arinc 429, 4 Ethernet 100 base T, 3 USB 2.0, WLAN 802.11b/g, GSM 3G

Display: 10.4" touchscreen LED backlighted

Weight: 5,5 kg

Duty tool for pilot

- Versatile Pilot attached Class II
- Tablet PC embedded in a docking station

Processing: Intel® Core™2 Duo processor1.6GHz, (6MB L2, 1066 MHz FSB) 2.5 inch SATA 250GB SSD **Interfaces:** *Optional AID* with Arinc 429/717 HS/LS interf.
Built in Iridium, 2 USB, Ethernet, RS232, 2G/3G Wifi

Display: 10.4" touchscreen Backlighted

Weight: 0,980 Kg