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Luft- und Raumfahrt - Modulare und offene Avionikarchitekturen - Teil 005: Software

Série aérospatiale - Architectures Avioniques Modulaires et Ouvertes - Partie 005 : Software

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CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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Contents

Page

European foreword 5

Introduction 6

1 Scope 7
1.1 General scope 7
1.2 Software Architecture Overview 7
1.3 Software Architectural Components 7
1.3.1 General 7
1.3.2 Functional Applications 8
1.3.3 Application Management (AM) 8
1.3.4 Operating System (OS) 8
1.3.5 Generic System Management (GSM) 8
1.3.6 Run-Time Blueprints (RTBP) 9
1.3.7 Module Support Layer (MSL) 9
1.3.8 Application to OS Interface (APOS) 9
1.3.9 Module Support to OS Interface (MOS) 9
1.3.10 System Management to Blueprints Interface (SMBP) 9
1.3.11 System Management to OS Interface (SMOS) 9
1.3.12 OS Logical Interface (OLI) 9
1.3.13 GSM Logical Interface (GLI) 9
1.3.14 System Management Logical Interface (SMLI) 9
1.3.15 Module Logical Interface (MLI) 9

2 Normative references 10

3 Terms, definitions and abbreviations 11
3.1 Terms and definitions 11
3.2 Abbreviations 11

4 System Functions 14
4.1 System Management Function 14
4.1.1 General 14
4.1.2 GSM Function 15
4.1.3 AM Function 18
4.1.4 Error Handling 19
4.1.5 Built-In Test 19
4.2 Communication 21
4.2.1 MOAA Communication Model 21
4.2.2 Types of Data Transfer 24
4.2.3 Communication Configuration 25
4.2.4 Communication Protocols 26
4.2.5 Multicast 28
4.2.6 Distributed Multicast 30
4.2.7 Streaming 34
4.2.8 Data Representation 34
4.3 Security Management 40
4.3.1 Application Security Management 40

4.3.2 Generic Security Management ... 41
4.3.3 Encryption/Decryption and Authentication ... 42
4.3.4 Security Audit ... 43
4.3.5 Security Reference Monitoring ... 43
4.4 Module Management ... 43
4.5 Mass Memory Management ... 44
4.5.1 Overview ... 44
4.5.2 MMM Local File Management ... 44
4.5.3 Application File Access ... 45
4.5.4 CFM Download ... 45
4.5.5 Application Downloading ... 46
4.6 Graphics Management ... 47
4.7 Power Management ... 47
4.7.1 GSM Controlled Solution ... 48
4.7.2 MLI Controlled Solution ... 49
4.8 Network Management ... 50
4.8.1 Network Definition ... 50
4.8.2 Network Configuration ... 50
4.8.3 Network Health Monitoring ... 51
4.8.4 Network Technology Transparency ... 51
4.9 Time Management ... 51
4.9.1 Time reference ... 52
4.9.2 Clock Hierarchy ... 53
4.9.3 Clock Configuration ... 54
4.9.4 Clock Management ... 54
5 Software Architecture Definition ... 55
5.1 MSL ... 56
5.1.1 MSL Module Management ... 56
5.1.2 MSL Communication Capability ... 57
5.1.3 Resident Software ... 61
5.2 OSL ... 61
5.2.1 GSM ... 61
5.2.2 OS Functions ... 69
5.3 RTBP ... 86
5.3.1 Overview ... 86
5.3.2 RTBP tree ... 86
5.3.3 SMBP Services to Access the RTBP Tables ... 87
5.4 Application Layer ... 88
5.4.1 Language Considerations ... 89
5.4.2 Application Error Handling ... 89
6 Direct Interfaces Definitions ... 90
6.1 APOS ... 90
6.2 MOS ... 93
6.2.1 Generic MOS ... 95
6.2.2 Specific Services ... 137
6.2.3 MOS Bespoke Extension Services ... 152
6.3 SMBP ... 170
6.3.1 RTBP Tree Grammar ... 171
6.3.2 Services for Retrieving Tables ... 177
6.4 SMOS ... 187
6.4.1 Process and Thread Management Services ... 189
6.4.2 Fault Management Services ... 190

6.4.3 VC Configuration Services ... 192
6.4.4 Network Configuration Services ... 199
6.4.5 Security Management Services ... 202
6.4.6 Built-In Test Management Services ... 207
6.4.7 CFM Information Services ... 211
6.4.8 CFM Resources Management Services ... 214
6.4.9 Time Configuration Services ... 217
6.4.10 Logging Management Services ... 218

7 Logical Interfaces Definitions ... 222
7.1 OLI ... 222
7.1.1 VC Header ... 222
7.1.2 OLI Services ... 222
7.2 GLI ... 222
7.2.1 GLI Representation ... 222
7.2.2 GLI Services ... 222
7.3 SMLI ... 230
7.3.1 SMLI Representation ... 230
7.3.2 SMLI Services ... 230
7.4 MLI ... 238
7.4.1 TC Header ... 238
7.4.2 MLI Services ... 238
7.4.3 Protocol ... 259

8 Data Type Definitions ... 265
8.1 IDL ... 265
8.1.1 General ... 265
8.1.2 Basic Types ... 265
8.1.3 Name Spaces ... 265
8.1.4 Limitations ... 266
8.2 Data Types ... 266

9 Tailoring ... 290

Annex A (normative) RTBP XML Schema ... 297
A.1 MOAA Types ... 297
A.2 MOAA Type Extensions ... 303
A.3 MOAA Runtime Blueprints ... 306

Annex B (informative) Standard Evolution Form ... 320

Bibliography ... 321

European foreword

This document (EN 4660-005:2019) has been prepared by the Aerospace and Defence Industries Association of Europe - Standardization (ASD-STAN).

After enquiries and votes carried out in accordance with the rules of this Association, this Standard has received the approval of the National Associations and the Official Services of the member countries of ASD, prior to its presentation to CEN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by February 2020, and conflicting national standards shall be withdrawn at the latest by February 2020.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 4660-005:2011.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

The purpose of this MOAA standard is to define a set of open architecture standards, concepts & guidelines for Advanced Avionics Architectures (A3).

The three main goals for the MOAA Standards are:

— reduced life cycle costs;

— improved mission performance;

— improved operational performance.

The MOAA standards are organised as a set of documents including:

— a set of agreed standards that describe, using a top down approach, the Architecture overview to all interfaces required to implement the core within avionics system and

— the guidelines for system implementation through application of the standards.

The document hierarchy is given hereafter: (in Figure 1 the document is highlighted)

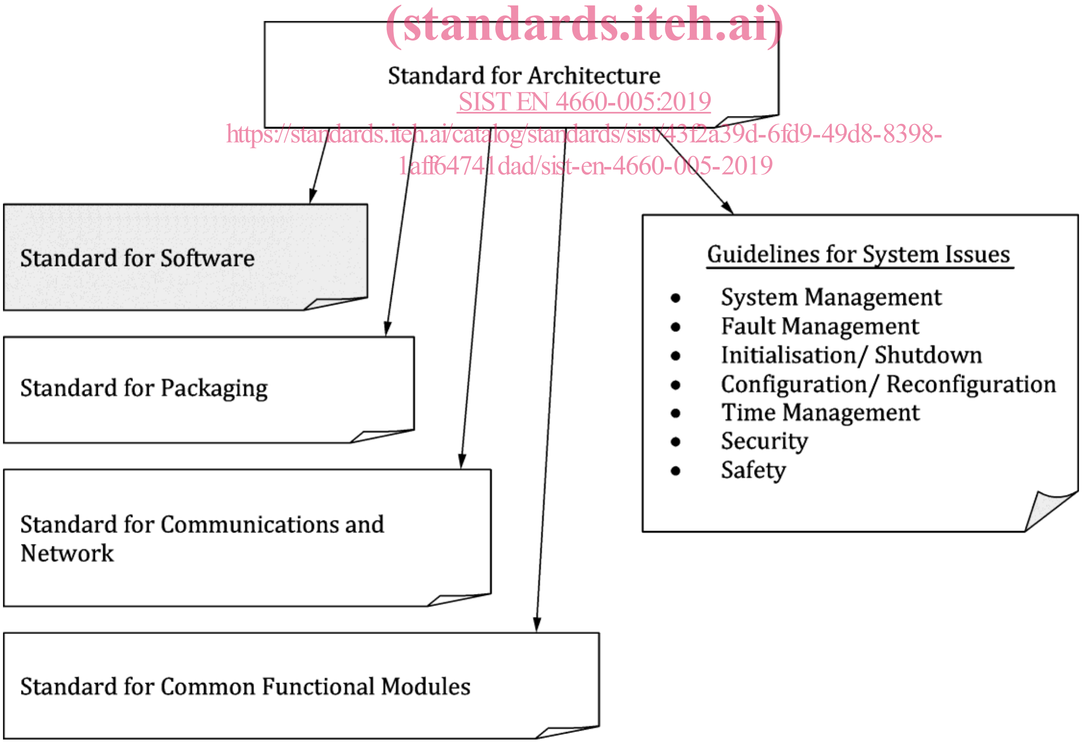

Figure 1 — MOAA Standard Documentation Hierarchy

1 Scope

1.1 General scope

This European Standard establishes uniform requirements for design and development of software architecture for modular avionics systems.

1.2 Software Architecture Overview

The MOAA Software Architecture is based on a three-layer stack as shown by a simplified Figure 2.

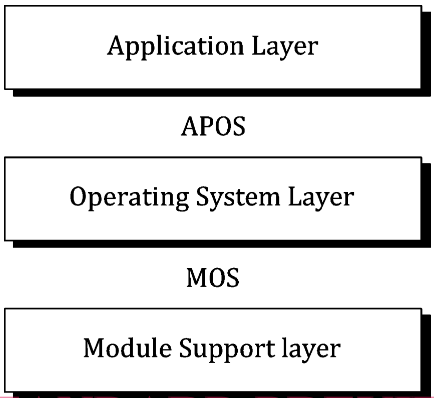

Figure 2 — MOAA Three Layer Software Architecture

Each layer is described in terms of it dependency/independency on both the aircraft system and the underlying hardware.

Table 1 — Software Layer Independence

Software Layer	Aircraft Dependency	Hardware Dependency
Application Layer (AL)	Dependent	Independent
Operating System Layer (OSL)	Independent	Independent
Module Support Layer (MSL)	Independent	Dependent

1.3 Software Architectural Components

1.3.1 General

Figure 3 provides an overview of the software architectural components and software interfaces.

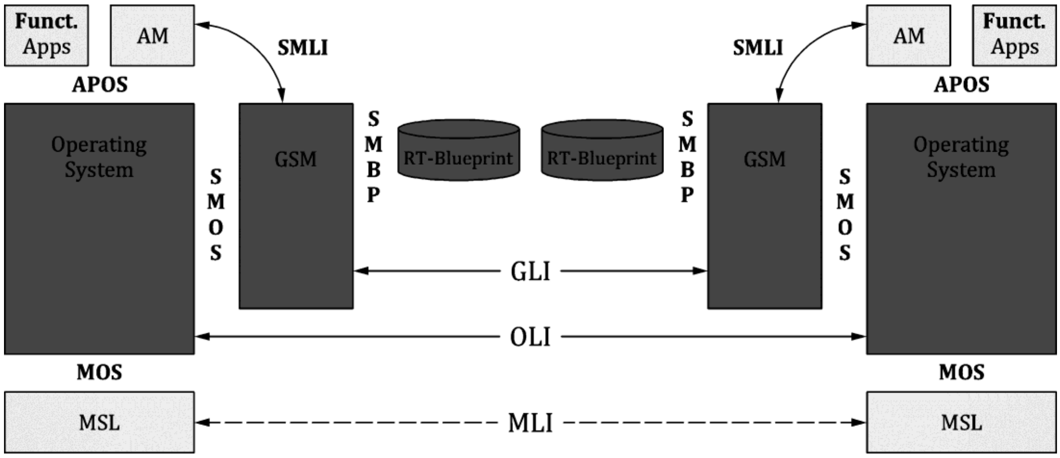

Figure 3 — The Software Architecture Model

1.3.2 Functional Applications

The term "Functional Applications" relates to all functions that handle the processing of operational data, e.g.

- Radar Applications;
- Mission Management;
- Stores Management;
- Vehicle Management System;
- Communication, Navigation and Identification.

1.3.3 Application Management (AM)

AM is responsible for the non-standardised system management, i.e. the AM performs the non-generic system management. As an example, the AM may perform the mission/moding management. The interface between the AM and GSM is the System Management Logical Interface (SMLI) (see 4.1.3).

1.3.4 Operating System (OS)

A Real-Time OS provides the part of OSL functionality that controls the real-time behaviour of the Processing Element and its associated resources (see 5.2.2).

1.3.5 Generic System Management (GSM)

The GSM is responsible for the management of the core processing (see 4.1.2 and 5.2.1). This functionality is divided into four areas:

- Health Monitoring;
- Fault Management;
- Configuration Management;
- Security Management.

1.3.6 Run-Time Blueprints (RTBP)

The RTBP contain the information (e.g. process description, routing information, fault management data) required to configure and manage the core processing on which it is hosted (see 5.3).

1.3.7 Module Support Layer (MSL)

The MSL encapsulates the details of the underlying hardware and provides generic, technology independent access to low-level resources (see 5.1).

1.3.8 Application to OS Interface (APOS)

The APOS is a direct interface that separates the aircraft dependent software (AL) from the aircraft independent software (OSL). Its purpose is to provide the processes in the AL with a standardised OS independent interface to those services provided by the OS, thus promoting the portability and re-use of application software (see 6.1).

1.3.9 Module Support to OS Interface (MOS)

The MOS is a direct interface that separates the OSL from the hardware dependent software (MSL). Its purpose is to provide the OS with a hardware independent/technology transparent interface to the functionality contained within the MSL. The MOS therefore allows the same OSL software to reside on different implementations of a CFM regardless of the underlying hardware (see 6.2).

1.3.10 System Management to Blueprints Interface (SMBP)

This direct interface, encapsulated within the OSL between the GSM and the blueprints, allows the structure and implementation of the blueprints to remain non-standardised, while defining a standardised interface to them (see 6.2.3).

1.3.11 System Management to OS Interface (SMOS)

This direct interface, encapsulated within the OSL, describes the services provided by the OS to the GSM (see 6.3).

1.3.12 OS Logical Interface (OLI)

The OLI describes the intercommunications between two instantiations of OS's regarding Virtual Channel (VC) communications and data presentation (see 7.1).

1.3.13 GSM Logical Interface (GLI)

The GLI describes the intercommunications between GSM instances on separate RE (see 7.2).

1.3.14 System Management Logical Interface (SMLI)

The SMLI standardises a VC based communication protocol between the AM and GSM. AM and the GSM must cooperate and to do so, they communicate and synchronise themselves via the SMLI (see 7.3).

1.3.15 Module Logical Interface (MLI)

This logical interface (communication protocol) defines the logical interactions between modules to meet the module interoperability and system buildability requirements (see 7.4).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEEE 1588:2008, *Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems*[1]

IEEE 754:1985, *Binary Floating-Point Arithmetic*

IEEE 802.3, *IEEE Standard for Ethernet*

ISO/IEC 14977:1996, *Information technology — Syntactic metalanguage — Extended BNF*[2]

ASAAC2-GUI-32450-001-CPG Issue 01, *Final Draft of Guidelines for System Issues*[3]

— *Volume 1 — System Management*

— *Volume 2 — Fault Management*

— *Volume 3 — Initialisation and Shutdown*

— *Volume 4 — Configuration/Reconfiguration*

— *Volume 5 — Time Management*

— *Volume 6 — Security*

— *Volume 7 — Safety*

ARINC 653P1, *Avionics Application Software Standard Interface, Part 1, Required Services*, (Version 3, 11-2010)[4]

ARINC 653P2, *Avionics Application Software Standard Interface, Part 2, Extended Services*, (Version 2, 06-2012)[4]

OpenGL® ES, The Khronos Group Inc.[5]

RFC 1350:1992, *The TFTP Protocol (Revision 2)*[6]

RFC 2347:1998, *TFTP Option Extension*[6]

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1 Published by: IEEE (Institute of Electrical and Electronics Engineers), http://standards.ieee.org

2 Published by: International Organization for Standardization (ISO), www.iso.org

3 In preparation at the date of publication of this standard.

4 Published by: ARINC, www.aviation-ia.com/product-categories

5 Published by: The Khronos group, www.khronos.org

6 Published by: RFC Editor, www.rfc-editor.org

RFC 2348:1998, *TFTP Block Size Option*[6]

RFC 2349:1998, *TFTP Timeout Interval and Transfer Size Options*[6]

RFC 951:1985, *Bootstrap Protocol (BOOTP)*[6]

RFC 1542:1993, *Clarification and Extensions for the Bootstrap Protocol*[6]

RFC 2132:1997, *DHCP options and BOOTP Vendor Extensions*[6]

3 Terms, definitions and abbreviations

For the purposes of this document, the terms, definitions and abbreviations apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at http://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1 Terms and definitions

Use of “shall”, “should” and “may” within the standards observe the following rules:

— the word 'SHALL' in the text expresses a mandatory requirement of the standard;

— the word 'SHOULD' in the text expresses a recommendation or advice on implementing such a requirement of the standard. It is expected that such recommendations or advice be followed unless good reasons are stated for not doing so;

— the word 'MAY' in the text expresses a permissible practice or action. It does not express a requirement of the standard.

3.2 Abbreviations

AC	Aircraft
AGT	Absolute Global Time
AL	Application Layer
ALT	Absolute Local Time
AM	Application manager
APOS	Application to OS [interface]
ASAAC	Allied Standard Avionics Architecture Council
ATM	Asynchronous Transfer Mode
BIT	Built-In Test
BMC	Best Master Clock
BMC	Between Module Communication
CBIT	Continuous BIT

CDR	Common Data Representation
CFM	Common Functional Module
CM	Configuration Management
COTS	Commercial-Off-The-Shelf
CPU	Central Processing Unit
DMC	Distributed Multicast Communication
DPM	Data Processing Module
EBNF	Extended Backus-Naur Form
EW	Electronic Warfare
FC	Fibre Channel
FIFO	First In First Out
FM	Fault Management
GLI	Generic System Management Logical Interface
GSM	Generic System Management
HM	Health Monitoring
HW	Hardware
IA	Integration Area
IBIT	Initiated BIT
ID	Identification
IDL	Interface Definition Language
IEEE	Institute of Electrical and Electronics Engineers
IF	Interface
IMA	Integrated Modular Avionics
IMC	Intra Module Communication
IPC	Intra Processor Communication
IPEC	Intra PE Communication
LC	Logical Configuration
LSB	Least Significant Byte
MC	Master Clock
MLI	Module Logical Interface
MMM	Mass Memory Module
MOS	MSL to OS [interface]
MRC	Master Reference Clock
MSB	Most Significant Byte
MSL	Module Support Layer
MSU	Module Support Unit

N/A	Not Applicable
NC	Network Channel
NII	Network Independent Interface
NIU	Network Interface Unit
NSM	Network Support Module
NW	Network
OC	Ordinary Clock
OLI	Operating System Logical Interface
OMG	Object Management Group
OS	Operating System
OSL	Operating System Layer
PBIT	Power-Up BIT
PCM	Power Conversion Module
PE	Processing Element
PSE	Power Supply Element
PTP	Precision Time Protocol
PU	Processing Unit
QoS	Quality of Service
RE	Resource Element
RC	Remote Clock
RF	Radio Frequency
RFC	Request for Comments
RLT	Relative Local Time
RTBP	Runtime Blueprints
RU	Routing Unit
SCU	Switch Control Unit
SM	Security Management
SMBP	System Management to Blueprints Interface
SMLI	System Management Logical Interface
SMOS	System Management to OS Interface
SPM	Signal Processing Module
SW	Software
TC	Transfer Connection
TC	Transparent Clock
tftp	trivial file transfer protocol
TLS	Three Layer Stack