Advantages and Application of MATLAB/SIMULINK in MAAB Design Patterns

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Introduction

› In software engineering, a **design pattern** is a general reusable solution to a commonly occurring problem in software design.

  › It is not a finished design

  › It is a description or template, for how to solve a problem, that can be used in many different situations.

  Christopher Alexander says, each pattern is a three-part rule which expresses a relation between a certain context, a problem, and a solution.

  › A pattern is a proven solution to a problem in a context.

Design Patterns overview

› Design patterns represent a solutions to problems that arise when developing software within a particular context.
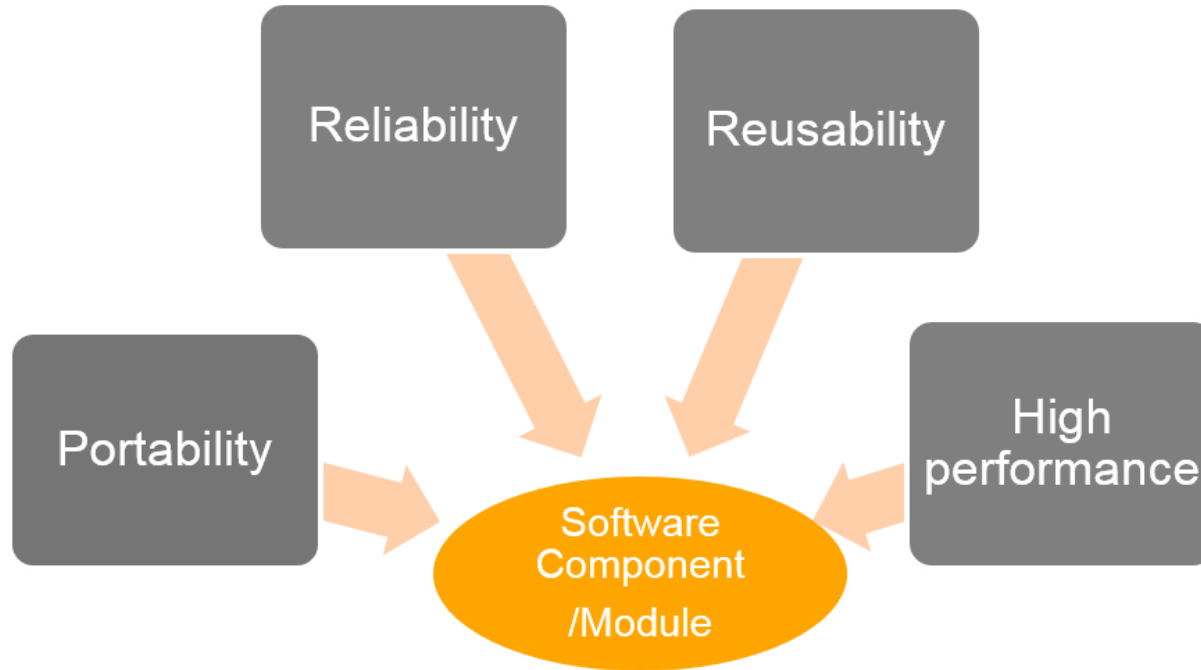
› **Objective**

Patterns = f(Problem, Solution)

› **Subject to constraint**

Hardware platform

Software architecture base

Requirement of a embedded system software

Categorizing Pattern

Authors would like to address the design patterns which are analyzed in the following areas

› Multiplicity of Design and Architectural Simplicity

› Ease of Analysis

› Consistent and Repeatable structure

› Duplicate consistent behavior

Design patterns under study

Duplicate consistent behavior

Multiplicity of design and Architectural simplicity

Consistent and Repeatable structure

Ease of analysis
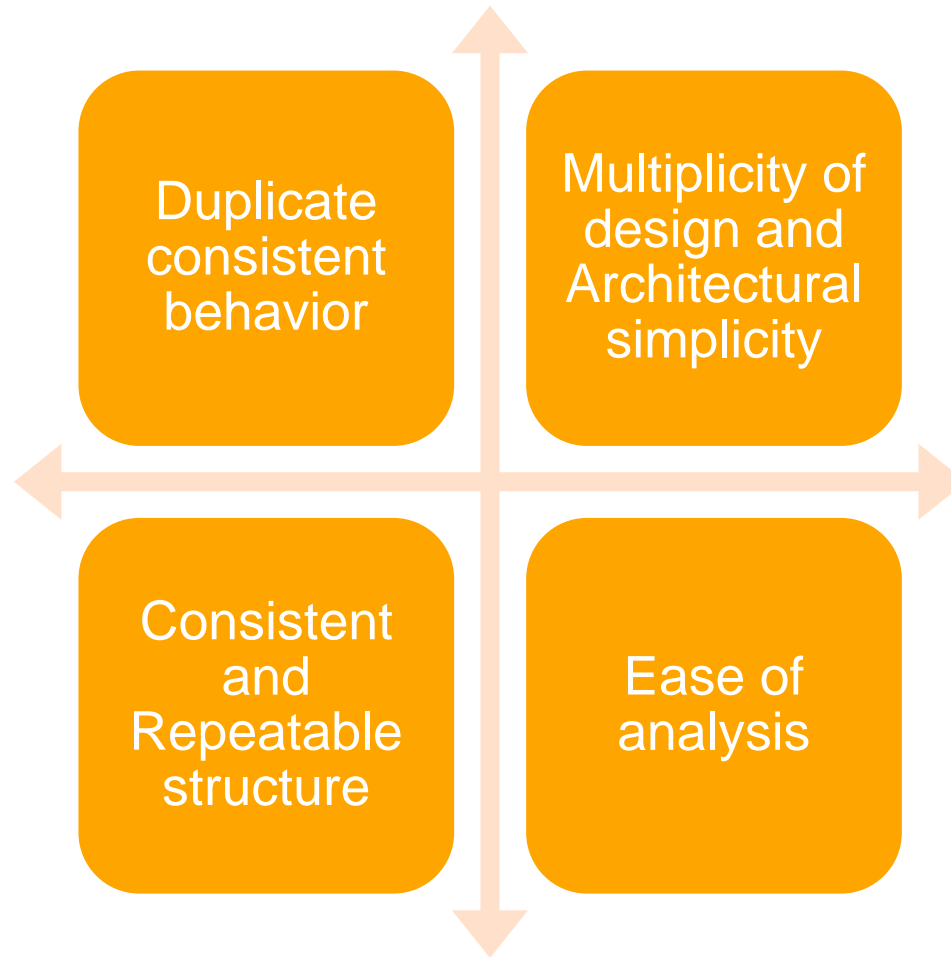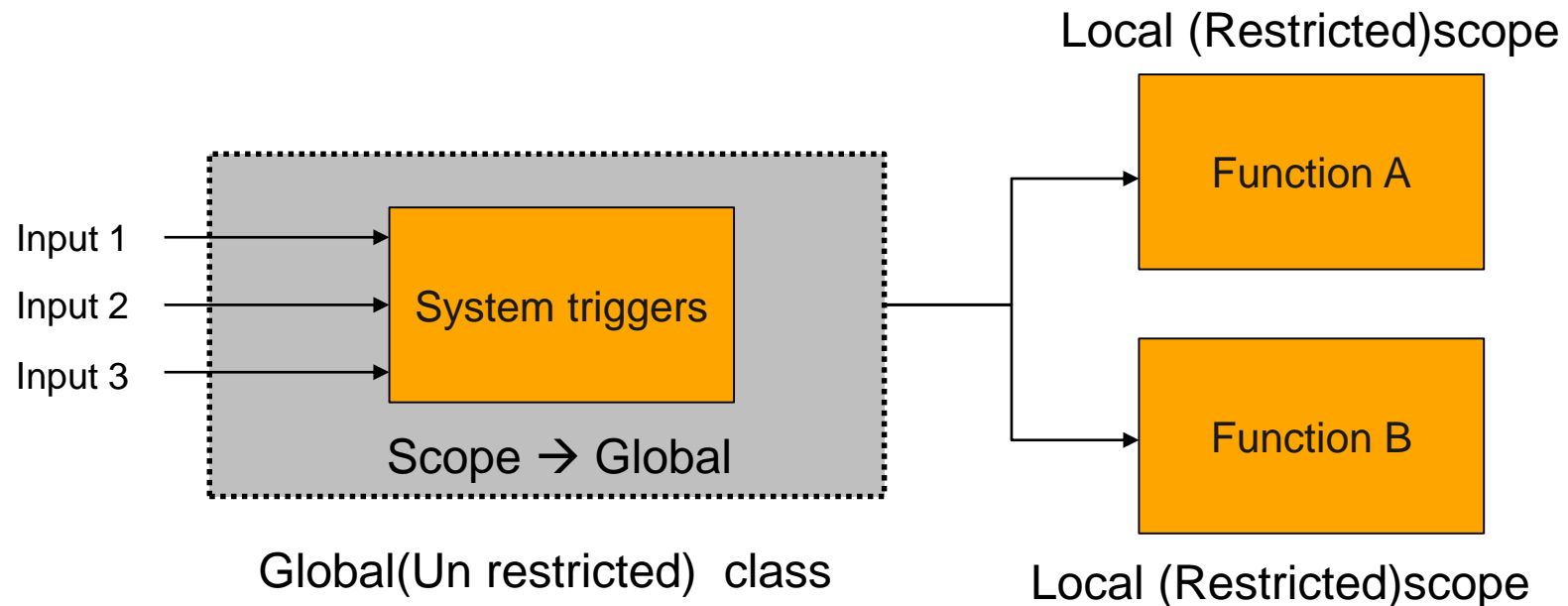
Multiplicity of design and Architectural Simplicity
- Design Pattern MAAB guidelines

› To enhance Multiplicity of Design and Architectural simplicity, we use the concepts of coupling and functional encapsulation.

› Coupling is of two types,

  › Modular (Interconnections restricted to few subcomponents of an entire component)

  › Integral (Interconnections throughout)

› Functional encapsulation - Systems where functions are clearly executed by a subset of components.

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# Multiplicity of design and Architectural simplicity

Portability - How MATLAB helps

› Portability of embedded software ensures easy reuse and also reduces CPU time and memory consumption across various hardware.

Local (Restricted)scope

Input 1
Input 2
Input 3

System triggers

Scope → Global

Function A

Function B

Global(Un restricted) class

Local (Restricted)scope

Ease of analysis - Design pattern MAAB guidelines

› Integrating the modules of the Tier 1 suppliers with the Original Equipment Manufacturers (OEM) software is the rising trend in the automotive industry.

› This requires a lot of simulation to ensure the proper behavior of the throughput.

› For the shared software development, the modifications in one function should not affect the overall system.

› Authors present how MATLAB/SIMULINK can be used to have effective and proper behavior
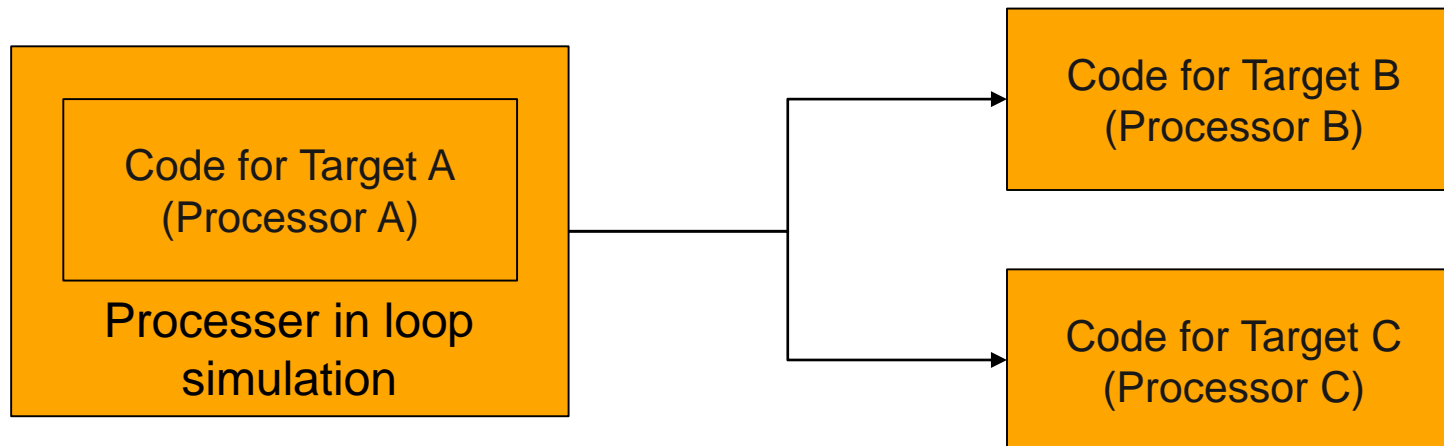
Ease of analysis
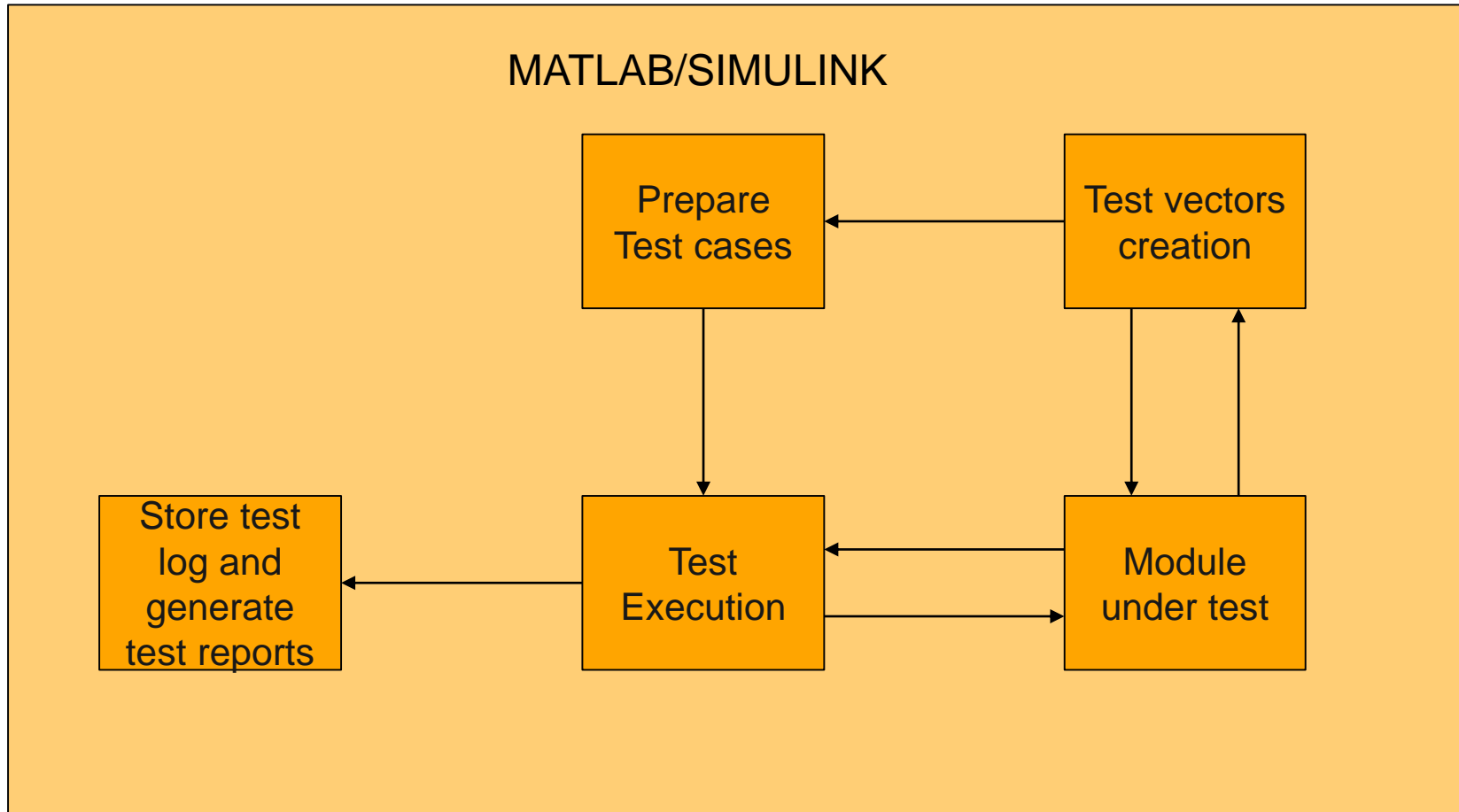
Consistent and Repeatable structure - Design Pattern MAAB guidelines

› Processor in loop can be used to check the software in various hardware platforms. This aids Reliability and Reusability of software.

Duplicate consistent behavior- Design Pattern MAAB guidelines

› It is necessary to know whether the desired functionality is derived from the model even after the model is converted into instructions.

› the model designed must be tested in the actual ECU environment to know whether the design is working in the desired manner.

› **Generated code properties**

   › Follows MISRA C

   › Multiplicity of code by using Automotive software libraries

   › Easy to analyze by using different subsystems

   › Efficiency in testing the generated code

Duplicate consistent behavior

Auto code via MATLAB/SIMULINK
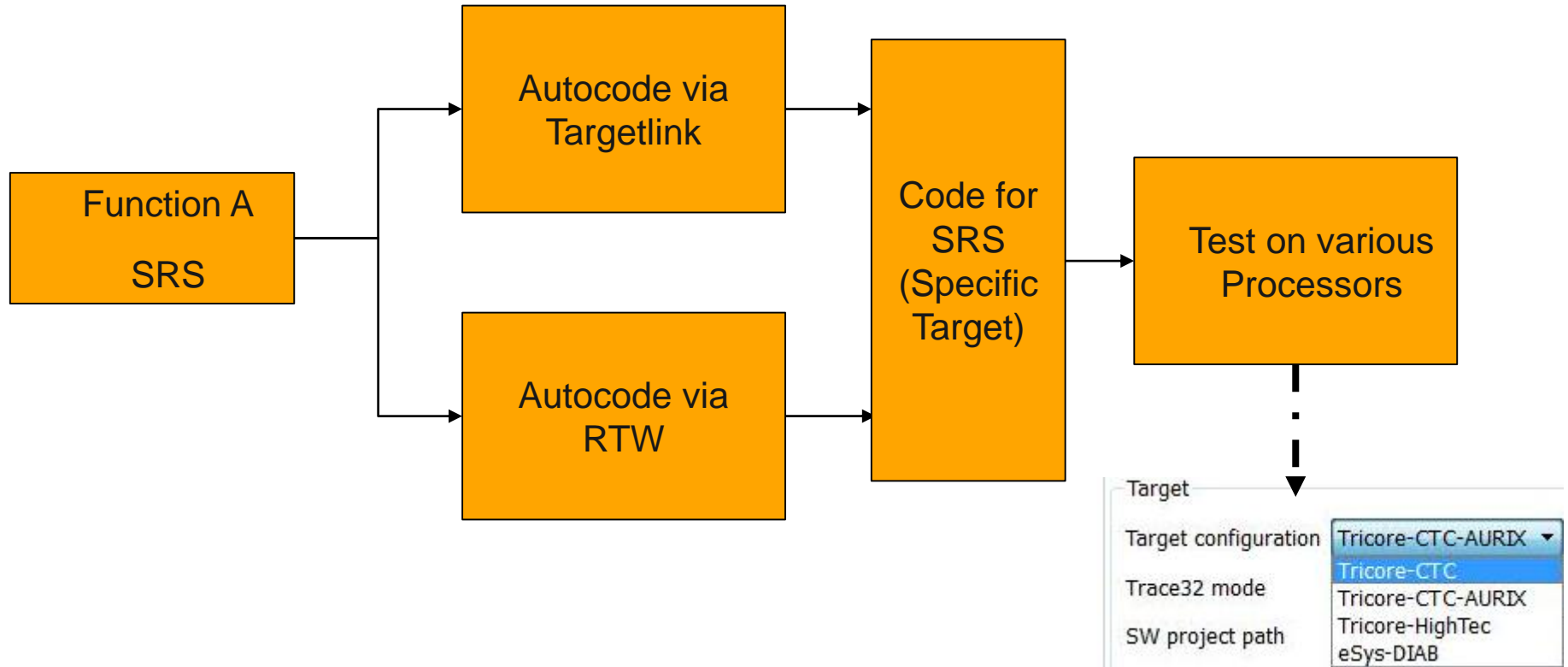
ECU environment is virtually created and it is used to test the model in the actual environment using Processor in Loop (PIL).
Assures if the software runs in multiple hardware

Conclusion

› There are many Design patterns which have not been addressed above, which can be used for problem solving.

› MATLAB/SIMULINK can be effectively used for implementation of Design patterns.

› Consistent and repeatable architecture can be achieved.

› Model can be easily analyzed.

› The results using the MATLAB/SIMULINK model are reproducible across globe

› Consistent architecture will be followed as design patterns are the best practice in the industry.

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Reference

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Thank you
for your attention!