EAST-ADL Introduction

Behavior

EAST-ADL Behavior

Some Purposes of a Behavioral definition:

- Behavioural Specification
  A definition of intended behavior for documentation purposes
- Behavioural Simulation
  A definition of intended behavior for simulation
- Behavioural Analysis
  A definition of intended behavior for (formal) analysis of properties
- Behavioural Synthesis
  A definition of intended behavior for configuration, code generation, etc.

EAST-ADL Behavior

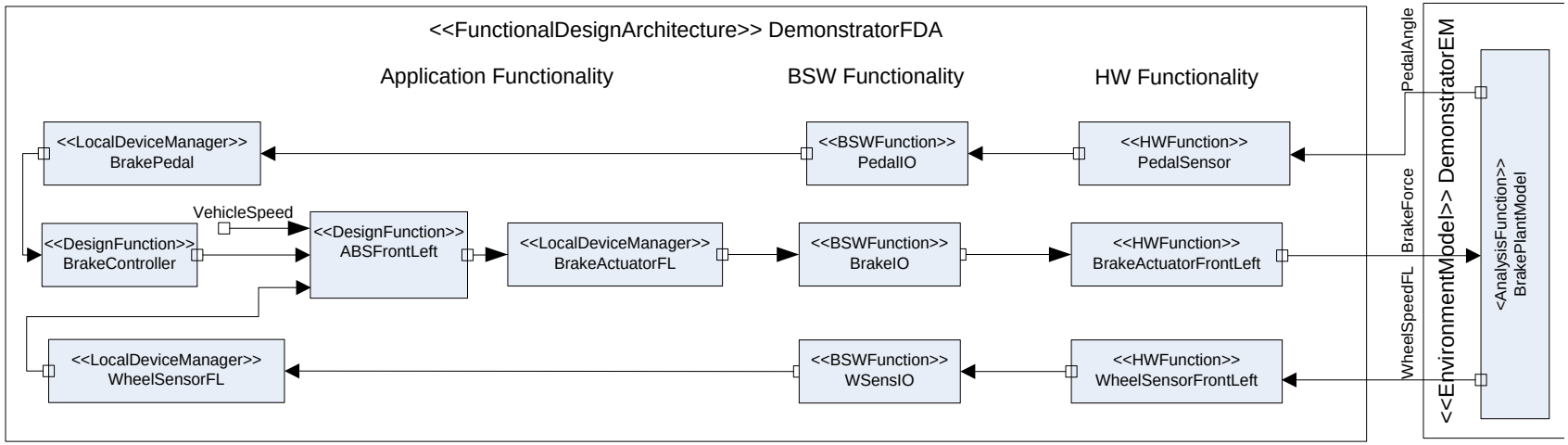
EAST-ADL is primarily a structural representation

Behavior aspects includes:

- Execution semantics
- Transfer functions
- Integrated Behavior of systems/subsystems

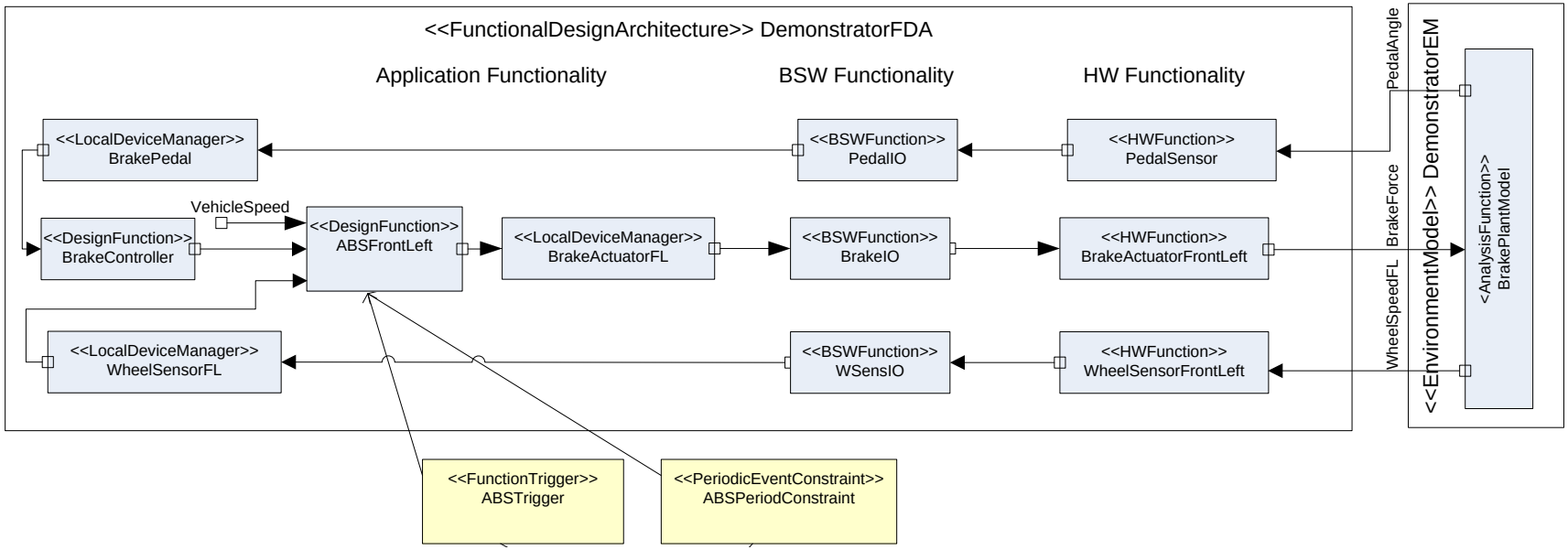
EAST-ADL Model on Design Level

Structure



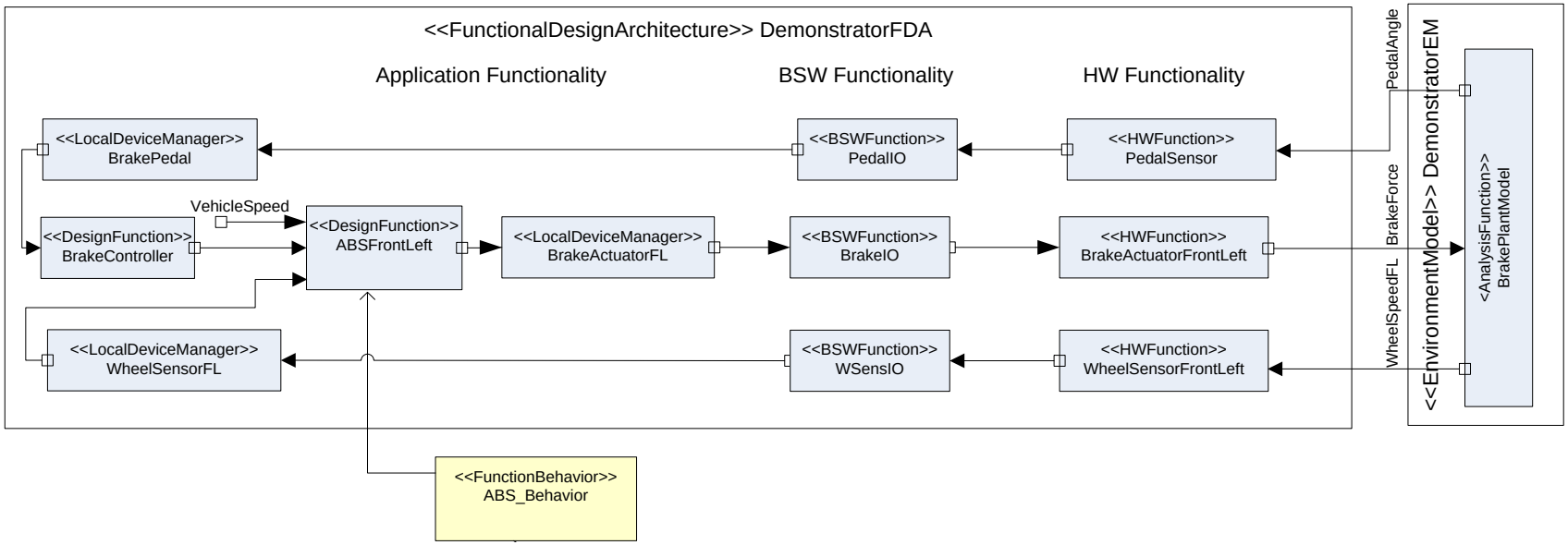
EAST-ADL Model on Design Level

- Timing/Triggering



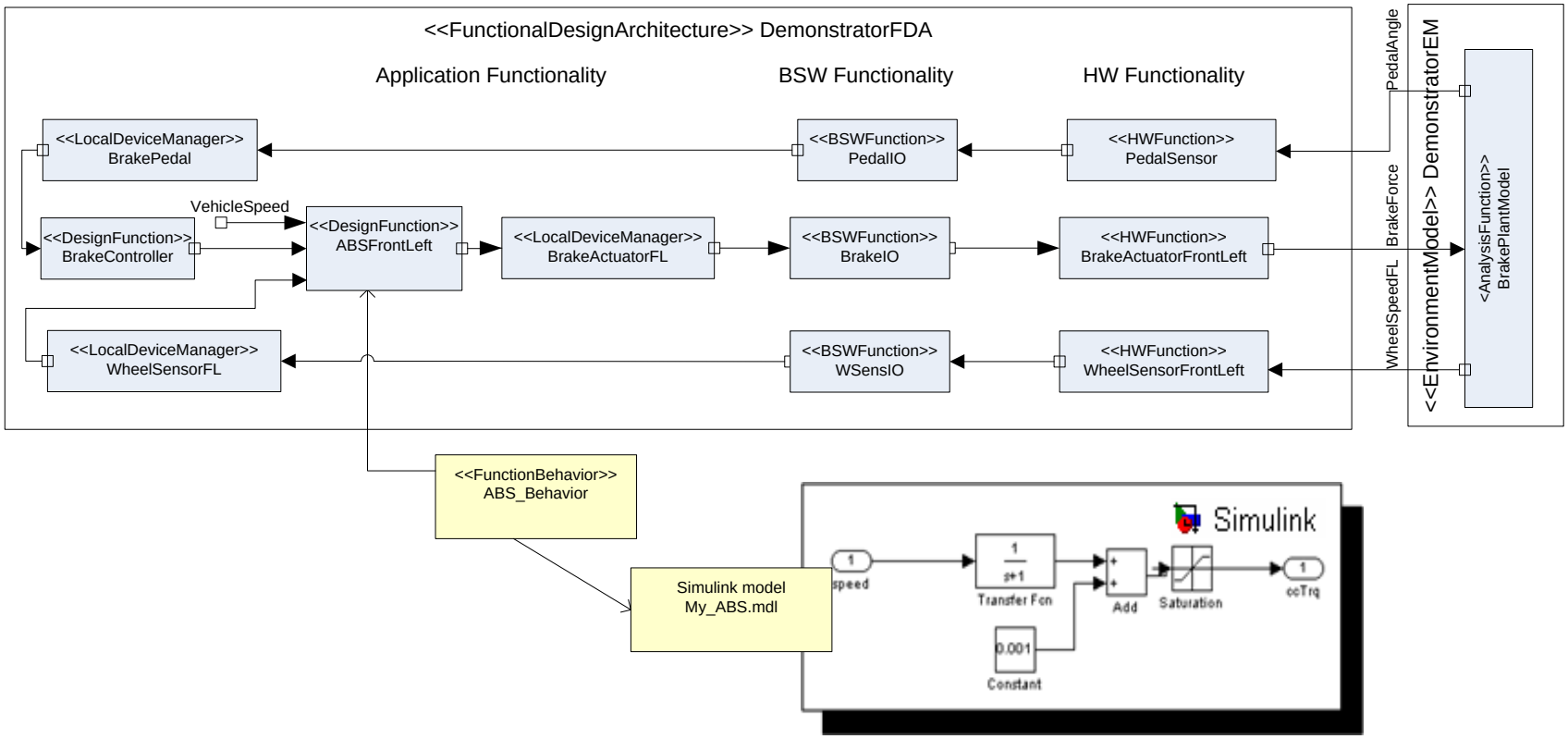
EAST-ADL Model on Design Level

Transfer Function – ”Black-box” behavior



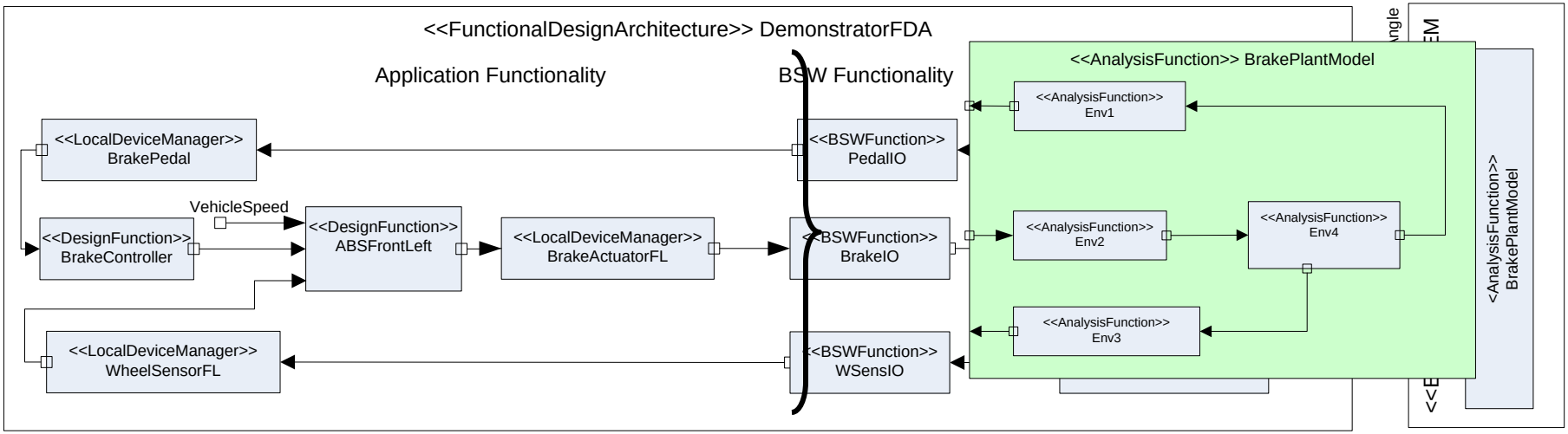
EAST-ADL Model on Design Level

Transfer Function – ”Black-box” behavior



EAST-ADL Model on Design Level

Behavior of environment (Plant)

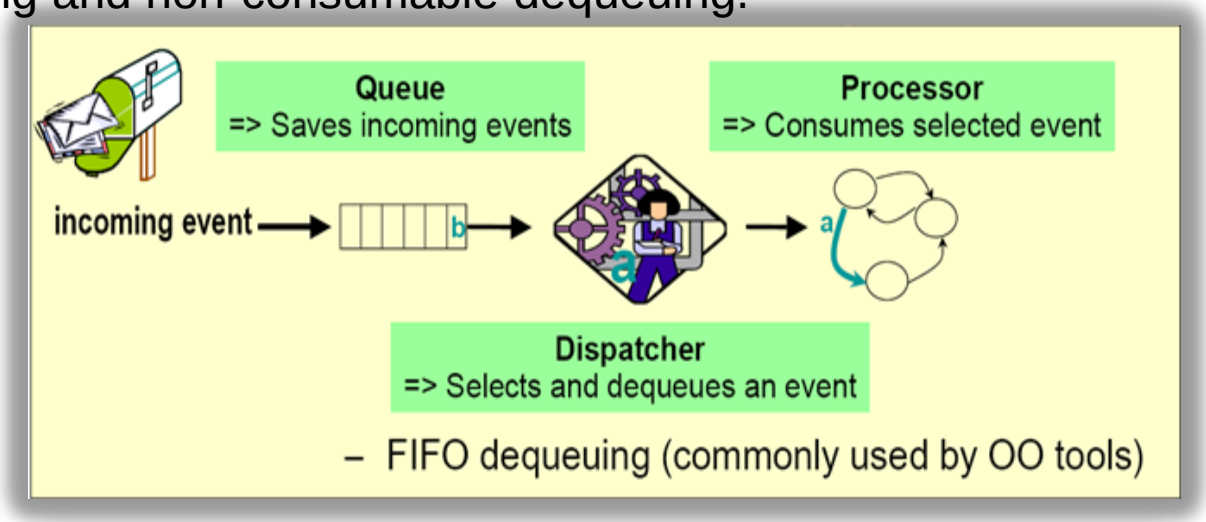


Typically in plant model:

- Non-causal: ”Power Ports” – {Torque,Speed}, {Pressure, Flow}, etc.
- Continuous Time: No triggers

Semantics of Function Behavior

- Computation(transfer function): follows the semantics of the external representation used (e.g. Simulink or StateMate).
- Execution: synchronous
  1. Read inputs from input ports
  2. Execute Behavior with fixed inputs (run-to-completion)
  3. Provide outputs to output ports
- The targeted ports are single size buffers with non-blocking access, overwritable queuing and non-consumable dequeuing.



Behavioral notations

Commercial tools

- Simulink
- Ascet
- Scade
- StateCharts
- ...

Open Notations

- UML State charts, Activity diagrams
- SPIN
- UPPAAL
- Modelica
-

Model Structure must be respected

- Inputs, outputs

Execution Semantics must be respected

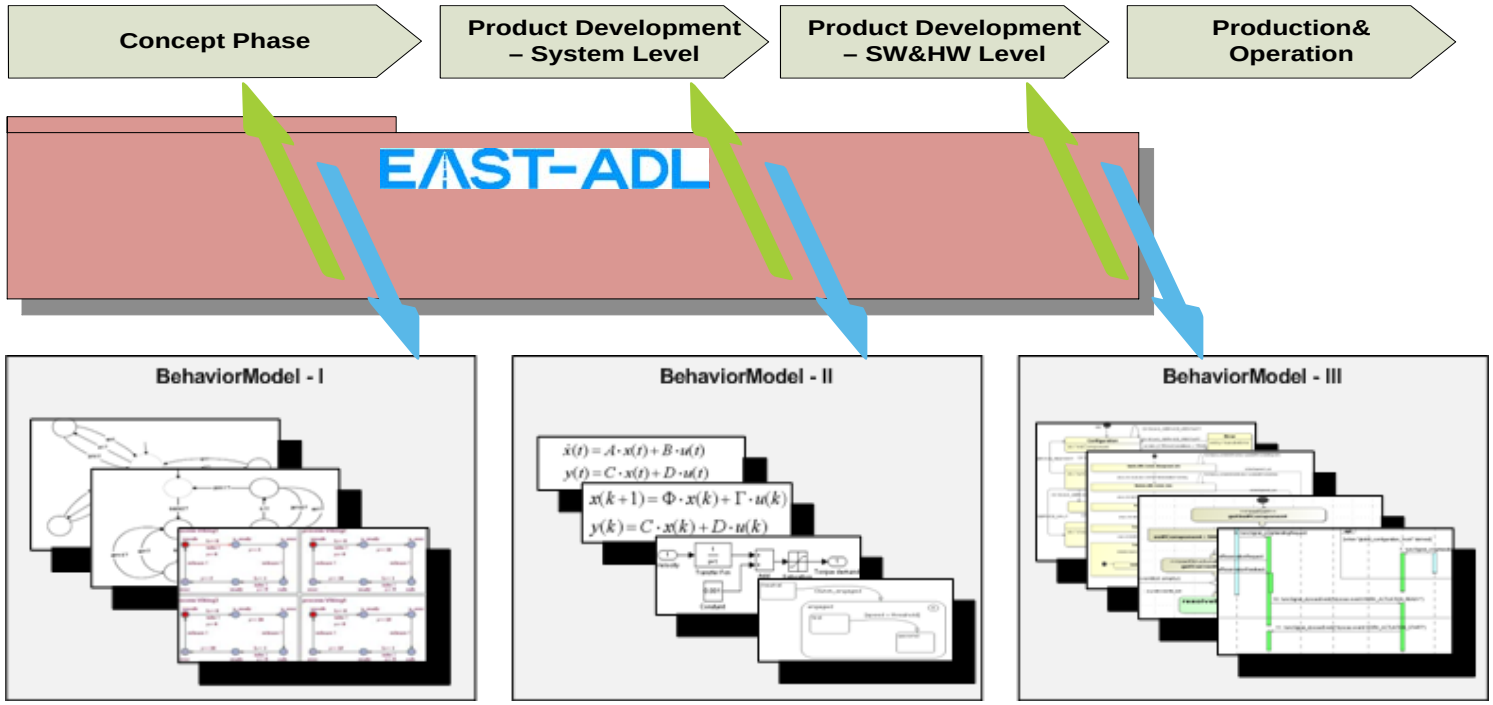
- Continuous/discrete
- Triggering
- Data Exchange

Support for Modes

- Modes
  - Declarative modes – ”assuming mode X, this is what happens”
  - Transfer functions, constraints, triggers refer to mode(s)
- Mode Groups
  - Mutually exclusive set of modes: {driver_present, driver_absent}, {parked, stand-still, in-motion}
  - The realization of mode switches and mode notifications is part of ”black-box” behavior

Generic Roles of Behavior Modeling

Defining system modes, computation/transfer functions, execution dynamics, and related error behaviors.
Refining textual requirement, operation situation and use case statements.
Supporting communication&comprehension, analysis and V&V (e.g., test case generation).



EAST-ADL Behavior Modeling

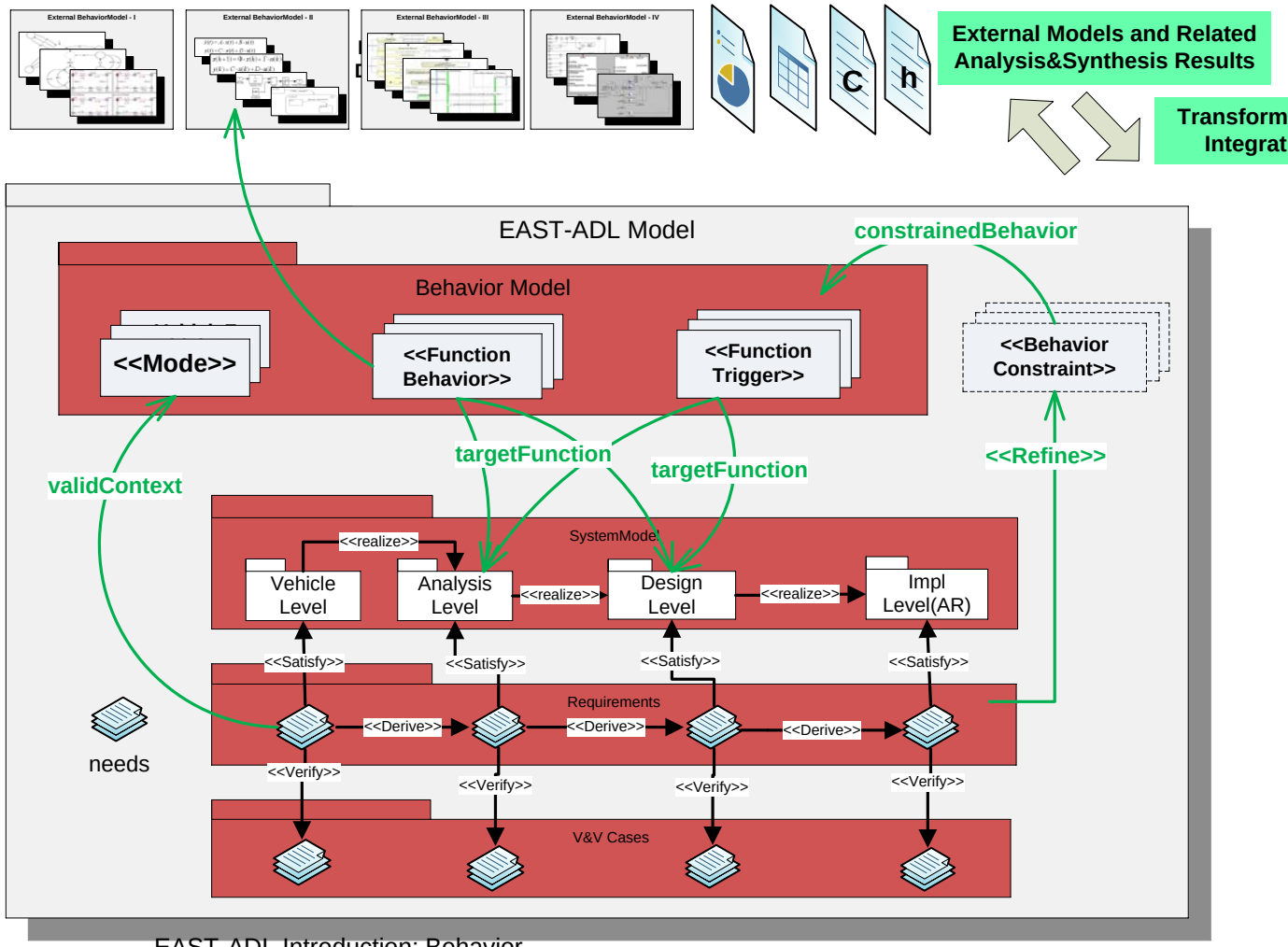
System Behavior

System Structure

Requirement

V&V Definition

Lifecycle Stages



Concept Phase | Product Development – System Level | Product Development – SW&HW Level

Summary

- EAST-ADL Provides Structure and Triggering
  - Leaf Functions execute synchronously (EE-system) or non-causally (Plant/Environment)
- ”Transfer Function” is defined in external tools and notations

Purpose:

- Allow integration of models from different sources
- Allow simulation, analysis, synthesis of integrated models

Work is ongoing to also define a native behavior for ”behavioral constraints”

Summary, cont'd

Purposes of Behavior definition

- Supporting System definition:
  modes, function behavior, function trigger
- Supporting Error definition
  Error behaviors
- Formalizing textual descriptions in requirements and related statements.
- Facilitating analysis and V&V (e.g., test case generation).
- Dedicated support for physical interaction:
  Power ports.
- "input language" to external models and formalisms (e.g., Simulink, SPIN)