



European Component Oriented Architecture (ECOA®) Collaboration Programme: Preliminary traceability matrix between AS6/AS7 metamodel concepts

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Prepared by
Dassault Aviation and Thales DMS

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Note: This specification is preliminary and is subject to further adjustments. Consequently, users are advised to exercise caution when relying on the information herein. No warranties are provided regarding the completeness or accuracy of the information in this preliminary version. The final version of the document will be released to reflect further improvements.

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0 Introduction

This document identifies:

- The preliminary traceability matrix between AS6/AS7 metamodel concepts to ease migration to AS7,
- The remaining open technical points at the end of the work on the preliminary version of the ECOA AS7 specification.

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1 Preliminary traceability matrix between AS6/AS7 metamodel concepts

1.1 Application Level Concepts (Single Node Platform)

Legend:

	ECOASpecificationOption
	ECOASpecificationExtension

The absence of crosses in the "API impact", "Behaviour impact" and "Impact on existing AS6 component" columns of the table below means that this is not applicable.

Domain	Concept	AS6	AS7	Comparison / Explanation	API impact	Behaviour impact	Impact on existing AS6 components (source code and behaviour)
Data Types	Basic type on 64 bits	T_uint64 T_int64	T_uint64	T_uint64 is an optional type in AS7 [OPTION UINT64] in AS7	X		No impact on existing AS6 components if option is available.
			T_int64	T_int64 is an optional type in AS7 [OPTION INT64] in AS7	X		No impact on existing AS6 components if option is available.
	Namespace	Namespace		data types naming conflicts are solved by the use of different library names			
	libraries dependancies	Use attribute		dependendies between libraries are deduced from types definition analyses in AS7			
Component level	Software lowest level block Implementing treatments to be sequentially executed	Module	Concrete Component	Identical			
	Set of Software lowest level blocks related to the same functional need	Component	Composite	An AS7 composite does not provide or require services. Its interface is composed of operations.			
	Recursive composition artefact	Composite	Composite	An AS7 composite does not provide or require services. Its interface is composed of operations.			
Component Kind	Components with a functional implementation	Module / Component / Composite	Standard component / composite				
	Periodic triggering component	TriggerInstance	PeriodicTriggerManager Component	See Domain "Trigger"			
	Component able to schedule an alarm with an absolute time	DynamicTriggerInstance	DynamicTriggerManager Component	Same behaviour as AS6 dynamicTriggerInstance Scope = AS7 composite [OPTION DYNAMIC TRIGGER MANAGER]			
	Component interfacing ECOA and non-ECOASpecification worlds	Driver Component	External Component	AS7 External component is the only component that is not single-threaded (one additional thread to exchange with non-ECOASpecification software) No external operation allowing non-ECOASpecification software to generate an Event towards an ECOASpecification component. [OPTION AUTO START EXTERNAL TASK] allows to automatically start the External Component additional thread	X (API modified based on concept evolutions)	X	Once AS6 driver components re-designed as AS7 external components (with source code updates), behaviour change is minor.
				[OPTION SUPERVISION]			
	Component able to manage other components		Supervisor Component			X (new)	No impact on existing AS6 components
Container	Software providing the operating environment for a component	Container	Container	Identical			

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Domain	Concept	AS6	AS7	Comparison / Explanation	API impact	Behaviour impact	Impact on existing AS6 components (source code and behaviour)
Insertion policies	Pre-requisites to insert a component into an ECOA system (QoS, ressources requirements, available options on ECOA platform, scheduling policy...)	insertion policies					
Components interactions	Instance of an exchange mechanism between components	Operation	Operation				
	Set of operations related to the same functional need	Service	Operation Metadata Implicit Links	Traceability with system components possible using metadata. Prefix in Implicit Links may be used to group operations having the same connexion rules (then possibly mimic a micro-services approach).			
	N to P exchange corresponding to command and notification functional intentions	Event	Event				
	N to P exchange corresponding to information functional intention	Versioned Data	Versioned Data				
	1 server to N clients double exchange corresponding to transaction functional intention	RequestResponse	RequestReponse	Immediate RR added	X (new API for immediate RR)		No impact on existing AS6 components (same API for deferred RR)
	External Interface to exchange with non-ECOA world	External Interface	External Interface	External Interface is optional in AS7 [OPTION EXTERNAL INTERFACE]	X		No impact on existing AS6 components if option is available.
	Expected performances (period, max ageing etc.) on operations	Quality of Service (QoS)	Operation metadata				No impact on existing AS6 components execution if the AS7 platform offers the same level of QoS data consideration than the one of the AS6 platform components were previously executed on.
Trigger	Periodic trigger	triggerInstance within a Component Implementation	PeriodicTrigger Manager Component	AS7 PeriodicTriggerManager can be connected to any component of an Application: its scope may be wider than an AS6 triggerInstance.			
	Dynamic trigger	dynamicTrigger within a Component Implementation	Component Trigger	AS7 trigger event has no parameter and is always activating. AS7 trigger cannot be set using an absolute time (it only accepts a delay). The scope of an AS7 Trigger may be smaller than the AS6 dynamicTrigger.	X (new API for Trigger but no impact on AS6 components reuse)	X	Evolution but possibility to create an AS7 standard component behaving the same way than AS6 dynamicTrigger (then no impact on existing AS6 components source code in case of reuse, but new AS7 component to be created/added in assembly and deployment)
			DynamicTriggerManager Component	Same behaviour as AS6 dynamicTriggerInstance Scope = AS7 composite [OPTION DYNAMIC TRIGGER MANAGER]			No impact on existing AS6 components if option is available.
Pinfo	Read access to non-volatile memory data	Pinfo	Pinfo	No read access restriction (public/private) in AS7 infrastructure		X	No impact on existing AS6 components but a specific attention on pinfo access is required from AS7 integrators.
	Write access to non-volatile memory data		Writable Pinfo	[OPTION PINFO WRITE]	X (new API)	X (new)	No impact on existing AS components
Context		User Context	User Context	Not optional in AS7			

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Domain	Concept	AS6	AS7	Comparison / Explanation		API impact	Behaviour impact	Impact on existing AS6 components (source code and behaviour)
		Warm Start Context	Warm Start Context	[OPTION WARM START CONTEXT]				
Property		Property	Property					
Variable	Conditional links management data		Variable	[OPTION SUPERVISION]		X (new API)	X (new)	No impact on existing AS6 components
Assembly		Operation Links	Operation Links					
	Connexion between groups of operations involving the same components	Service Links	Implicit Links	Implicit links are not fully configurable (example : fifosize)			X	No impact on existing AS6 components but a specific attention on assembly schema is required from AS7 integrators.
	Promotion of a component interface to the upper-level composite interface	Promotion Links	Promotion Links					
	Dynamic management of connexions between components		Conditional Links	Available only if supervision option is available [OPTION SUPERVISION]			X (new)	No impact on existing AS6 components
Behaviour	Management of component states	Lifecycle	Lifecycle	AS7 lifecycle is extended (UNAVAILABLE state and RESET transition are added)				
	Start-up	Phased approach	Explicit attribute to select start-up mode	AS7 defines 3 start-up modes : - none (when start-up is managed by Supervisor components or User Interface) - minimal: components are started by infrastructure with no synchronization control. - synchronized (when the initialization of all components id finished, all components are started): compliant with AS6 infrastructure behaviour with a wider scope (application instead of AS6 component level).			X	No impact on existing AS6 components when synchronized mode is chosen. New start-up modes added for more flexibility in ECOA use.
	Description of components algorithm structure for early validation purpose	Behaviour						No impact on existing AS6 components
Infrastructure services	Time management	local time	local time	Identical		X (if options not available)	X	No impact on existing AS6 components when options are available.
		system time	system time	System time synchronization not guaranteed by AS7 infrastructure: when unavailable, the system time API returns local time with an error code. [EXTENSION] required to ensure availability of system time.	In AS7, API time services are only generated on request (specific model attribute).			
		UTC time	UTC time	when UTC time is unavailable, the UTC time API returns local time with an error code [OPTION UTC TIME] to ensure availability uf UTC time				

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Domain	Concept	AS6	AS7	Comparison / Explanation	API impact	Behaviour impact	Impact on existing AS6 components (source code and behaviour)
	Log					X (components log activation is always possible but not standardized)	No impact on existing AS6 components but platform logging configuration is managed differently.
	Entity responsible for triggering recovery procedures in case of errors (Fault Handler)	isFaultHandler	isFaultHandler	AS6 Core and AS7 Core are limited to a specific API generation enabling components to raise errors.			
Deployment	Treatments whose execution and data are isolated in a separated and dedicated memory space	Protection Domain	Executable	AS7 components are deployed in an application (mono-node architecture) An application is an executable that can create children sub-executables.			
	Software made of components and deployed on a single computing node Possible unit of exchange between industrial partners		Application				
			Task	AS7 Task corresponds to a group of AS6 Modules to be sequentially executed with the same priority.		X	No impact on existing AS6 components but AS7 integrators are fully responsible for components deployment (not only responsible for the definition of priorities). With AS7, Integrators may still define a deployment equivalent to the one the infrastructure would have generated for a given AS6 platform.
			Port	Set of Application external operations which are grouped considering a technical matter (physical channel, direction, protocol etc.) [OPTION COMM PORTS]			
Generation / Building	Instructions for components integration	Bin-desc	APIType and APIVersion Extra elements Deployment attributes	AS7 allows the use of a non-standard language binding for ECOA API (provided that it respects SW interface requirements and authorized languages which are C, C++, Ada, High Integrity Ada, Java, Python and Rust) Association between binary files and concrete components is not necessary in AS7 (bijection) Compiling complementary instructions are given in AS7	X (extended authorized API)		No impact on AS6 components reuse
Fault Management	Ability to apply recovery actions	Fault Handler	Fault Handler	AS7 Fault Handler option is restricted to application level in ECOA Core perimeter [OPTION FAULT HANDLER]			

Table 1 : Preliminary traceability matrix between AS6 and AS7 Application Level Concepts (Single Node Platform)

1.2 System Level Concepts

AS6	AS7
ECOAS6 system requirements deal with the following concepts: <ul style="list-style-type: none">• Logical system• Multi-nodes or multi-platforms assembly• Fault Management• System Time• ELI (ECOAS6 Logical Interface)	ECOAS7 system requirements may be addressed in the following extensions: <ul style="list-style-type: none">• MULTI_APP_ASSEMBLY• SYSTEM_TIME• FAULT_MANAGEMENT• ELI

Table 2: Preliminary traceability matrix between AS6 and AS7 System Level Concepts

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2 Remaining open technical points at the end of the work on the preliminary version of the ECOA AS7 specification

At the end of the study several technical points remain open and will need to be addressed in order to obtain a complete ECOA AS7 Standard.

These technical points include:

- Documentary and technical development of the **options** (via PART6 – Options of the **ECOA Architecture Specification and possible adjustments on other PARTS**) identified during the study, namely:
 - [OPTION SUPERVISION],
 - [OPTION DYNAMIC TRIGGER],
 - [OPTION UINT64],
 - [OPTION INT64],
 - [OPTION FAULT HANDLER],
 - [OPTION EXTERNAL INTERFACE],
 - [OPTION PINFO WRITE],
 - [OPTION WARM START CONTEXT],
 - [OPTION AUTO START EXTERNAL TASK],
 - [OPTION UTC TIME],
 - [OPTION COMM PORTS].
- Documentary and technical development of **extensions**. At this stage, those identified are as follows:
 - MULTI_APP_ASSEMBLY,
 - SYSTEM_TIME,
 - FAULT_MANAGEMENT,
 - ELI (ECOA Logical Interface).
- Documentary and technical development of **bindings**:
 - Complete reference bindings :
 - Ada Language Binding,
 - High Integrity Ada Language Binding.
- Finally, it is recommended:
 - To develop and/or upgrade a tooled chain in support of the ECOA AS7 Standard,
 - To standardize ECOA AS7 with the BNAE.

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