

# FlexRay Executable (Reference) Model

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Version 1

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# What is the FlexRay Executable (Reference) Model?

## **Purpose**

- The FlexRay Consortium decided to establish an executable reference model (ERM) to support the following goals:
  - Availability of an executable protocol specification
  - Availability of protocol model to be used with the conformance tests
  - Verification (RTL) and validation (Silicon) of FlexRay implementations

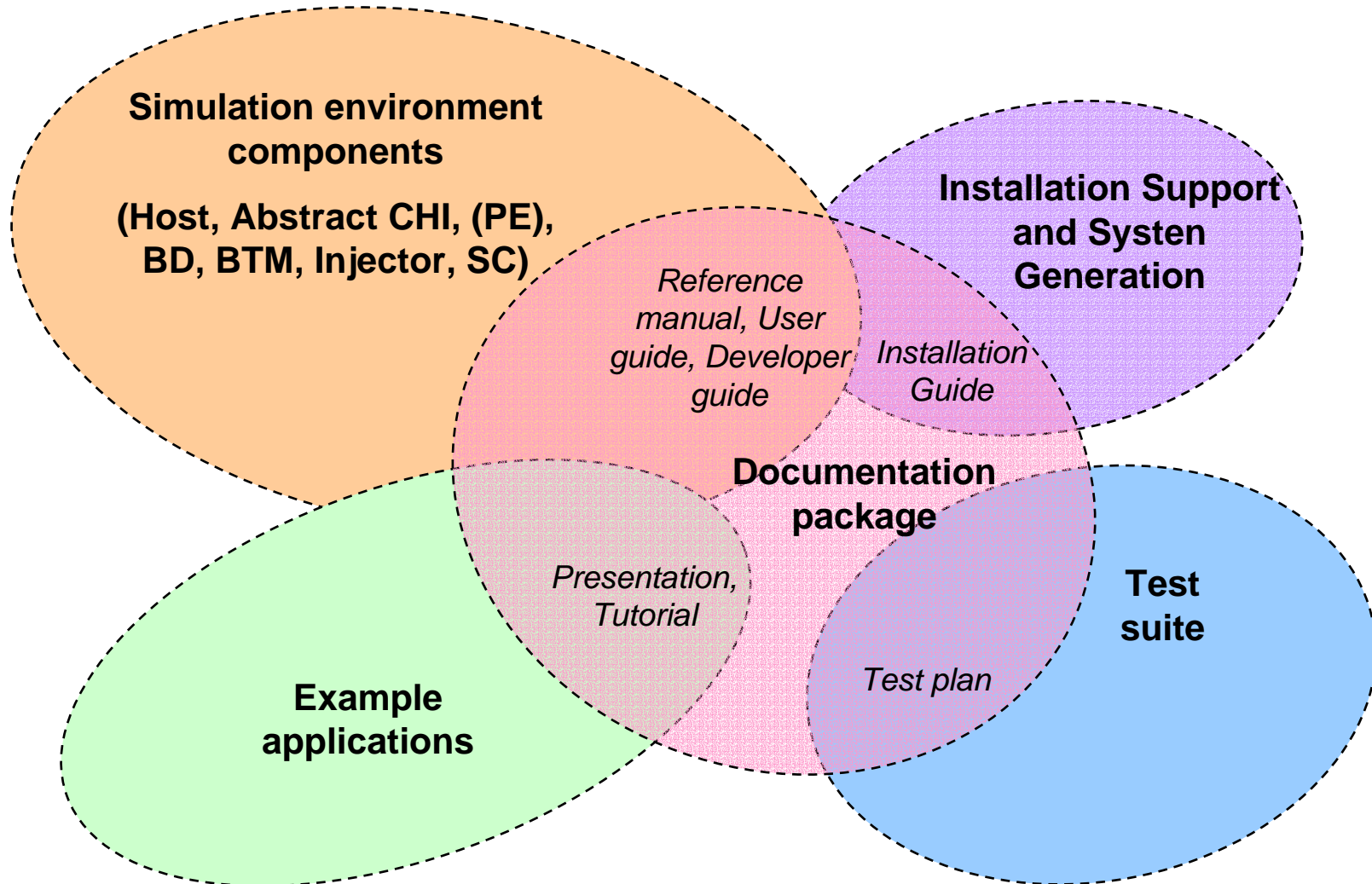
## **Components**

- The ERM implements strictly the protocol specification V2.1 and subsequent revised and published versions. It is embedded in a simulation environment that allows to analyze a wide variety of network topologies. The simulation environment contains the necessary sub-models
  - FlexRay Bus Model and Star Coupler Model
  - FlexRay Bus Guardian
- The sub-model for the Bus Model and Star Coupler Model is a logical abstraction of the physical layer described in the functional physical layer specification. It is used to simulate the physical bus interface. As the Star Coupler is optional, the simulation environment works with and without the Star Coupler model.
- The sub-model for the Bus Guardian (BG) implements the functional bus guardian specification. As the BG is optional, the simulation environment works with and without the BG model. The first release of ERM and simulation environment will not contain the BG, as the concept is still under definition in the protocol work group (BG Task Force).
- The ERM supports configurations of different topologies and clusters with multiple nodes.

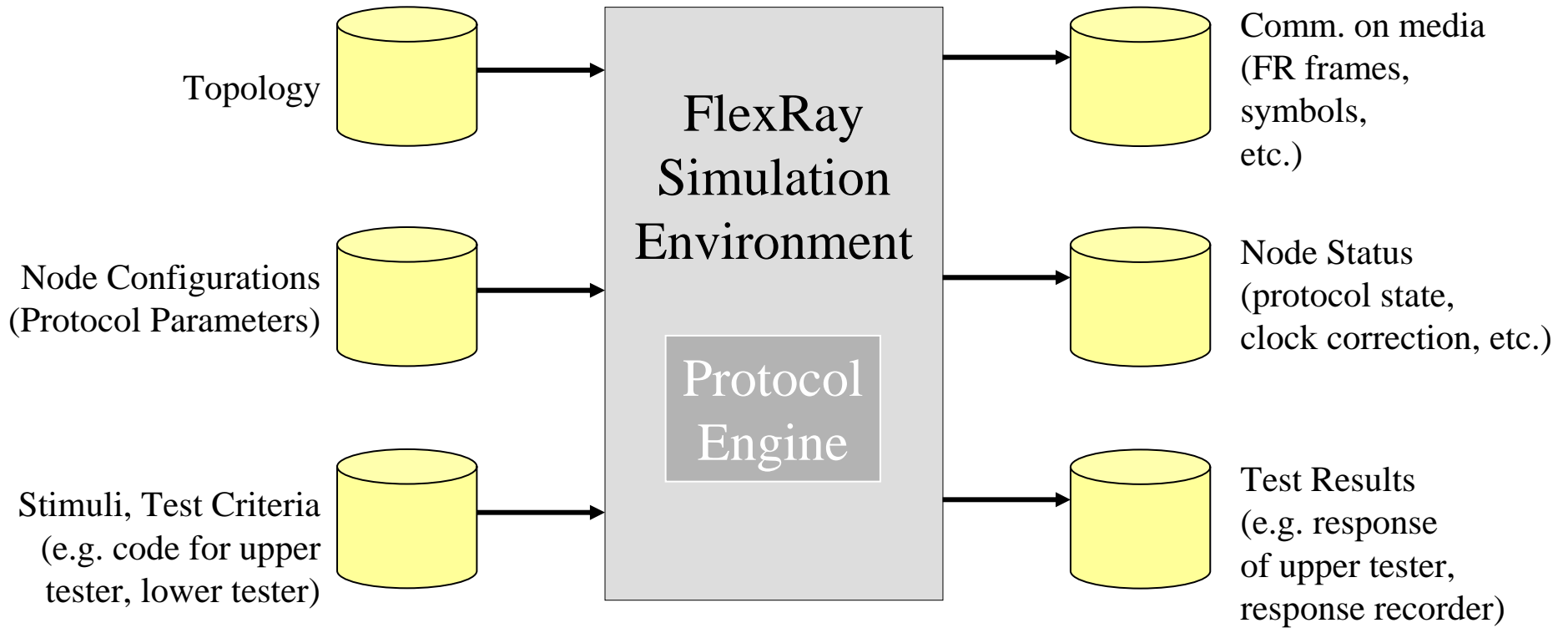
## **Technical Requirements**

- The ERM is written in the SystemC programming language. It is accurate to the microtick clock of the transmitter at the FlexRay bus and is capable to simulate with sample clock accuracy on the receiver side. The ERM is functional accurate at the boundary between Protocol Engine and Controller-Host-Interface. It is running under Redhat Linux 7.3

# Executable (Reference) Model Release Content



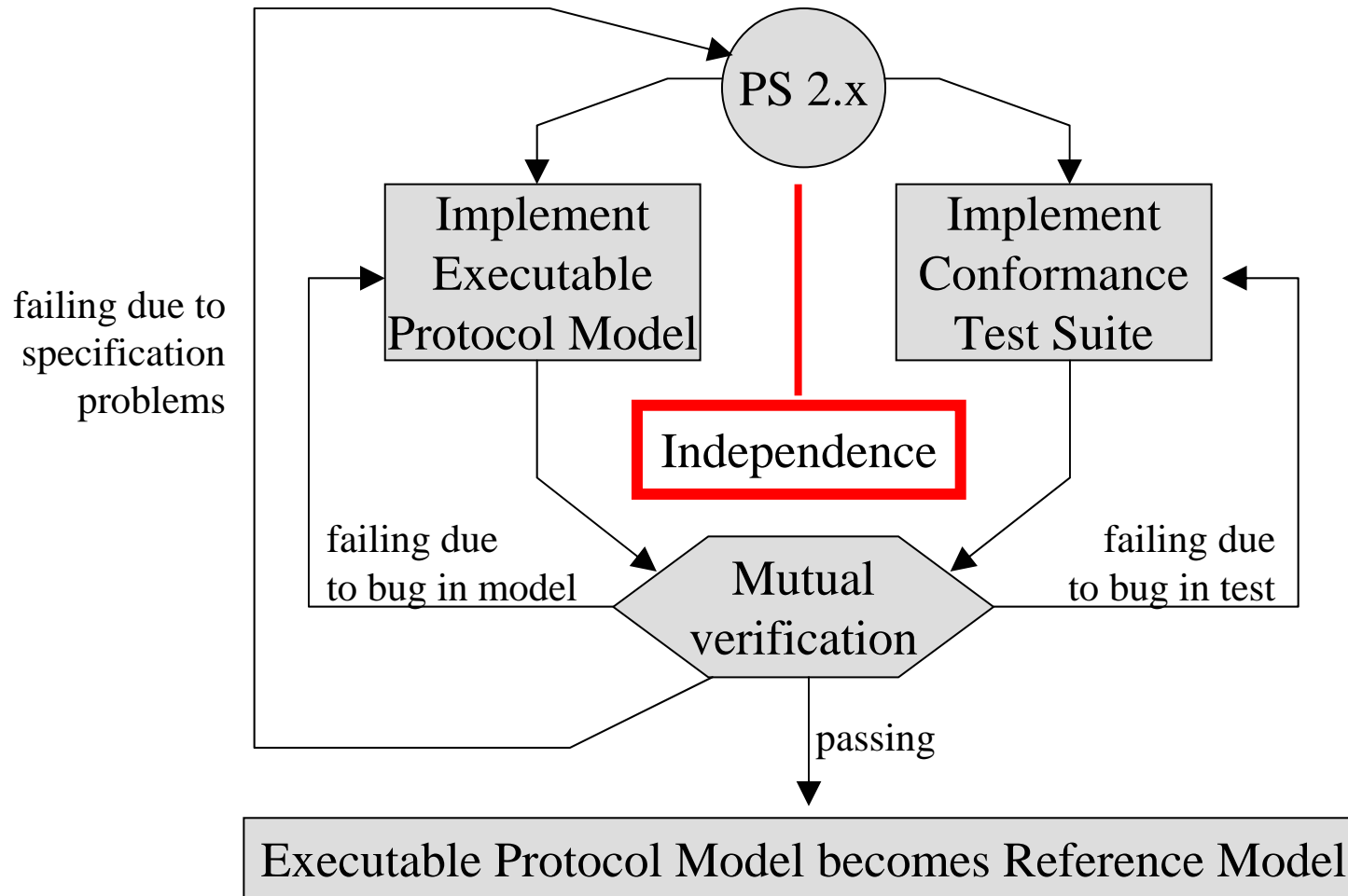
# Executable Model - External Interfaces



# Declaration of FlexRay Reference Model

- Consortium Process:** It is commonly understood that the FlexRay Consortium is proceeding in the following way:
- The Conformance Test Working Group (CTWG) and the Conformance Test Partner (CTPs) are defining a Conformance Test (CT) that is being specified in the Conformance Test Specification based on the Protocol Specification and the Electrical Physical Layer Specification of the FlexRay Communications System Specifications (FCSSs). The CT for the bus guardian (BG) will be included once the BG is committed by the FlexRay Consortium and is incorporated in the Bus Guardian Specification within the FCSSs.
  - The CTPs will test the executable model (EM) against the CT.
    - If a test case or a test case instance should fail then the FCSSs will serve as the reference for clarification.
    - Should the FCSSs contain an error then a change request will be filed according to the change management process defined by the FlexRay Consortium.
  - Once the EM passes the CT successfully the EM becomes the executable reference model (ERM) and the CT becomes the certified conformance test (CCT) through approval given by the FlexRay SC and the FlexRay EB.

# FlexRay Executable Model Relation to Conformance Test



# Licensing of the FlexRay Executable Model

## ***Business Model***

- The ERM is licensed to any FlexRay consortium member upon request either as an End User or as an Extended End User.
  - End User
    - > FSL offers a usage license for the executable model and the simulation environment (and later of course also the ERM and the simulation environment) and all its updates to End Users as an executable (black box) for a license fee of 50,000 Euro. There is no right to sublicense the ERM and the simulation environment to third parties. Sublicensing has to be negotiated separately with FSL. If the FlexRay consortium terminates, a suitable end user license agreement will be offered to the licensee. Maintenance fee shall be 10% of the initial license fee per year.
  - Extended End User
    - > FSL offers a usage license for the executable model and the simulation environment (and later of course also the ERM and the simulation environment) and all its updates to Extended End Users as an executable (black box) and source code (white box) for a license fee of 125,000 Euro . There is no right to sublicense the ERM and the simulation environment to third parties. Sublicensing has to be negotiated separately with FSL. If the FlexRay consortium terminates, a suitable end user license agreement will be offered to the licensee. Maintenance fee shall be 10% of the initial license fee per year. Availability of the EM and ERM

# FlexRay Reference Model Status

## Executable Model v2.1.0.2

- Complete, CD ready for shipment, ready for download on FTP site
- FlexRay specification level 2.1
- Supported Platform: Linux
- Signature of licensing agreement required, contact FSL sales representative

## Roadmap

- Reference Model declaration by FlexRay Consortium by 16DEC05
- Bus Guardian
  - no BG implemented currently as the BG concept is still under discussion
  - BG models will be provided by Freescale according to license contract
  - new BG development ongoing in consortium (two concepts: central and decentral) – will start model development when stable



# Thank you

