

# Software Architecture Reuse Technologies in Critical Embedded Systems

## *Systematic Literature Review*

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## GOAL OF THE SLR:

**To analyze and characterize** the research efforts on the field of **architecture reuse**, and more specifically on **reuse technologies in CES development**, such as *patterns, patterns languages, views, frameworks, viewpoint, reference architectures, reference models and architectural styles*, from researchers' and practitioners' point of view.

## Primary Research Questions

- ? Which of the proposed reuse technologies (patterns, patterns languages, views, frameworks, viewpoint, reference architectures, reference models and architectural styles) are the most used in CES development?
- ? Which are the reported pros and cons of the reuse technologies in the development of CES?
- ? Which are the application domains in where the reuse technologies, applied in CES, have been conducted?
- ? Which of these technologies can be related to each other and in which way?
- ? What evidence is available to adopt the reuse technologies in the development of CES?

# Question Quality and Amplitude

P

**Population:** *“Software projects in Critical Embedded Systems (CES) that uses reuse technologies”.*

I

• **Intervention:** *“different reuse technologies as framework, pattern, wiew, viewpoint, reference architecture, reference model, language patterns, and styles, used during the development of CES”.*

C

• **Comparison:** We can compare each reuse technology, in a given application domain where CES are developed, and to conclude which is the most used and why; and,

O

• **Outcomes:** *“The analysis and characterization of the studies proposed in the literature that report the use of any reuse technologies during the development of software to CES”.*

# Search

An initial scoping study was conducted to determine the search terms to use for each resource. The major terms in the search string come from our research questions.

After eleven iterations, was selected the following search string:

(“software architecture” OR architectural)

**AND**

(reuse OR reusing OR reusable OR reusability OR pattern OR view OR framework OR viewpoint OR “reference architecture” OR “reference model” OR “architectural style”)

**AND**

(“critical embedded system” OR “critical embedded software” OR “hard real-time system” OR “distributed real-time system” OR “embedded real-time” OR “critical real-time” OR “real-time embedded system”)

## Search

The publication databases selected for our SLR are shown in the following table.

According to [8], these databases are efficient to conduct SLR in the contexts of Software Engineering and CES. Furthermore, *Scopus* has been added, since it is considered the largest database of abstracts and citations [14];

Digital Library	Location
ACM Digital Library	<a href="http://dl.acm.org/">http://dl.acm.org/</a>
IEEE Xplore	<a href="http://ieeexplore.ieee.org/Xplore/home.jsp">http://ieeexplore.ieee.org/Xplore/home.jsp</a>
ScienceDirect	<a href="http://www.sciencedirect.com/">http://www.sciencedirect.com/</a>
Compendex	<a href="http://www.engineeringvillage.com/">http://www.engineeringvillage.com/</a>
Scopus	<a href="http://www.scopus.com/">http://www.scopus.com/</a>
Web of Science	<a href="http://apps.webofknowledge.com/">http://apps.webofknowledge.com/</a>

## Search

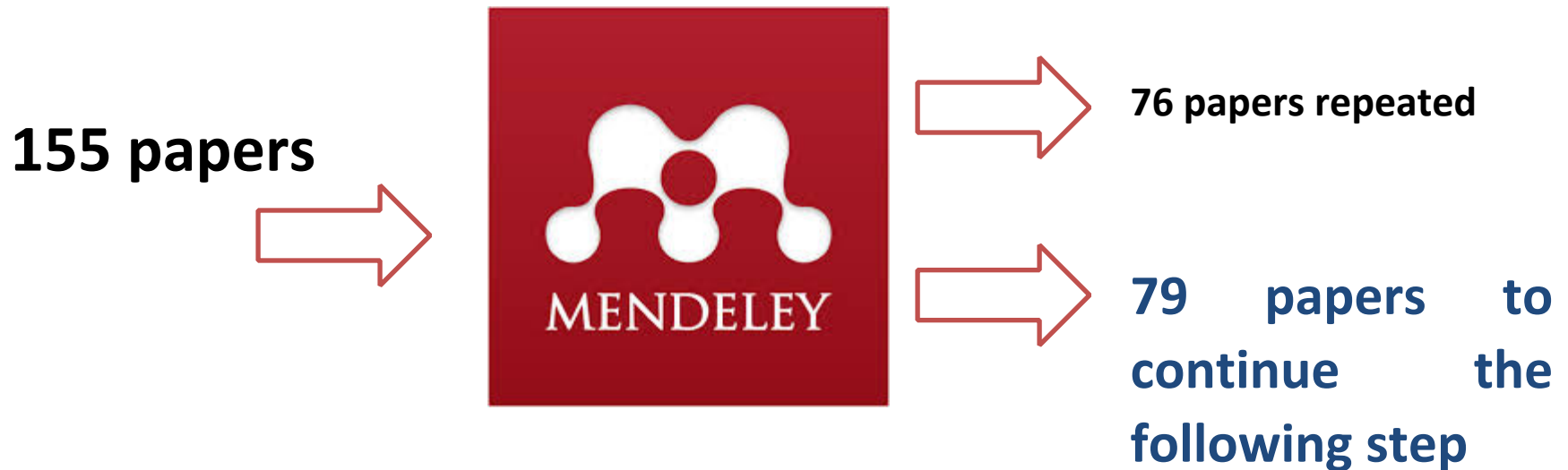
The final list of sources searched, their search terms, and the number of publications found for each resource are listed in the following table.

Digital Library	Total results found
ACM Digital Library	3
IEEE Xplore	37
ScienceDirect	7
Compendex	45
Scopus	45
Web of Science	22

**155**

## Search

Was made a depuration of duplicated papers using the ***Mendeley tool***, resulting in:





# Search

## First selection:

Based on this studies, **the title, abstract and conclusions**, if necessary, of each of the 79 primary studies were read and the inclusion and exclusion criteria were applied.

### Inclusion criteria



- IC1.** Study proposes or examines a software architecture reuse technology in critical embedded systems

### Exclusion criteria



- EC1.** Study does not propose or examine a software architecture reuse technology.
- EC2.** Study propose or examine a software architecture reuse technology but this is not oriented to CES.
- EC3.** Study is an editorial, keynote, opinion, tutorial, poster or panel.



- EC4.** The study is a previous version of a more complete study about the same research; and
- EC5.** The paper language is different to English, Portuguese and Spanish.
- EC6.** The paper is repeated.
- EC7.** The full paper is not available.

# Search

## First selection results:

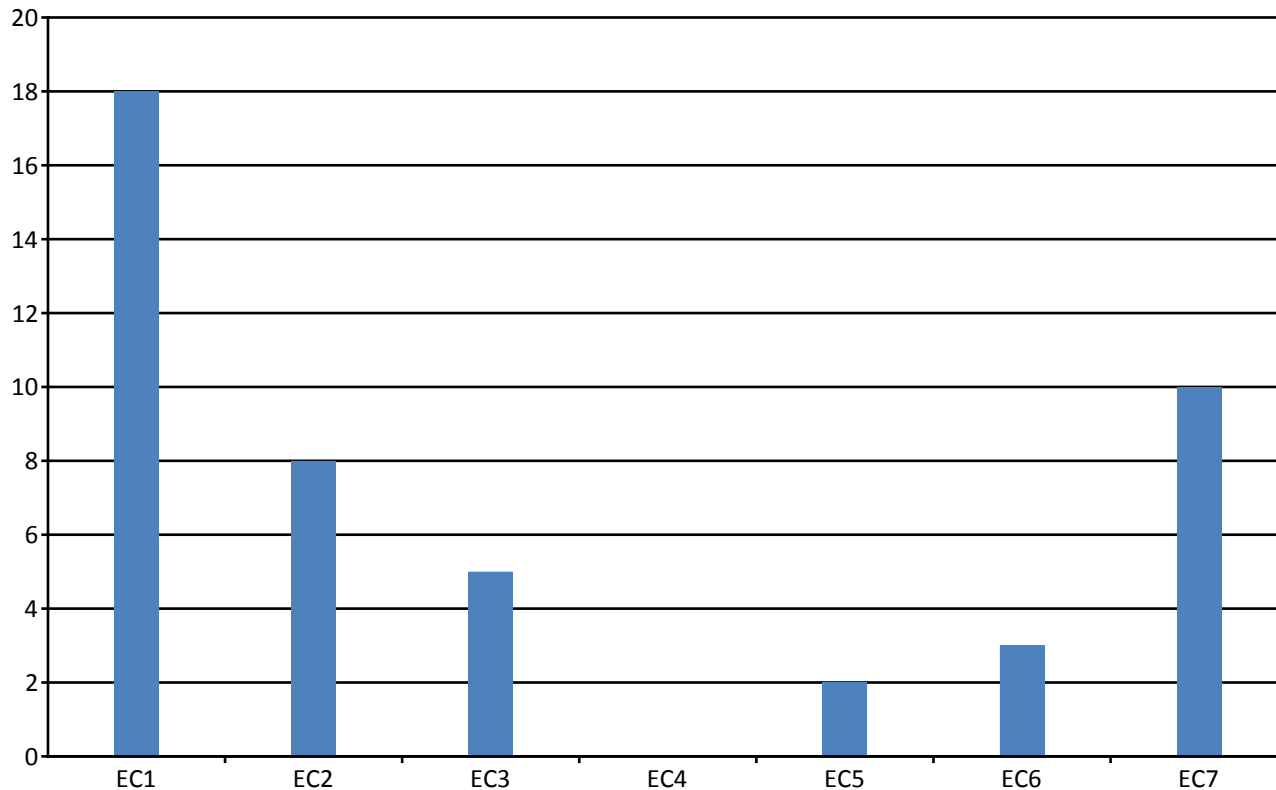
Digital Library	First selection
ACM Digital Library	0
IEEE Xplore	19
ScienceDirect	2
Compendex	3
Scopus	6
Web of Science	3

**33**

# Search

## First selection results:

Within the primary studies excluded set, the quantity for each exclusion criteria is showed in the following graphic:



**Total :**  
**44**



*Merci beaucoup*  
*Thank You*  
お疲れ様  
*Danke*  
*Gracias*  
*Grazie*  
谢谢你  
*Thanks*  
*Danke u*  
*Obrigado*