



# European Component Oriented Architecture (ECOA) Collaboration Programme: Architecture Specification Part 5: Platform Requirements

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**Note:** *This specification represents the output of a research programme and contains mature high-level concepts, though low-level mechanisms and interfaces remain under development and are subject to change. This standard of documentation is recommended as appropriate for limited lab-based evaluation only. Product development based on this standard of documentation is not recommended.*

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## 0 Introduction

This Architecture Specification provides the definitive specification for creating ECOA-based systems. It describes the standardised programming interfaces and data-model that allow a developer to construct an ECOA-based system. The details of the other documents comprising the rest of this Architecture Specification can be found in Section 3.

This document is Part 5 of the Architecture Specification, and describes the high level requirements for the conformity of platform to ECOA.

The purpose of this document is providing sets of requirements to help ECOA Platform or ECOA Reference Platform providers to build the right product and to help system integrators to check the conformance of their procurements.

The document relies on other Reference Manuals of the ECOA Architecture Specification and refers to them. The assumption is made that any ECOA Platform or ECOA Reference Platform is delivered at least with a Toolset, a Version Description and a User's Manual.

This document is structured as follows:

- Section 6 describes the generic high level requirements for any ECOA Platform,
- Section 7 describes the high level requirements for an ECOA Reference Platform.

The requirements use the following keywords for which the definitions are taken from the RFC 2119:

- SHALL – This word, or the terms "REQUIRED" or "MUST", mean that the definition is an absolute requirement of the specification.
- SHOULD - This word, or the adjective "RECOMMENDED", mean that there may exist valid reasons in particular circumstances to ignore a particular item, but the full implications must be understood and carefully weighed before choosing a different course.
- MAY - This word, or the adjective "OPTIONAL", mean that an item is truly optional. One vendor may choose to include the item because a particular marketplace requires it or because the vendor feels that it enhances the product while another vendor may omit the same item.

## 1 Scope

This purpose of this Architecture Specification is to establish a uniform method for design, development and integration of software systems using a component oriented approach.

## 2 Warning

This specification represents the output of a research programme and contains mature high-level concepts, though low-level mechanisms and interfaces remain under development and are subject to change. This standard of documentation is recommended as appropriate for limited lab-based evaluation only. Product development based on this standard of documentation is not recommended.

## 3 Normative References

Ref	Description
Architecture Specification Part 1	IAWG-ECOА-TR-001 / DGT 144474 Issue 3 Architecture Specification Part 1 – Concepts
Architecture Specification Part 2	IAWG-ECOА-TR-012 / DGT 144487 Issue 3 Architecture Specification Part 2 – Definitions
Architecture Specification Part 3	IAWG-ECOА-TR-007 / DGT 144482 Issue 3 Architecture Specification Part 3 – Mechanisms
Architecture Specification Part 4	IAWG-ECOА-TR-010 / DGT 144485 Issue 3 Architecture Specification Part 4 – Software Interface
Architecture Specification Part 5	IAWG-ECOА-TR-008 / DGT 144483 Issue 3 Architecture Specification Part 5 – Platform Requirements
Architecture Specification Part 6	IAWG-ECOА-TR-006 / DGT 144481 Issue 3 Architecture Specification Part 6 – ECOА Logical Interface
Architecture Specification Part 7	IAWG-ECOА-TR-011 / DGT 144486 Issue 3

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## Architecture Specification Part 7 – Metamodel

### Architecture Specification Part 8

IAWG-ECOА-TR-004 / DGT 144477

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Architecture Specification Part 8 – C Language Binding

### Architecture Specification Part 9

IAWG-ECOА-TR-005 / DGT 144478

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Architecture Specification Part 9 – C++ Language Binding

### Architecture Specification Part 10

IAWG-ECOА-TR-003 / DGT 144476

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Architecture Specification Part 10 – Ada language Binding

ISO/IEC 8652:1995(E) with COR.1:2000

Ada95 Reference Manual

Issue 1

ISO/IEC 9899:1999(E) Programming Languages – C

ISO/IEC 14882:2003(E) Programming Languages C++

## 4 Definitions

For the purpose of this standard, the definitions given in Architecture Specification Part 2 and those shown below apply.

## 5 Abbreviations

API	Application Programming Interface
ARINC	Aeronautical Radio, Incorporated
ASAAC	Allied Standards Avionics Architecture Council
ASC	Application Software Component
COTS	Commercial Off-The-Shelf
CPU	Central Processing Unit
DDS	Data Distribution Service
ECOА	European Component Oriented Architecture
ELI	ECOА Logical Interface
EUID	ECOА Unique Identifier (ID)
FIFO	First In, First Out
HR	High Resolution

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ID	Identifier
IMA	Integrated Modular Avionics
IoC	Inversion-of-Control
IP	Internet Protocol
LRU	Line Replaceable Unit
NaN	Not a Number
OS	Operating System
PC	Personal Computer
POSIX	Portable Operating System Interface
QoS	Quality of Service
RFC	Request For Comments
RT	Real Time
RTOS	Real-Time Operating System
SOA	Service-oriented Architecture
SW	Software
TCP	Transmission Control Protocol
UDP	User Datagram Protocol
UML	Unified Modeling Language
UTC	Coordinated Universal Time
VME	Versa Module Europa (bus)
XML	eXtensible Markup Language
XSD	XML Schema Definition

## 6 Generic Requirements for an ECOA Platform

This section provides generic high level requirements that a platform shall satisfy to claim a conformance to the ECOA Standard and then be identified as an ECOA Platform.

**Table 1 – Generic requirements for an ECOA Platform**

Id.	Requirement
	<b>Implementation</b>
GPR.1	The ECOA Platform <b>shall</b> conform to an identified version of the ECOA Standard (i.e. a given version of the ECOA Architecture Specification).
GPR.2	The ECOA Platform <b>shall</b> support at least one language binding.
GPR.3	Any language binding (of the bindings identified in the ECOA Standard) <b>shall</b> be supported in its entirety.
GPR.4	The platform <b>shall</b> be delivered with its logical model (see logical-system.xml in [Architecture Specification Part 2, Architecture Specification Part 7]).
GPR.5	The ECOA Platform <b>shall</b> map ECOA Modules onto realtime preemptible FIFO tasks based on the ECOA Module priorities.
GPR.6	The ECOA Platform <b>shall</b> map Protection Domains onto segregated memory spaces.
GPR.7	The ECOA Reference Platform <b>should</b> store logs in a non-volatile memory.
GPR.8	The ECOA Platform <b>should</b> enable the Application Software Components to use OS API (where such API is available), these Application Software Components being considered as drivers.
GPR.9	The software update of the ECOA Platform <b>should</b> be done on Integrator's site.
	<b>Hardware</b>
GPR.10	Each computing element in an ECOA Platform <b>shall</b> be synchronized to a single version of a time reference common across the whole ECOA Platform.
GPR.11	The maximum skew, from the ECOA Platform common time, <b>shall</b> be no more than 1msec.
	<b>Usage</b>
GPR.12	The ECOA Platform or its Toolset <b>may</b> provide a centralised capability to deploy binary elements (e.g. executables, platform-specific data) on Computing Nodes.
GPR.13	The ECOA Platform or its Toolset <b>may</b> offer a central capability to remove totally a deployment (e.g. erase of temporary or platform-specific data, release of platform-level resources used for the deployment, etc.).
GPR.14	The ECOA Platform or its Toolset <b>may</b> provide a centralized capability to access logs generated by Application Software Components through the ECOA Log API or

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	by the ECOA Platform itself (e.g. to signal of an internal problem).
GPR.15	Logs generated by the ECOA Platform <b>shall</b> be interpretable for a person not involved in the development of the ECOA Platform, i.e. the origin and a content of the log entry, eventually filtered by some means, shall provide information to determine the proximate cause of the log (e.g. resource exhaustion, technical problem, ECOA System inconsistency, etc.).
GPR.16	The ECOA Platform or its Toolset <b>shall</b> offer a runtime or off-line mean to generate logs in a format conform to the specifications.
GPR.17	The ECOA Platform or its Toolset <b>may</b> offer an off-line filtering capability to analyze logs (per Application Software Component, per Computing Node, etc.).
GPR.18	The ECOA Platform or its Toolset <b>may</b> offer a centralized capability to measure performances (Computing Node/core loads, memory use, etc.).
GPR.19	The ECOA Platform or its Toolset <b>should</b> provide a capability to set its variable elements (e.g. watchdog default values, network stack size, etc.).
GPR.20	The ECOA Platform or its Toolset <b>may</b> provide a capability to monitor and log interactions at service link level.
GPR.21	The ECOA Platform or its Toolset <b>should</b> provide a centralized capability to command ECOA Module Runtime Lifecycles.
GPR.22	The ECOA Platform or its Toolset <b>should</b> provide a centralized capability to select starting runtime lifecycle states (e.g no autostart of ECOA Supervision Modules)
GPR.23	The ECOA Platform or its Toolset <b>should</b> provide a centralized capability to report/monitor the runtime lifecycle states of ECOA Modules.
GPR.24	The ECOA Platform or its Toolset <b>should</b> provide a centralized capability to report/monitor the availability states of Services.
	<b>Development environment</b>
GPR.25	The ECOA Platform Toolset <b>shall</b> support the editing of platform-specific files (non ECOA files) for the configuration of platform-specific elements (e.g. compiler and linker options, IP address, stack sizes, etc.).
GPR.26	The ECOA Platform Toolset <b>may</b> provide automated generation of elements in support of Application Software Component development (ECOA Module skeletons, makefiles, etc.).
GPR.27	The ECOA Platform Toolset <b>may</b> offer a compatibility mode with the file structure defined in [Architecture Specification Part 2].
GPR.28	The ECOA Platform Toolset <b>shall</b> support the assembly and the integration of an Application Software Component delivered either in linkable binary (e.g. object code) or in source.
GPR.29	The ECOA Platform Toolset <b>shall</b> provide automatic generation of elements required for the deployment of an Assembly Schema, based on a given Deployment Schema.

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GPR.30	The ECOA Platform Toolset <b>may</b> support the incremental compilation and linking of Application Software Components referenced in a given Assembly Schema.
GPR.31	The ECOA Platform Toolset <b>should</b> enable the definition of compiler and linker options specific to an Application Software Component.
GPR.32	The ECOA Platform supplier <b>should</b> offer a standalone software development package for cross-development (compilation, unit testing) of Application Software Components by a person having no access to the ECOA Platform.
GPR.33	The ECOA Platform Toolset <b>should</b> be able to validate the linkages between ASCs at Design Time.
GPR.34	The ECOA Platform Toolset <b>should</b> offer a capability to configure the Application Software Component at Design Time.
GPR.35	The ECOA Platform Toolset <b>should</b> offer a capability to configure the Application Software Component at Design Time.
GPR.36	The ECOA Platform Toolset <b>should</b> offer a capability to ensure coarse grain resource allocation at Design Time.
GPR.37	The ECOA Platform Toolset <b>shall</b> offer a capability to ensure fine grain resource allocation at Design Time.
GPR.38	The ECOA Platform Toolset <b>should</b> generate adequate (reviewable) information about how each Protection Domain executable is laid out.
GPR.39	The ECOA Platform Toolset <b>should</b> be able to save and restore multiple configuration settings.
GPR.40	The ECOA Platform Toolset <b>should</b> be able run scripted actions.
<b>Documentation</b>	
GPR.41	The platform version description shall describe at least traceability matrix towards this requirement table, language(s) supported, RTOS employed, hardware interfaces supported, Open Standards supported, statement with regards to single-source dependencies, description of hardware with regards to robustness (i.e. avionic use, etc.), known defects/limitations, change reports for updates, licensing terms for the software, licensing terms for generated software embedded into the built software, available qualification evidence for HW and SW, etc.
GPR.42	The User's Manual <b>shall</b> describe how to setup and install the ECOA Platform in a vehicle platform.
GPR.43	The User's Manual <b>shall</b> describe all specific capabilities of the ECOA Platform (i.e. capabilities offered by this particular ECOA Platform in addition of those defined by the Reference Manuals) (e.g. available OS API).
GPR.44	The User's Manual <b>shall</b> describe the way to operate all generic and specific capabilities/features offered by the ECOA Platform and its Toolset (e.g. how to deploy an Application Software Component delivered in linkable binary or in source code, how to set compiler and linker options specific to an Application Software Component or to a set of Application Software Components, how to use the logging

	and performance monitoring related functionalities, etc.).
GPR.45	The User's Manual <b>shall</b> provide the Usage Domain (constraints and limitations) of the ECOA Platform, in particular limitations (e.g. maximum size of versioned data, maximum size of messages, maximum number of deployable ECOA Modules per Computing Node, Computing Node computing power, Computing Node memory size, inter-Computing Nodes communication bandwidth, etc.).
GPR.46	Synchronisation accuracy, precision and resolution <b>shall</b> be documented.
GPR.47	The User's Manual <b>shall</b> describe how to lead fine grain scheduling analysis.

## 7 Requirements for an ECOA Reference Platform

This section provides high level requirements that a platform shall fit to be an ECOA Reference Platform for training, development, ASC verification, etc.

**Table 2 – Requirements for an ECOA Reference Platform**

Id.	Requirement
	<b>Implementation</b>
RPR.1	The ECOA Reference Platform <b>shall</b> conform to an identified version of the ECOA Standard.
RPR.2	The ECOA Reference Platform <b>shall</b> fully support in its entirety any binding used by Application Software Components logged in the ECOA Catalogue (see business model).
RPR.3	The ECOA Reference Platform <b>shall</b> be delivered with its logical model (see logical-system.xml in [Architecture Specification Part 2, Architecture Specification Part 7]).
RPR.4	The ECOA Reference Platform <b>shall</b> map ECOA Modules onto realtime preemptible FIFO tasks based on the ECOA Module priorities.
RPR.5	The ECOA Reference Platform <b>should</b> provide a RT FIFO preemptible scheduler per processor.
RPR.6	The ECOA Reference Platform <b>shall</b> map Protection Domains onto segregated memory spaces.
RPR.7	The ECOA Reference Platform <b>shall</b> store logs in a non-volatile memory.
RPR.8	The ECOA Reference Platform <b>shall</b> enable the Application Software Components to use POSIX/Windows API, these Application Software Components being considered as drivers.
RPR.9	The software update of the ECOA Reference Platform <b>shall</b> be done on site in less than one hour.
RPR.10	The ECOA Reference Platform <b>shall</b> support user configuration of network exchanges (e.g. choice of security features) to facilitate communications with sufficiently high speed and low latency (e.g. by removing the default firewall by default or by setting level of security of the IP layer).
RPR.11	The ECOA Reference Platform <b>shall</b> support user configuration of system services to facilitate execution of real-time applications (e.g. by removing useless database services).
	<b>Hardware</b>
RPR.12	The ECOA Reference Platform <b>shall</b> use widely available hardware and software resources (PC, open OS, etc.).
RPR.13	The ECOA Reference Platform, in a minimal configuration to support ASC using the strict ECOA API defined in the Reference Manuals, <b>shall</b> be capable of running on a

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	single standalone development workstation.
RPR.14	The ECOA Reference Platform <b>shall</b> enable, in a transparent manner, the easy addition of network endpoints or memory on hardware resources.
RPR.15	Each computing element in an ECOA Platform <b>shall</b> be synchronized to a single version of a time reference common across the whole ECOA Platform.
RPR.16	The maximum skew, from the ECOA Platform common time, <b>shall</b> be no more than 1msec.
	<b>Usage</b>
RPR.17	The ECOA Reference Platform or its Toolset <b>shall</b> provide logins and separate workspaces for multiple users.
RPR.18	The ECOA Reference Platform or its Toolset <b>shall</b> provide a centralised capability to deploy binary elements (e.g. executables, platform-specific data) on Computing Nodes.
RPR.19	The ECOA Reference Platform or its Toolset <b>shall</b> provide a centralised capability to deploy multiple Assemblies on distinct parts of the hardware resources.
RPR.20	The ECOA Reference Platform or its Toolset <b>shall</b> offer a central capability to remove totally a deployment (e.g. erase of temporary or platform-specific data, release of platform-level resources used for the deployment, etc.).
RPR.21	The ECOA Reference Platform or its Toolset <b>shall</b> provide a centralized capability to access to logs generated by Application Software Components through the ECOA Log API or by the ECOA Platform itself (e.g. to signal of an internal problem).
RPR.22	Logs generated by the ECOA Reference Platform <b>shall</b> be interpretable for a person not involved in the development of the ECOA Reference Platform, i.e. the origin and the content of a log entry, eventually filtered by some means, shall provide information to determine the proximate cause of the log (e.g. resource exhaustion, technical problem, ECOA System inconsistency, etc.).
RPR.23	The ECOA Platform or its Toolset <b>shall</b> offer a runtime or off-line mean to generate logs in a format conform to the specifications.
RPR.24	The ECOA Reference Platform or its Toolset <b>shall</b> offer an off-line filtering capability to analyze logs (per Application Software Component, per Computing Node, etc.).
RPR.25	The ECOA Reference Platform or its Toolset <b>may</b> offer an on-line filtering capability to analyze logs (per Application Software Component, per Computing Node, etc.).
RPR.26	The ECOA Reference Platform or its Toolset <b>shall</b> offer a centralized capability to measure performances (Computing Node/core loads, memory use, etc.).
RPR.27	The ECOA Reference Platform or its Toolset <b>shall</b> provide a capability to set its variable elements (e.g. watchdog default values, network stack size, runtime-level checks, etc.)
RPR.28	The ECOA Reference Platform or its Toolset <b>shall</b> provide a capability to monitor and log interactions at service link level.

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RPR.29	The ECOA Reference Platform or its Toolset <b>shall</b> provide a centralized capability to command ECOA Module Runtime Lifecycles.
RPR.30	The ECOA Reference Platform or its Toolset <b>shall</b> provide a centralized capability to select starting runtime lifecycle states (e.g no autostart of ECOA Supervision Modules).
RPR.31	The ECOA Reference Platform or its Toolset <b>shall</b> provide a centralized capability to report/monitor the runtime lifecycle states of ECOA Modules.
RPR.32	The ECOA Reference Platform or its Toolset <b>shall</b> provide a centralized capability to report/monitor the availability states of Services.
	<b>Development environment</b>
RPR.33	The ECOA Reference Platform Toolset <b>shall</b> support the editing of platform-specific files (non ECOA files) for the configuration of platform-specific elements (e.g. compiler and linker options, IP address, stack sizes, etc.).
RPR.34	The ECOA Reference Platform Toolset <b>shall</b> provide automated generation of elements in support of Application Software Component development (ECOA Module skeletons, makefiles, etc.).
RPR.35	The ECOA Reference Platform Toolset <b>shall</b> offer a compatibility mode with the file structure defined in reference [Architecture Specification Part 2].
RPR.36	The ECOA Reference Platform Toolset <b>shall</b> support the assembly and the integration of an Application Software Component delivered either in linkable binary (e.g. object code) or in source.
RPR.37	The ECOA Reference Platform Toolset <b>shall</b> provide automatic generation of elements required for the deployment of an Assembly Schema, based on a given Deployment Schema.
RPR.38	The ECOA Reference Platform Toolset <b>shall</b> support the incremental compilation and linking of Application Software Components referenced in a given Assembly Schema.
RPR.39	The ECOA Reference Platform Toolset <b>shall</b> support the definition of compiler and linker options specific to an Application Software Component.
RPR.40	The ECOA Reference Platform supplier <b>should</b> offer a standalone software development package for cross-development (compilation, unit testing) of Application Software Components by a person having no access to the ECOA Reference Platform.
RPR.41	The ECOA Reference Platform Toolset <b>shall</b> be able to validate the linkages between ASCs at Design Time.
RPR.42	The ECOA Reference Platform Toolset <b>shall</b> offer a capability to configure the Application Software Component at Design Time.
RPR.43	The ECOA Reference Platform Toolset <b>shall</b> offer a capability to configure the Application Software Component at Design Time.
RPR.44	The ECOA Reference Platform Toolset <b>shall</b> offer a capability to ensure coarse grain

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	resource allocation at Design Time.
RPR.45	The ECOA Reference Platform Toolset <b>shall</b> offer a capability to ensure fine grain resource allocation at Design Time.
RPR.46	The ECOA Platform Toolset <b>should</b> generate adequate (reviewable) information about how each Protection Domain executable is laid out.
RPR.47	The ECOA Platform Toolset <b>should</b> be able to save and restore multiple configuration settings.
RPR.48	The ECOA Platform Toolset <b>should</b> be able run scripted actions.
	<b>Documentation</b>
RPR.49	The ECOA Reference Platform Version Description shall describe at least traceability matrix towards this requirement table, language(s) supported, RTOS employed, hardware interfaces supported, Open Standards supported, statement with regards to single-source dependencies, description of hardware with regards to robustness (i.e. avionic use, etc.), known defects/limitations, change reports for updates, licensing terms for the software, licensing terms for generated software embedded into the built software, available qualification evidence for HW and SW, etc.
RPR.50	The User's Manual <b>shall</b> describe how to setup and install the ECOA Reference Platform in IT facilities.
RPR.51	The User's Manual <b>shall</b> describe all specific capabilities of the ECOA Reference Platform (i.e. capabilities offered by this particular ECOA Reference Platform in addition of those defined by the Reference Manuals)(e.g. available OS API).
RPR.52	The User's Manual <b>shall</b> describe the way to operate all generic and specific capabilities/features offered by the ECOA Reference Platform and its Toolset (e.g. how to deploy an Application Software Component delivered in linkable binary or in source code, how to set compiler and linker options specific to an Application Software Component or to a set of Application Software Components, how to use the logging and performance monitoring related functionalities, how to create logins and workspaces, etc.).
RPR.53	The User's Manual <b>shall</b> describe the Usage Domain (constraints and limitations) of the ECOA Platform, in particular limitations (e.g. maximum size of versioned data, maximum size of messages, maximum number of deployable ECOA Modules per Computing Node, Computing Node computing power, Computing Node memory size, inter-Computing Nodes communication bandwidth, etc.).
RPR.54	Synchronisation accuracy, precision and resolution <b>shall</b> be documented.
RPR.55	The User's Manual <b>shall</b> describe how to lead fine grain scheduling analysis.