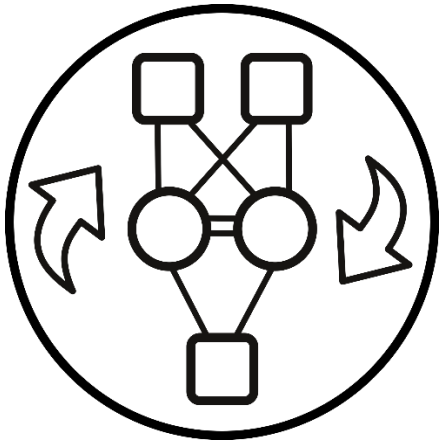
Reliability Evaluation of Distributed Embedded Systems

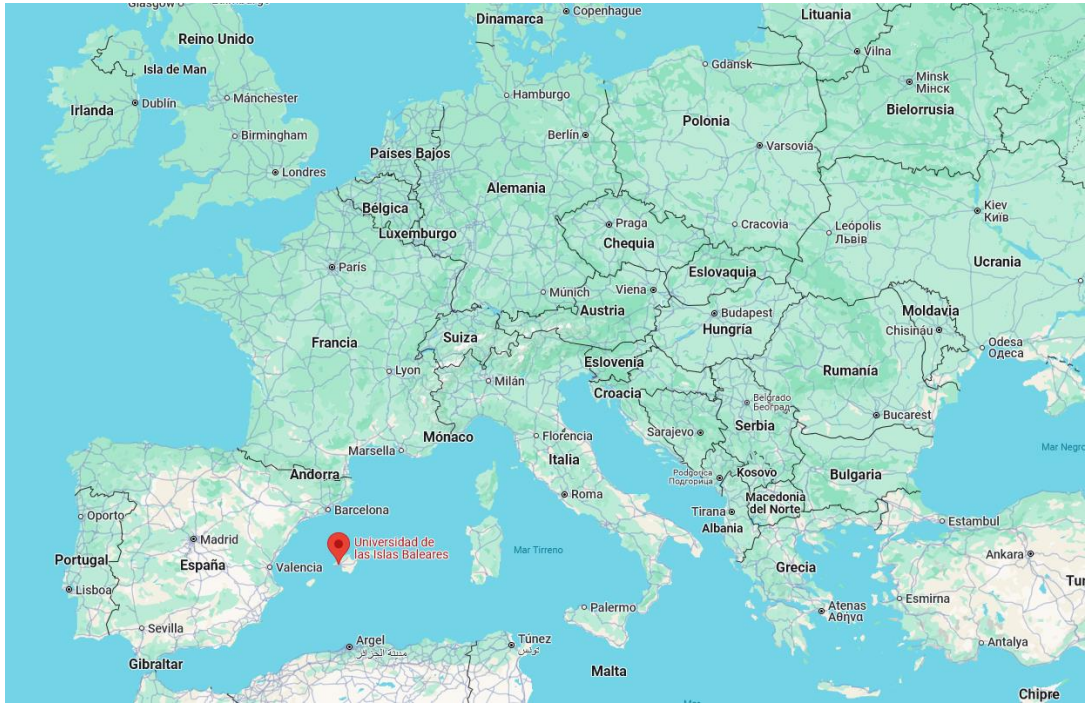


Alberto Ballesteros
Julián Proenza

Introduction

Alberto Ballesteros

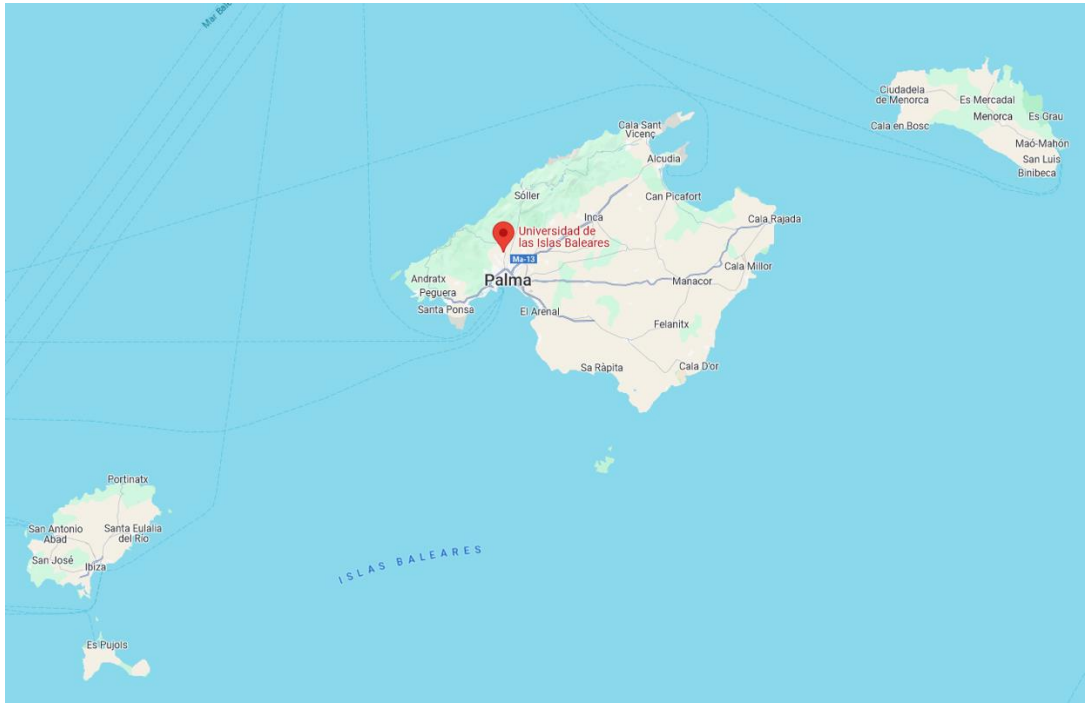
University of the Balearic Islands



Introduction

Alberto Ballesteros

University of the Balearic Islands



Introduction

Alberto Ballesteros

University of the Balearic Islands

Universitat de les Illes Balears

24 Buildings, 10 Faculties and 58 degrees

Introduction

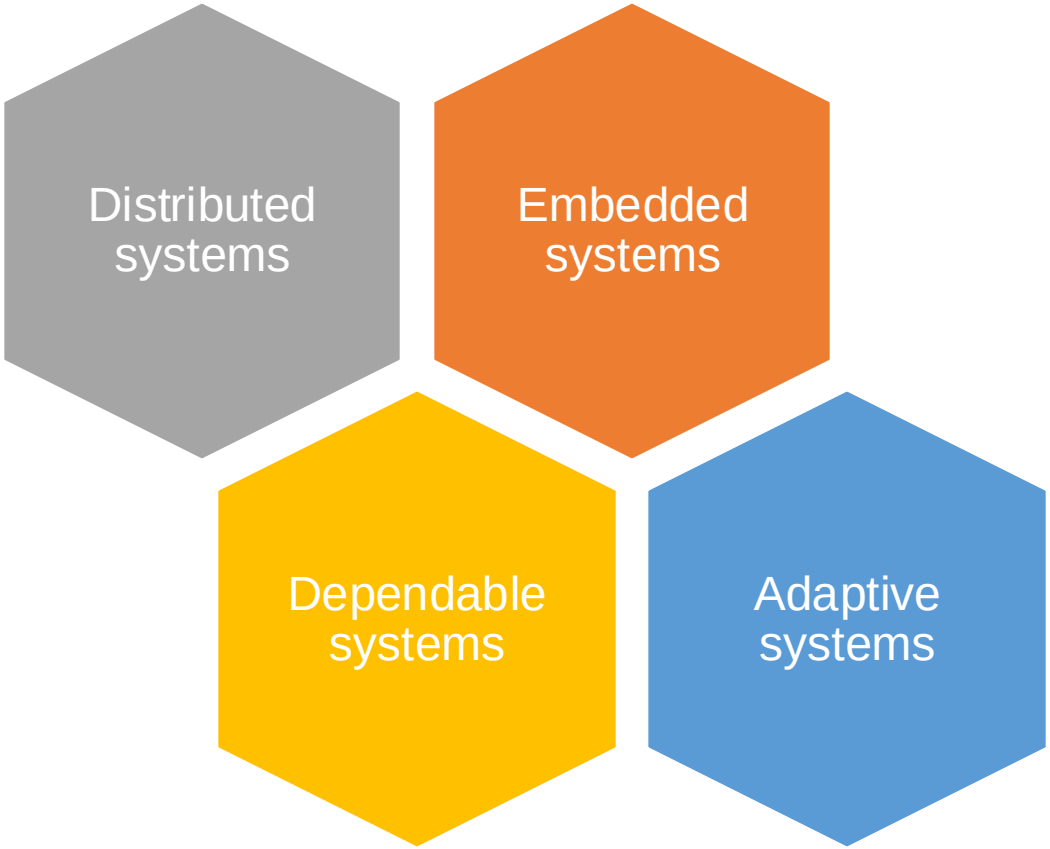
Alberto Ballesteros

University of the Balearic Islands

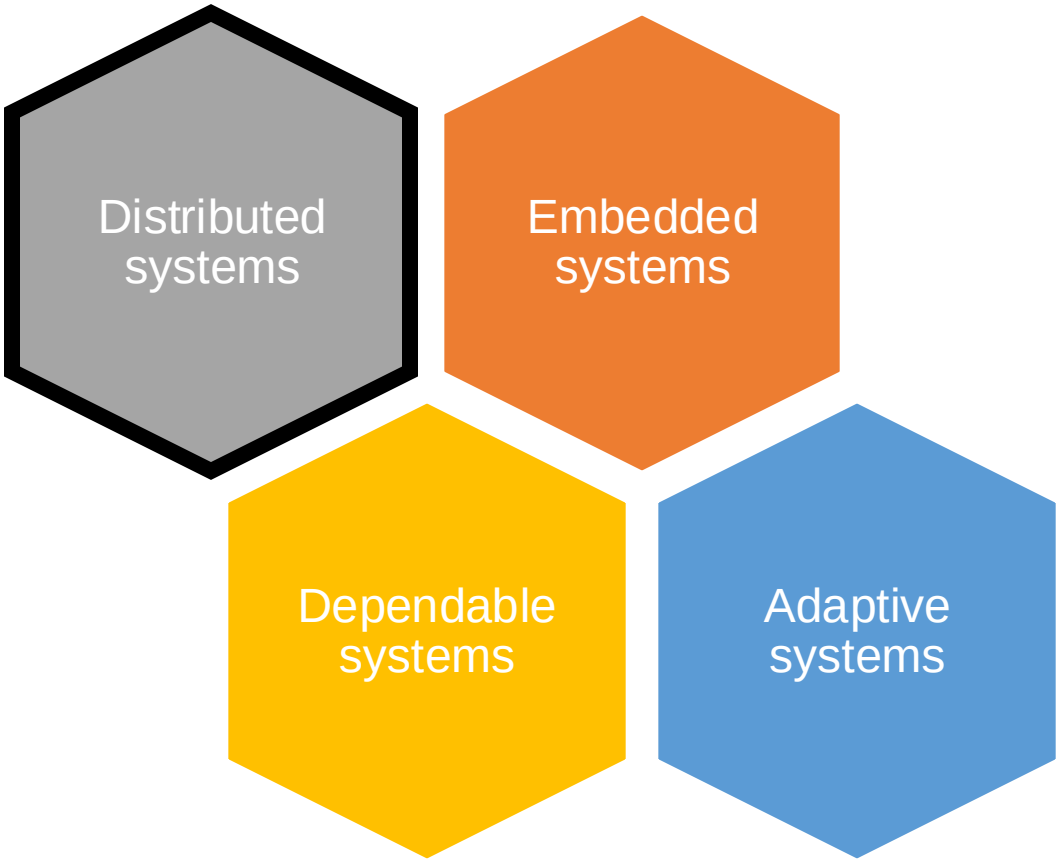
srv systems: robotics & vision

UIB Universitat de les Illes Balears

Introduction

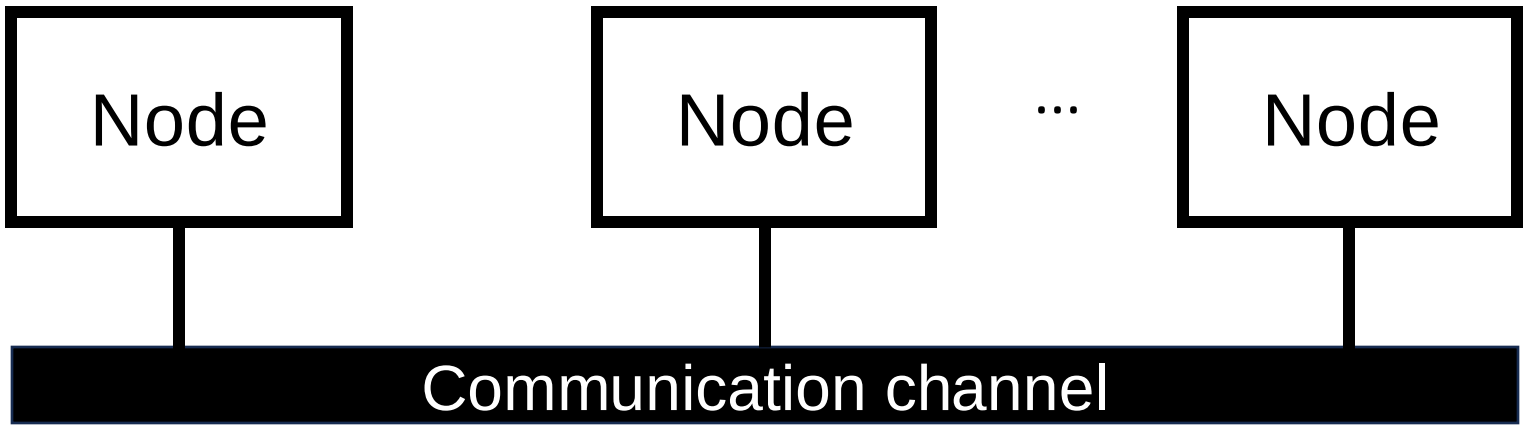


Introduction



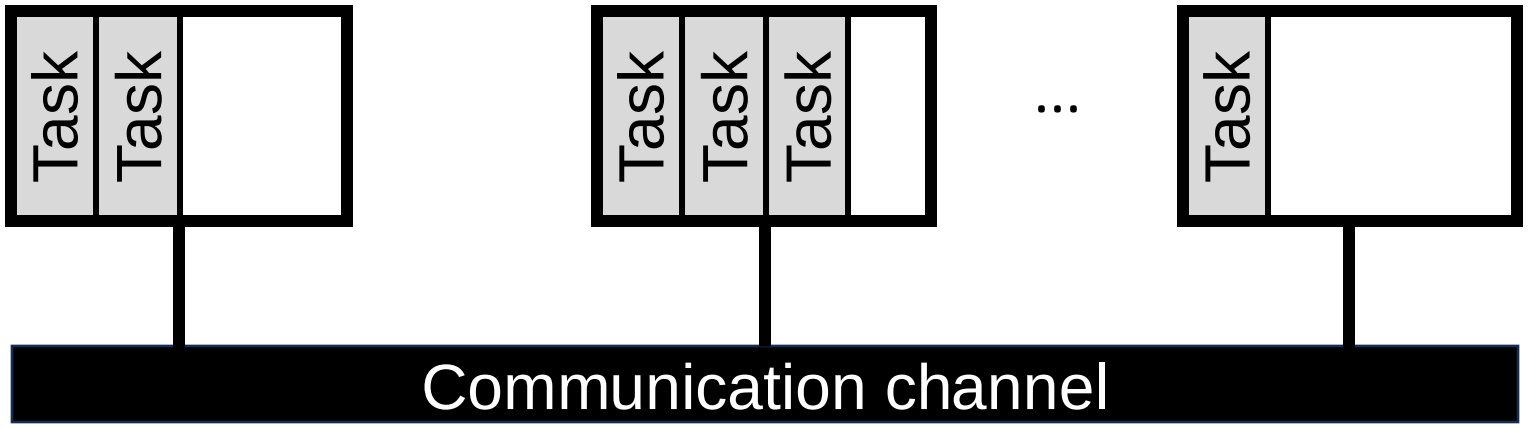
Introduction

Distributed Systems



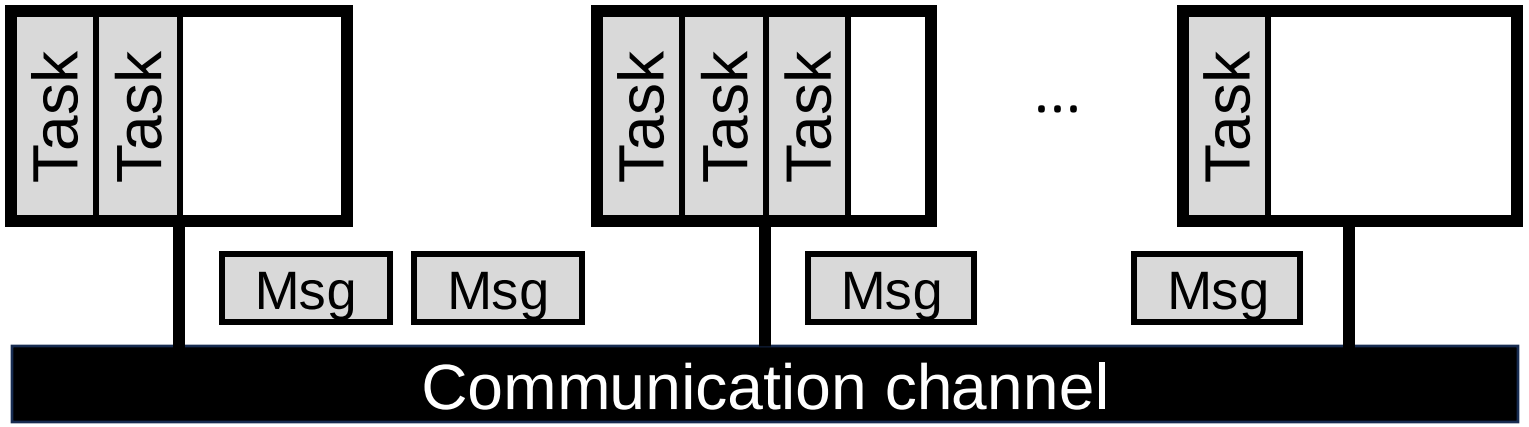
Introduction

Distributed Systems

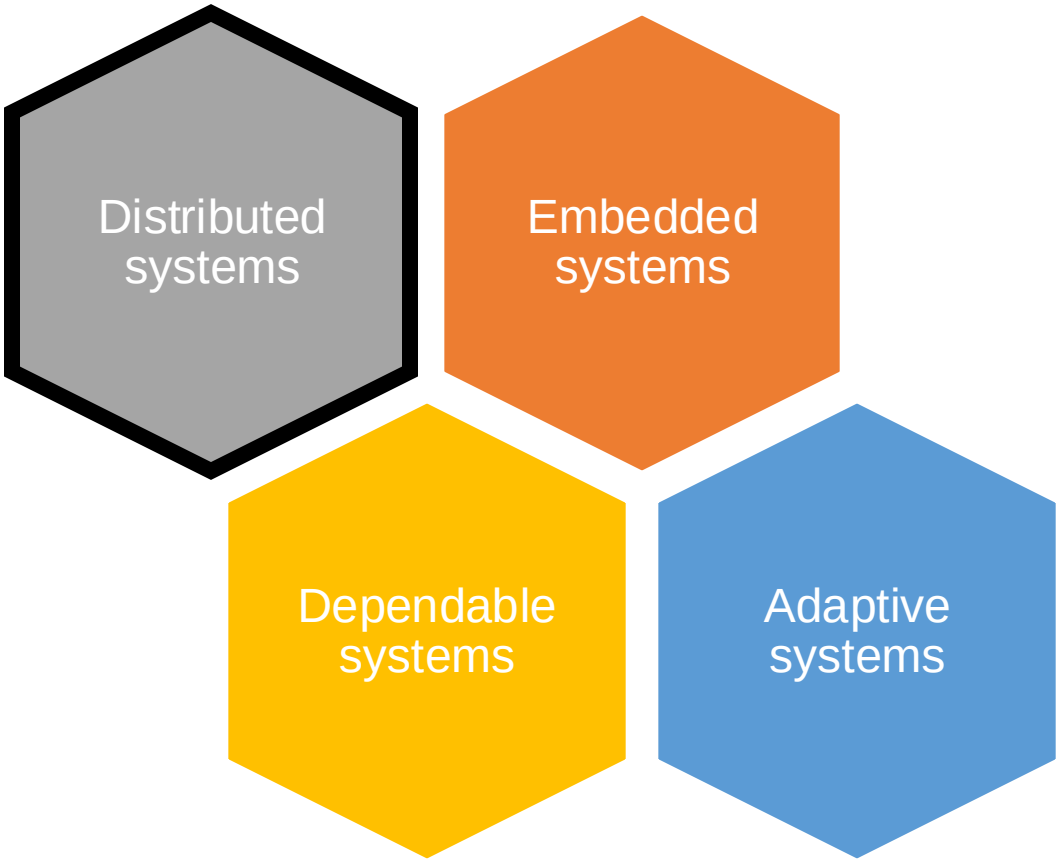


Introduction

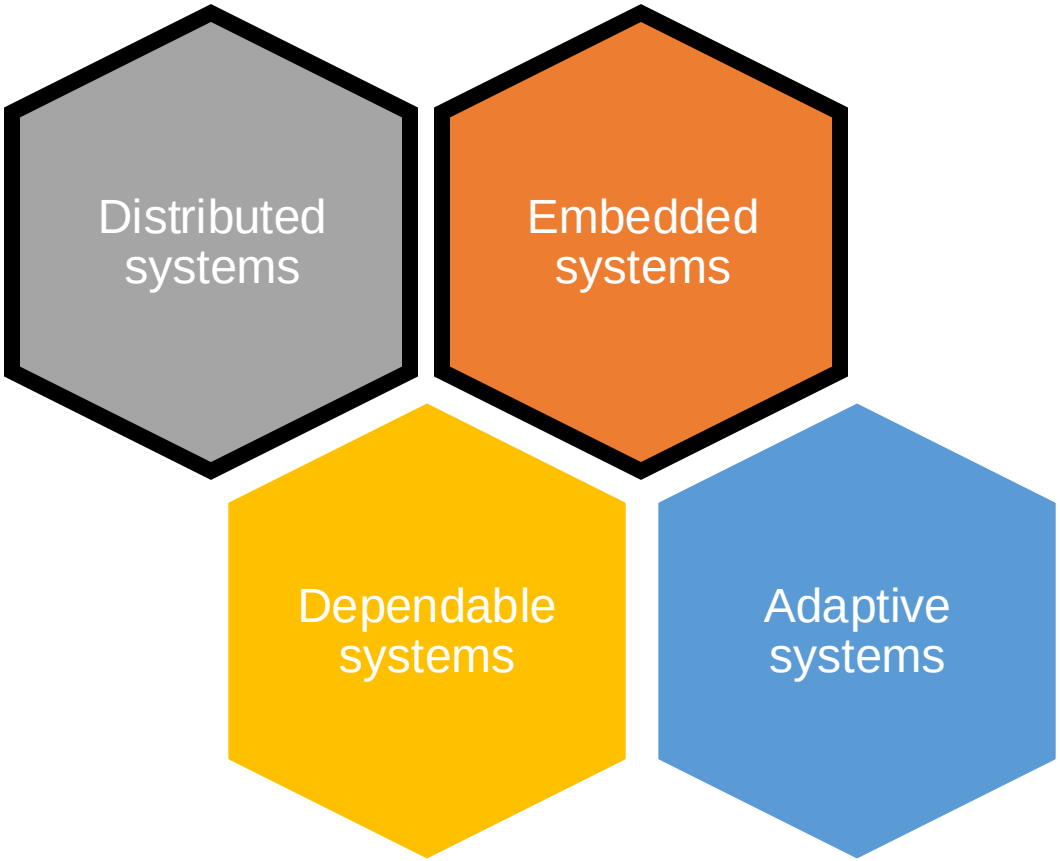
Distributed Systems



Introduction



Introduction



Introduction

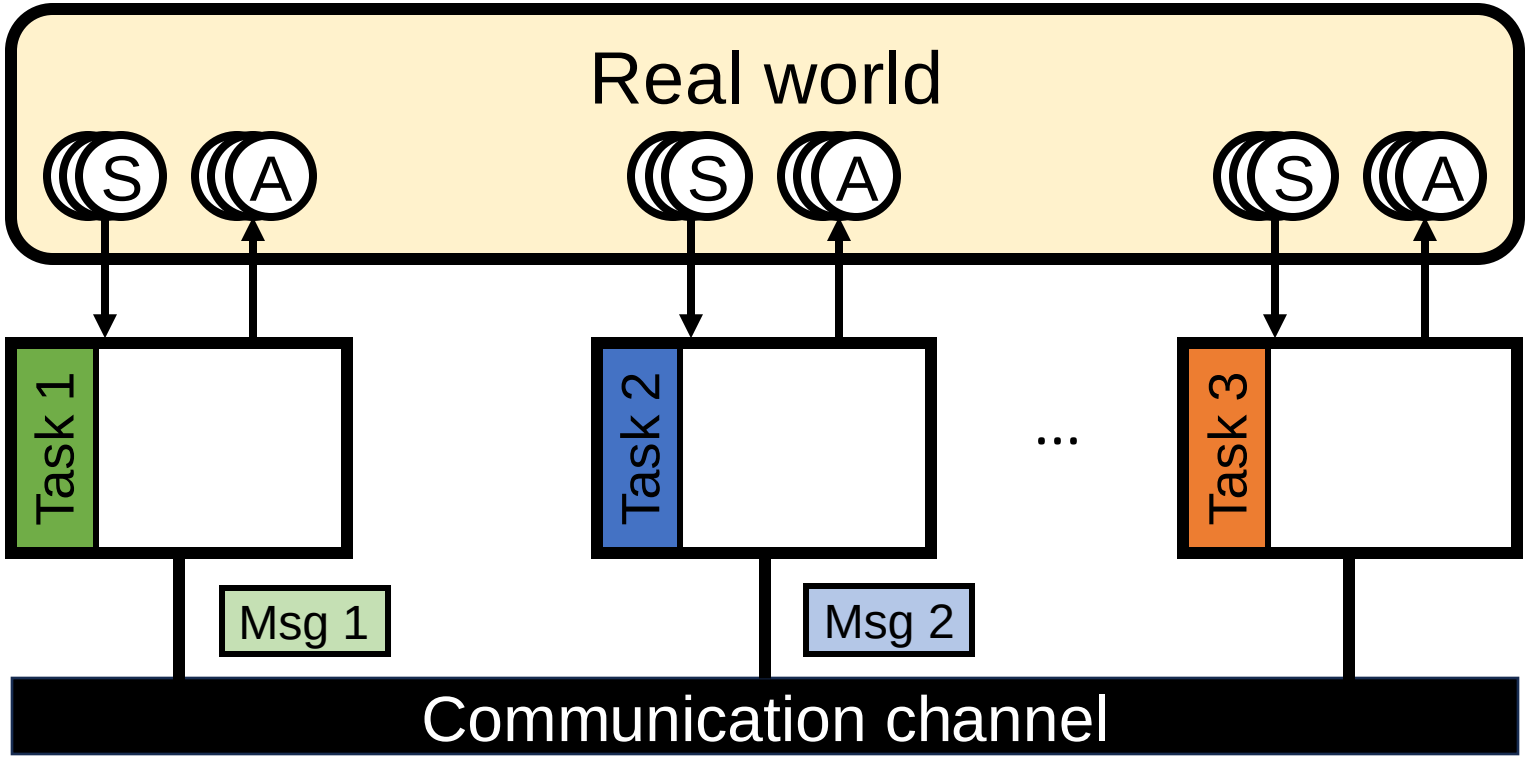
Embedded Systems

Introduction

Embedded Systems

Introduction

Distributed Embedded Systems

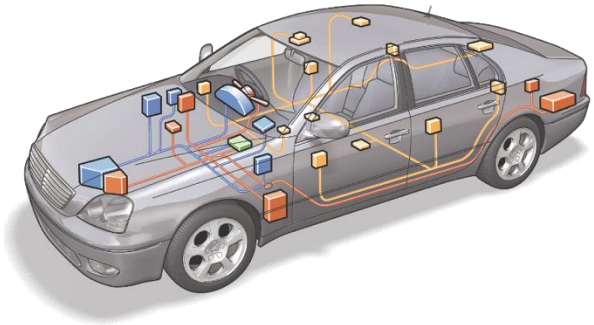


Introduction

Distributed Embedded Systems

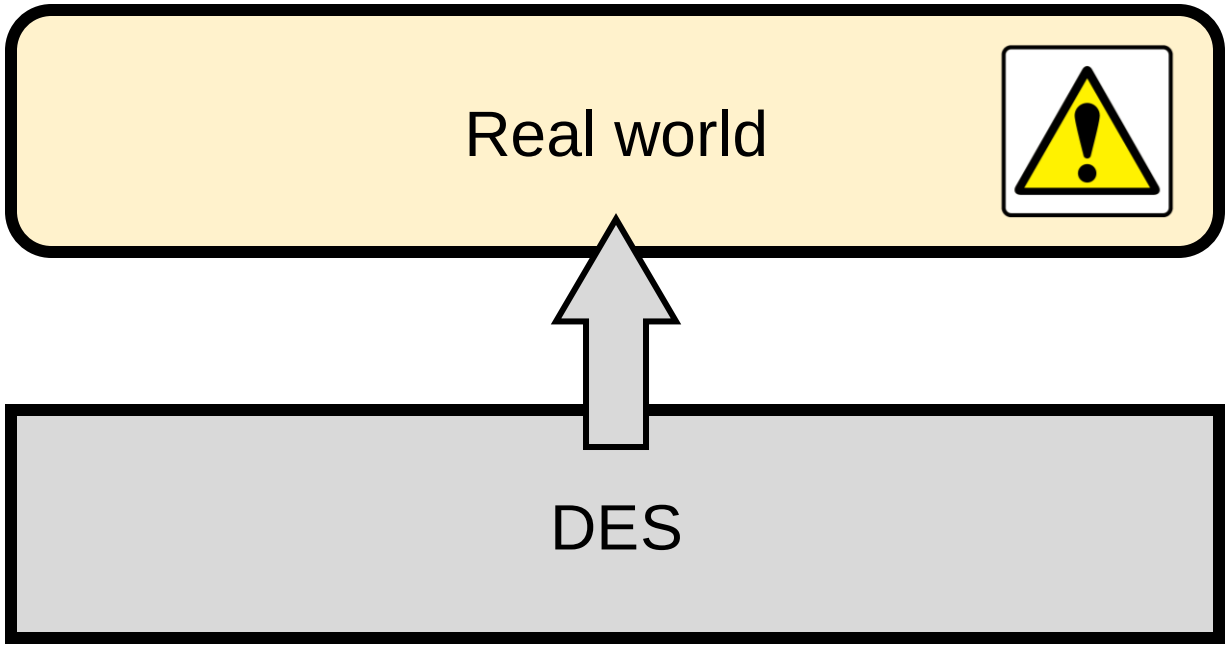
Examples

- Vehicles
- Factories
- Home automation

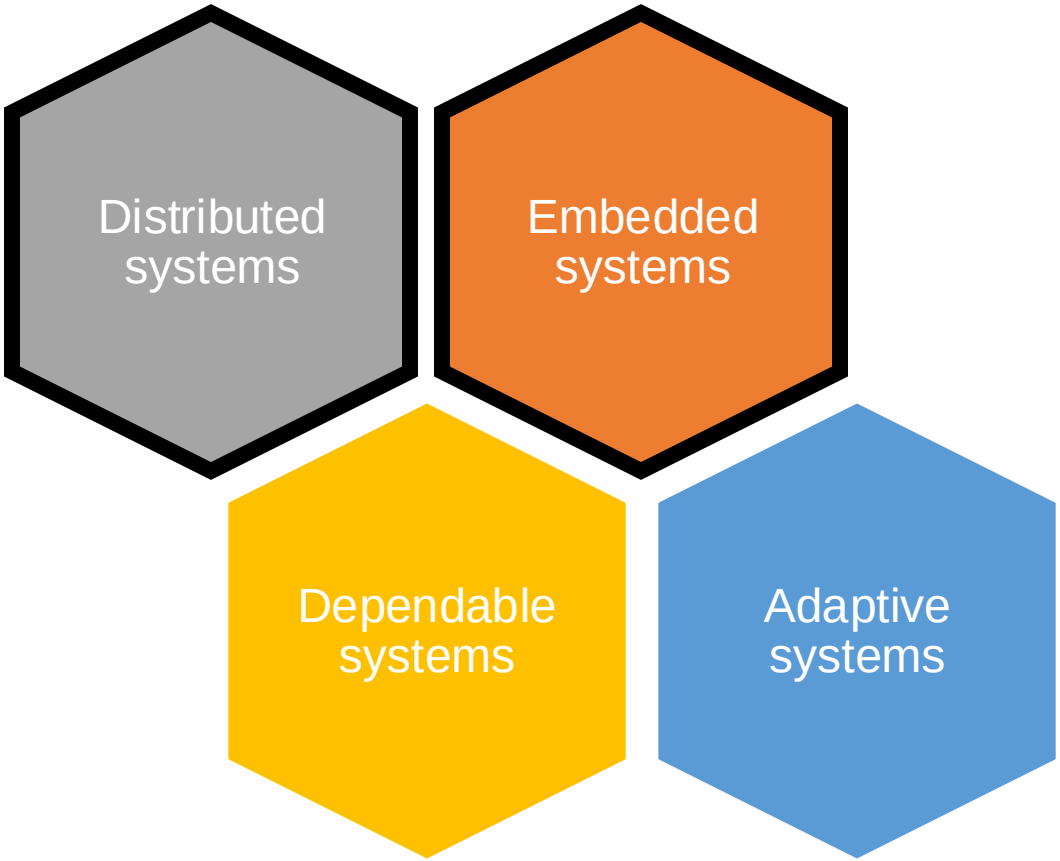


Introduction

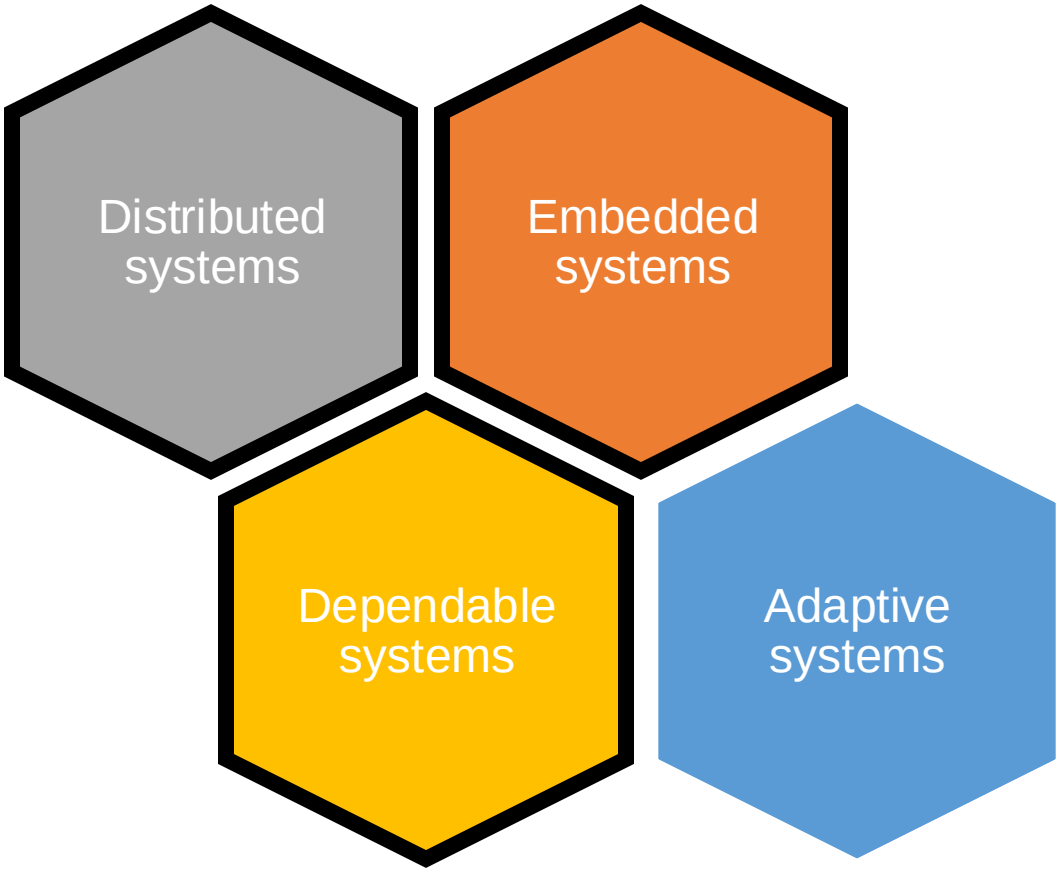
Distributed Embedded Systems



Introduction



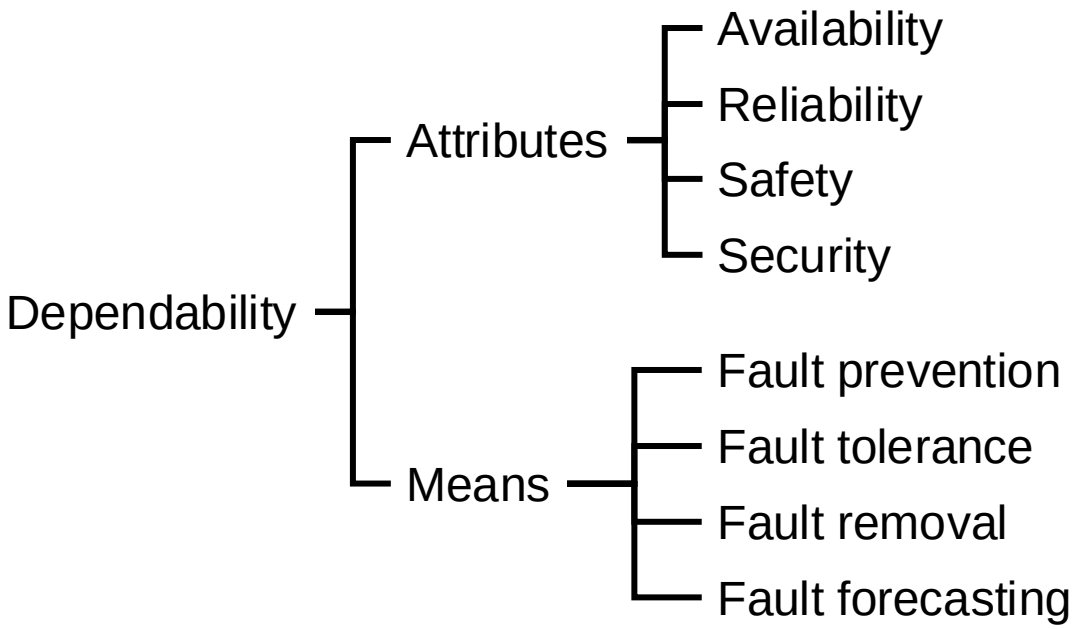
Introduction



Introduction

Dependable Systems

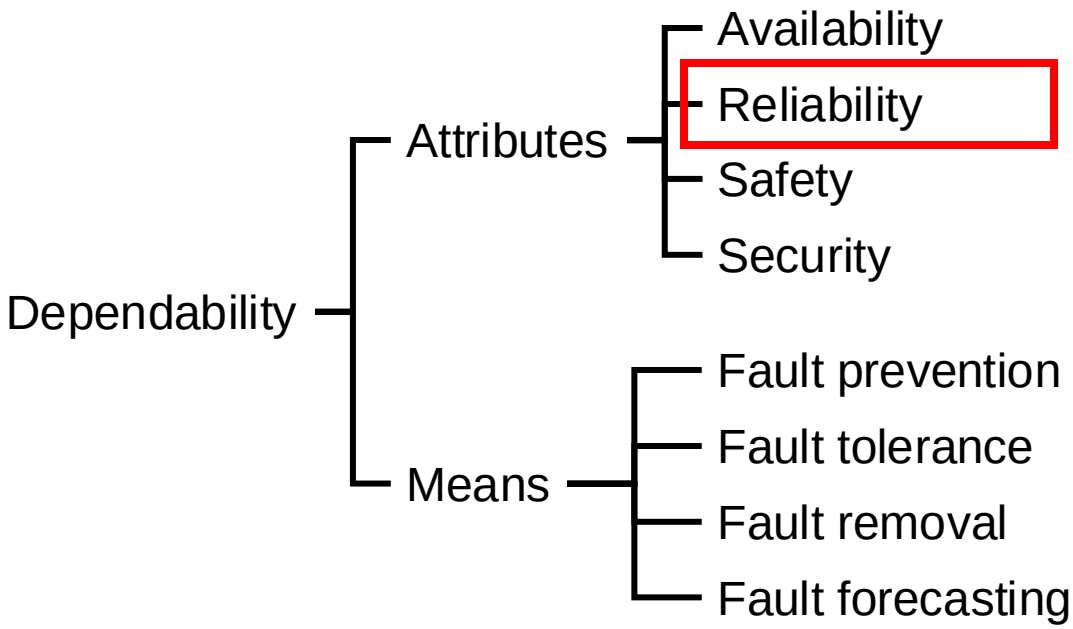
Dependability: Ability to deliver a service that can be justifiably trusted



Introduction

Dependable Systems

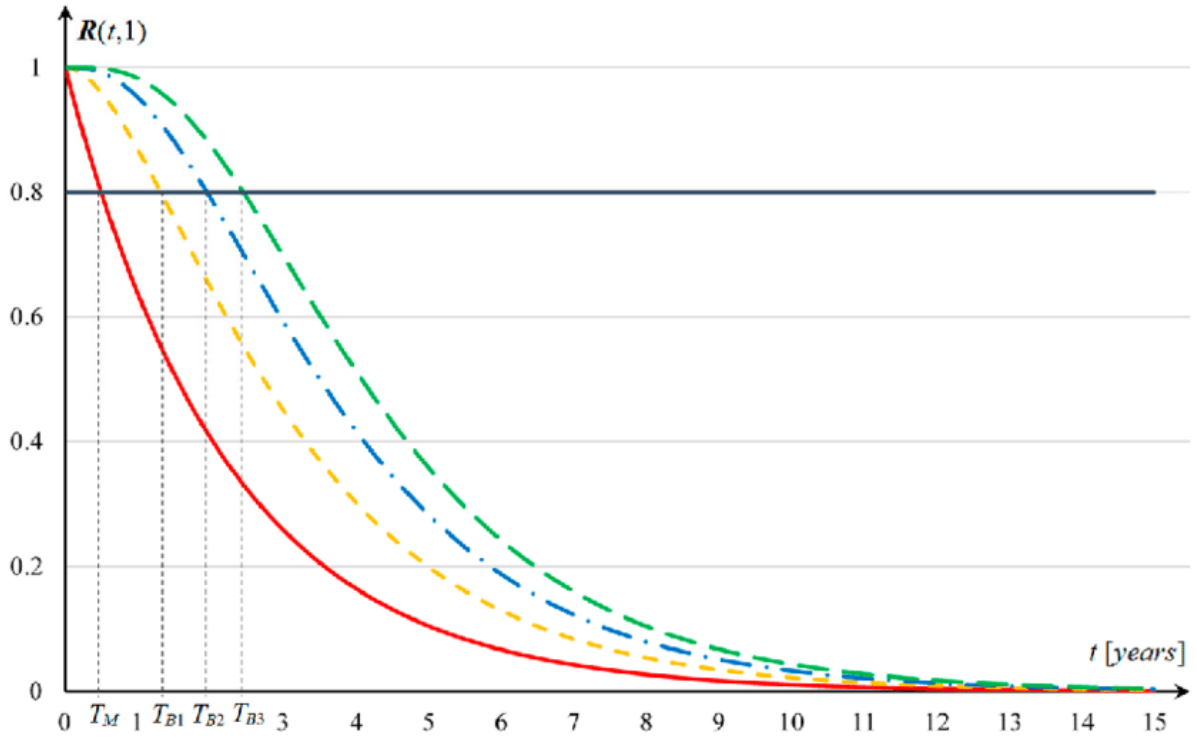
Reliability: Ability to deliver a correct service in a continuous manner



Introduction

Dependable Systems

Reliability: Ability to deliver a correct service in a continuous manner



Introduction

Dependable Systems

Reliability: Ability to deliver a correct service in a continuous manner

- *R*(t): Probability that a system operates the time interval [0,t] without failing

Introduction

Dependable Systems

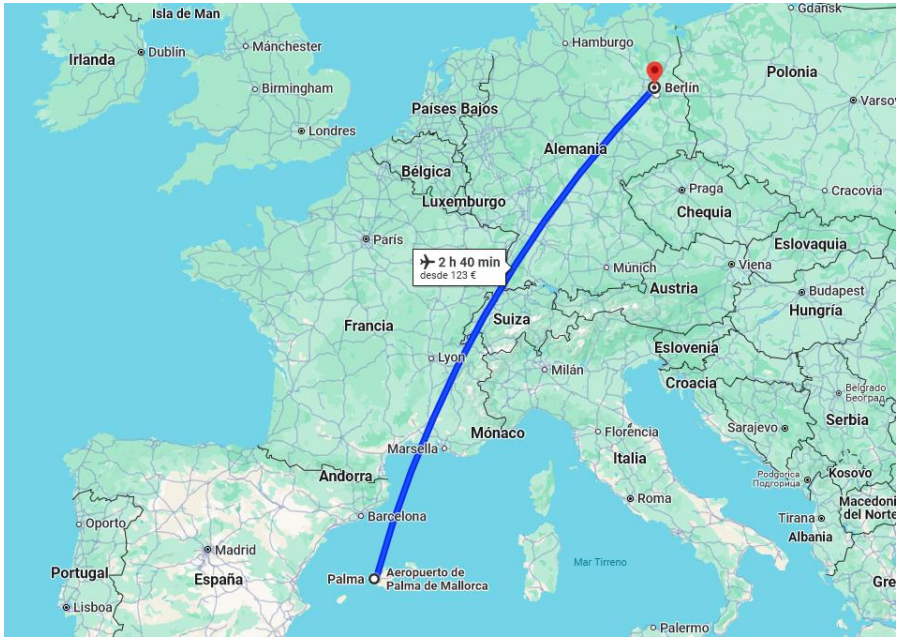
Reliability: Ability to deliver a correct service in a <u>continuous</u> manner

- *R*(t): Probability that a system operates the time interval [0,t] without failing

<u>Commercial aircraft</u>

R(2,4h): 0,999999 - 0,999999999

(6 to 9 nines)



Introduction

Dependable Systems

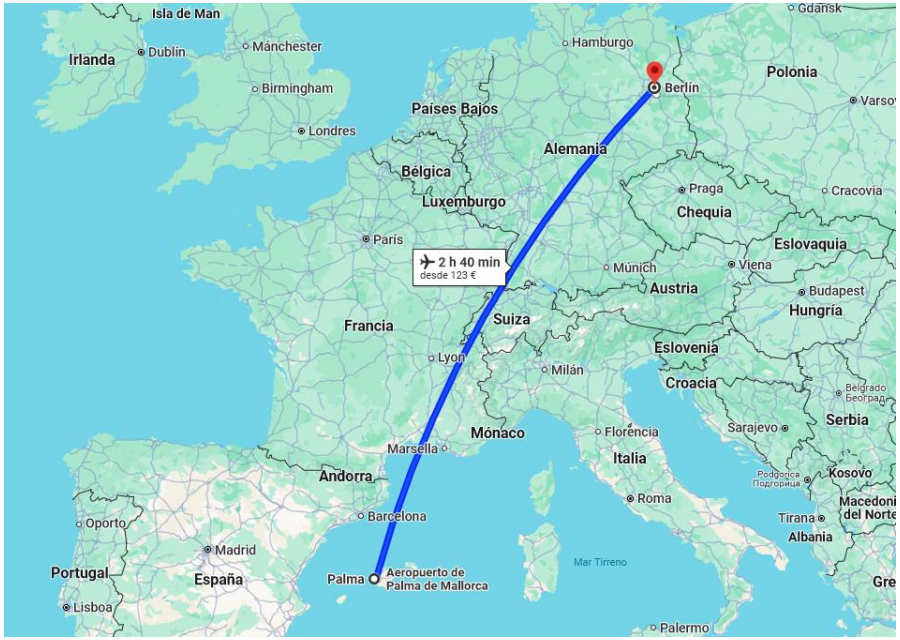
Reliability: Ability to deliver a correct service in a <u>continuous</u> manner

- *R*(t): Probability that a system operates the time interval [0,t] without failing

<u>Commercial aircraft</u>

R(2,4h): 0,999999 - 0,999999999

(6 to 9 nines)



There are modelling tools

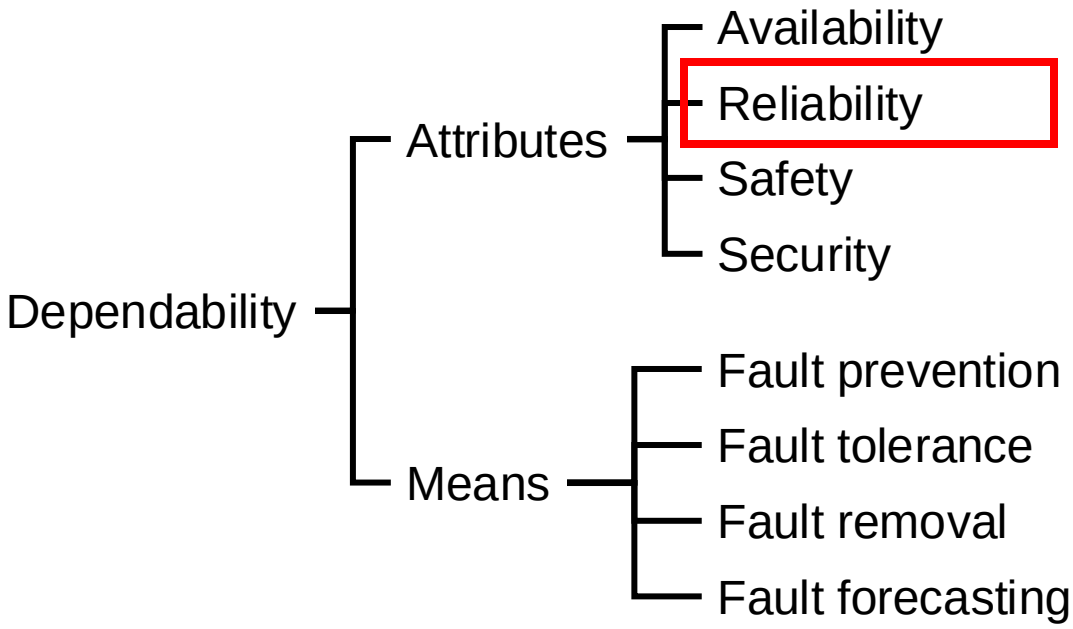
- Create model of the system
- Solve the model

It is costly!

Introduction

Dependable Systems

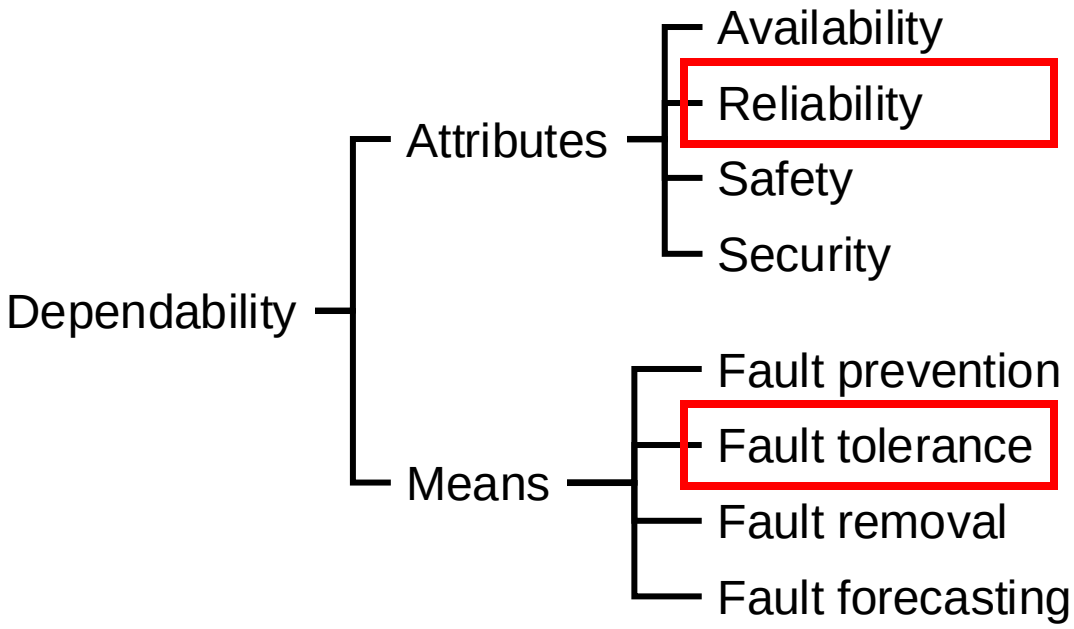
Dependability: Ability to deliver a service that can be justifiably trusted



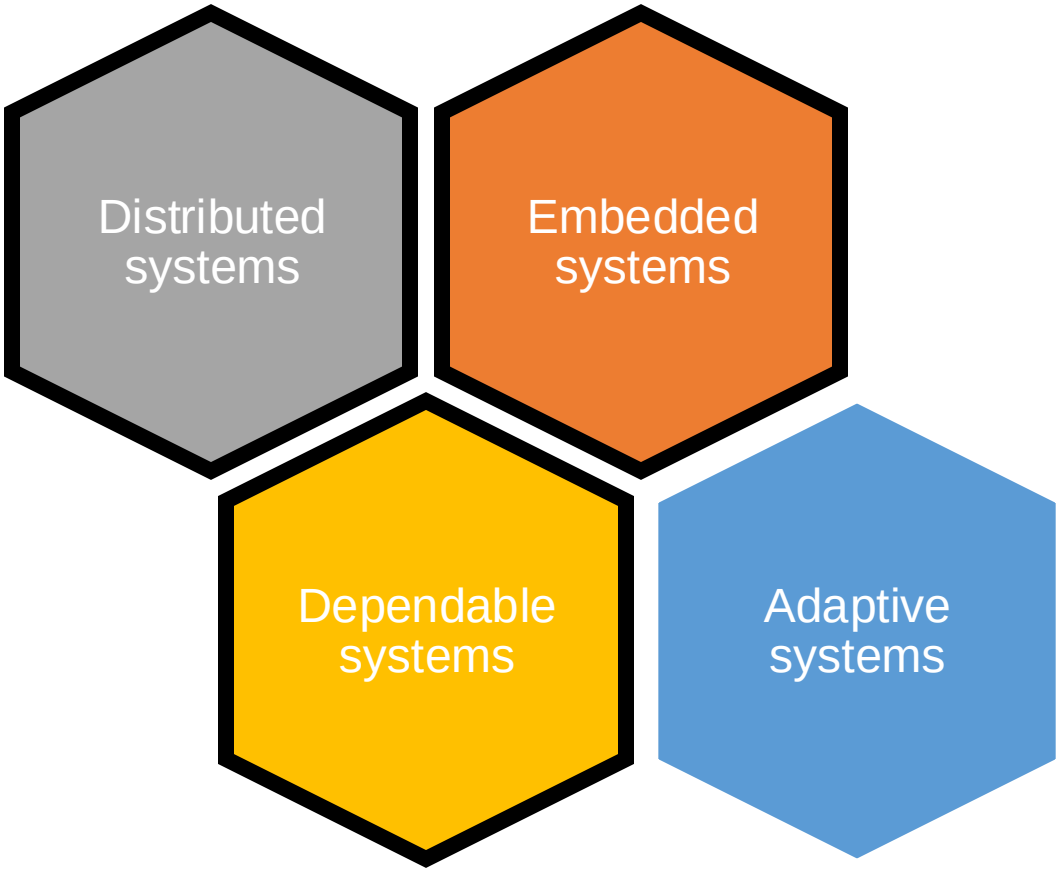
Introduction

Dependable Systems

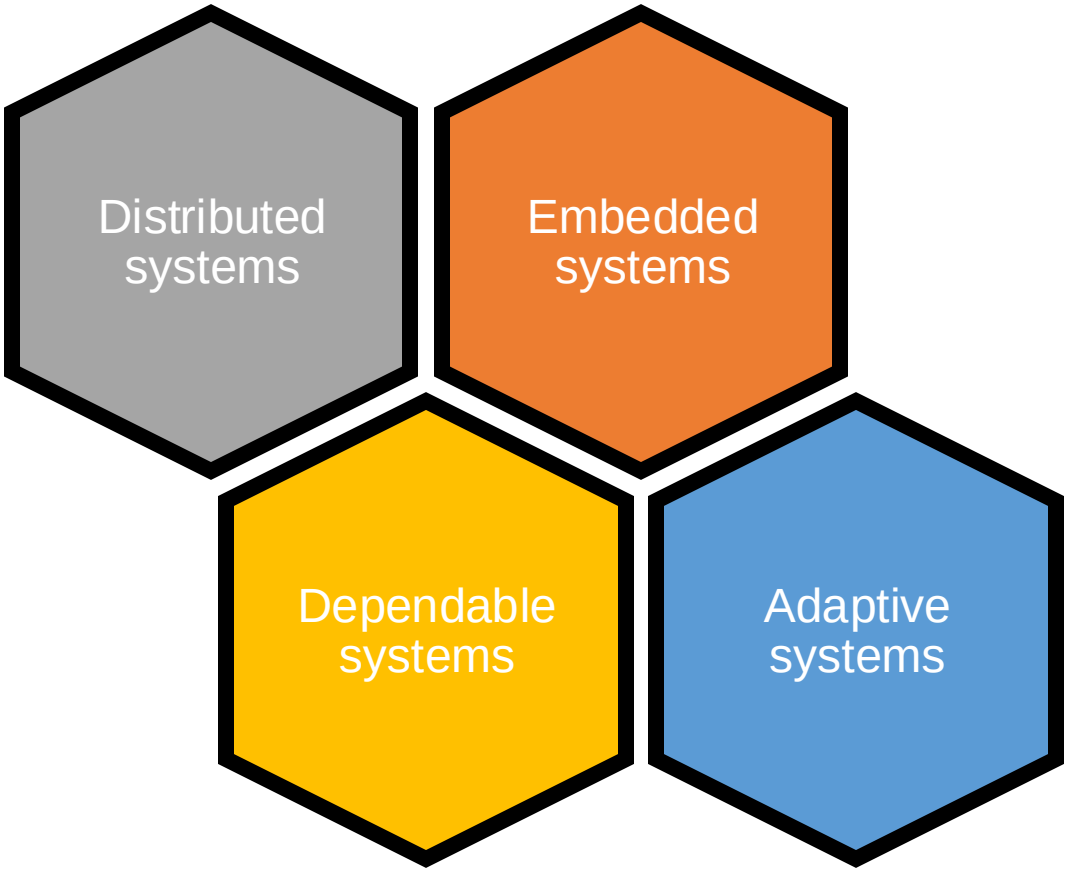
Fault tolerance: Design the system to provide a correct service, even in the presence of faults → Redundancy



Introduction

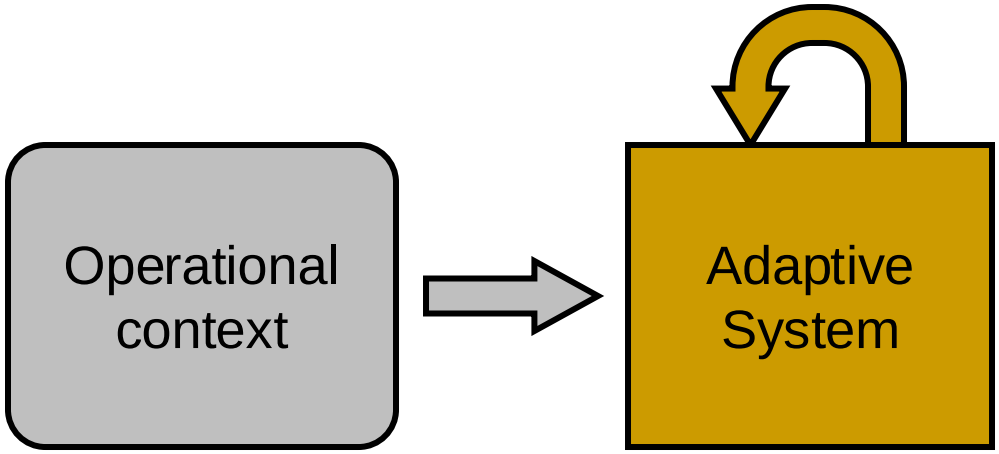


Introduction



Introduction

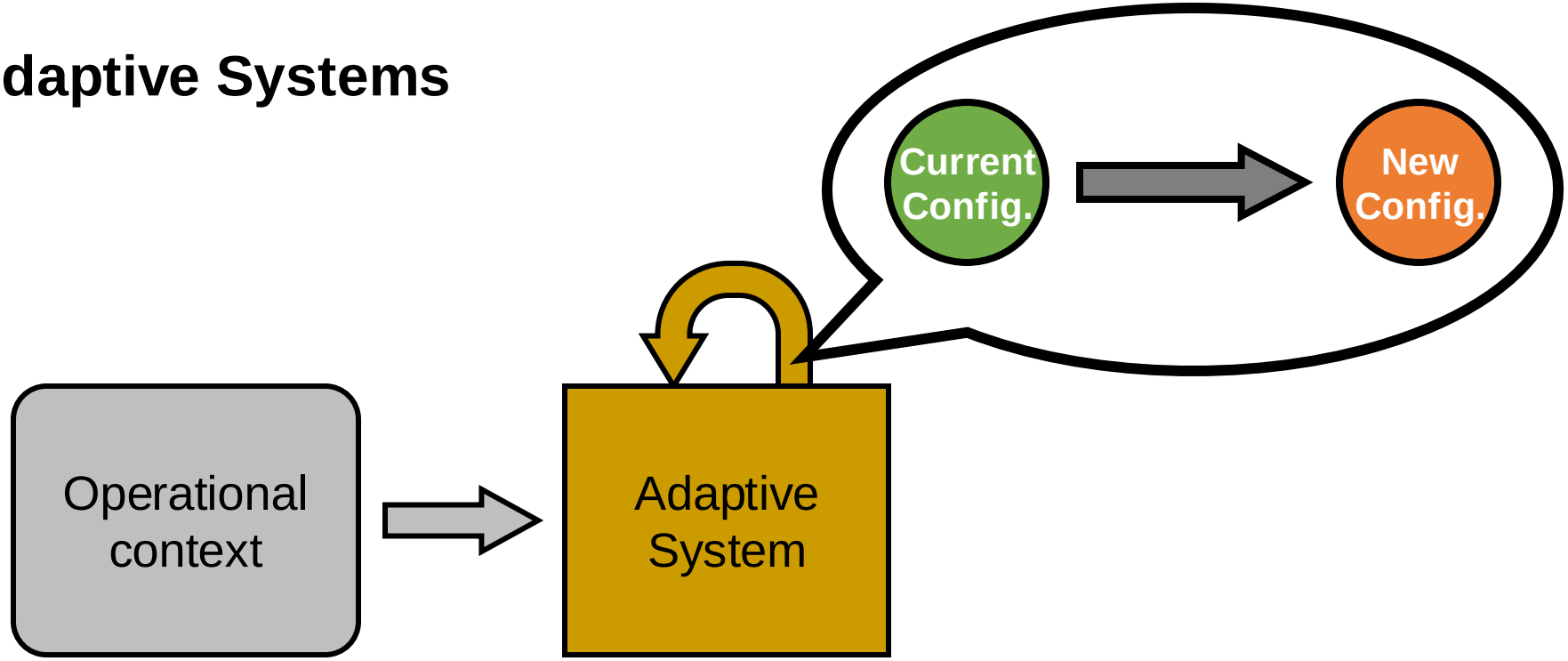
Adaptive Systems



- Status of the system
- Status of the environment
- Operational requirements

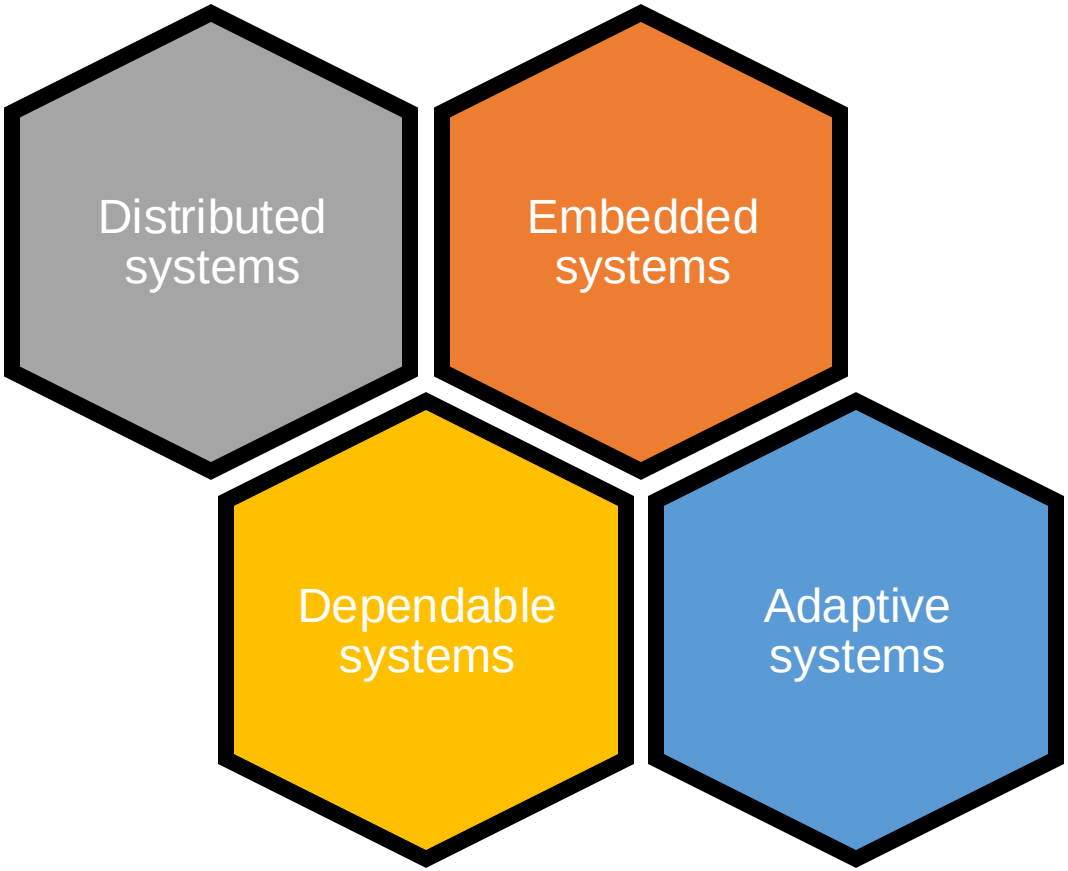
Introduction

Adaptive Systems

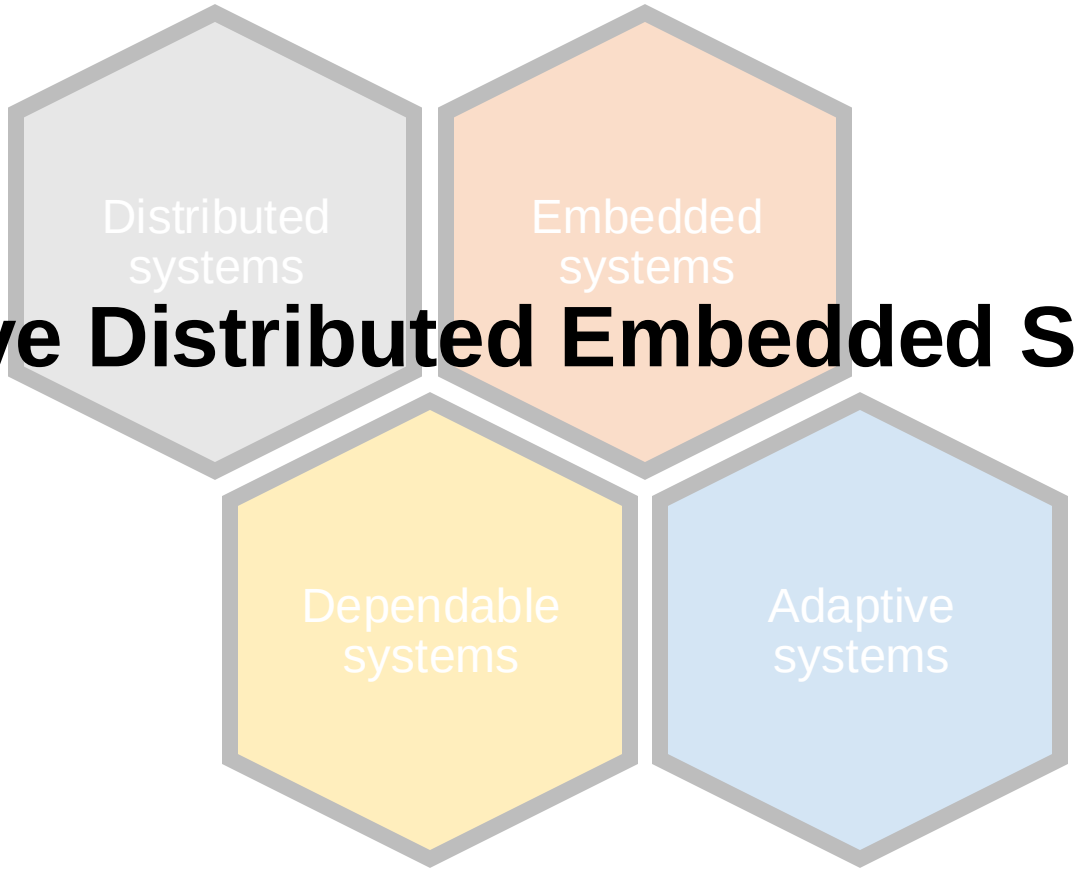


- Status of the system
- Status of the environment
- Operational requirements

Introduction



Introduction

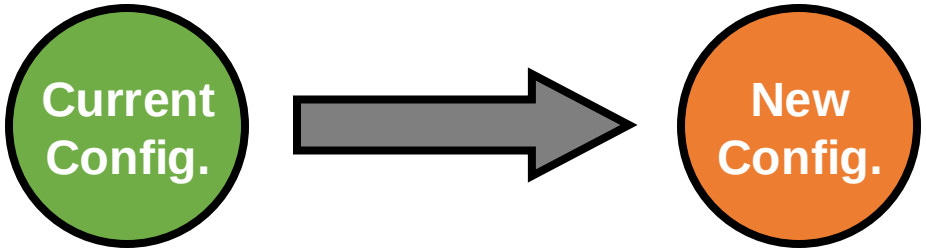


Adaptive Distributed Embedded Systems

Problem

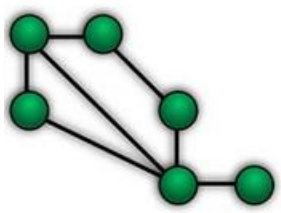
Find a new configuration while the system is running

- It must be done in a short time
- It must meet the operational requirements (reliability)

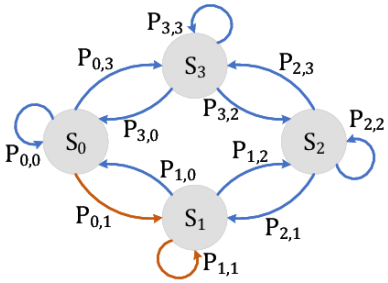


Problem

We have a tool to determine the reliability of a system!



System description



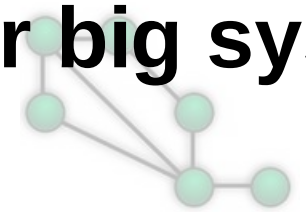
Markov chain

Prism
model checker

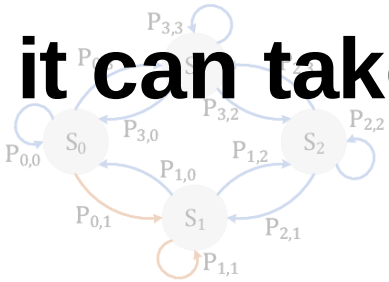
Problem

We have a tool to determine the reliability of a system!

For big systems it can take too much time



System description



Markov chain

Prism
model checker

Tasks

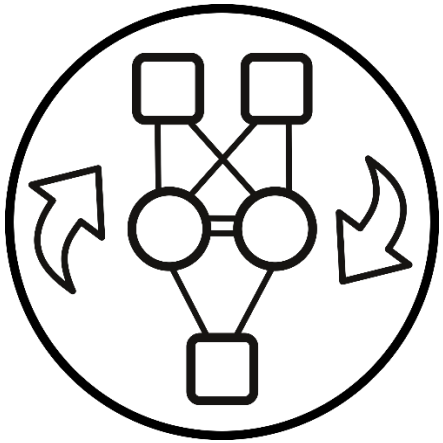
1. **Produce a dataset using the available tool**
   1. Generate different system descriptions (size and topology)
   2. Calculate the reliability
2. **Select the adequate ML technique**
   1. Select the most adequate technique to carry out the estimation of the reliability based on the results obtained
3. **Build, train and validate the model**
   1. Build the model
   2. Use the dataset obtained in 1 to train the model selected in 2
   3. Gather results and validate them

Tasks

Validation

- Accuracy of the results
- Time required

Reliability Evaluation of Distributed Embedded Systems



Alberto Ballesteros
Julián Proenza