# Generation of AADL Architecture Consistent Work Products: Simulink Behavioral Models, and Distributed Embedded Software using OCARINA


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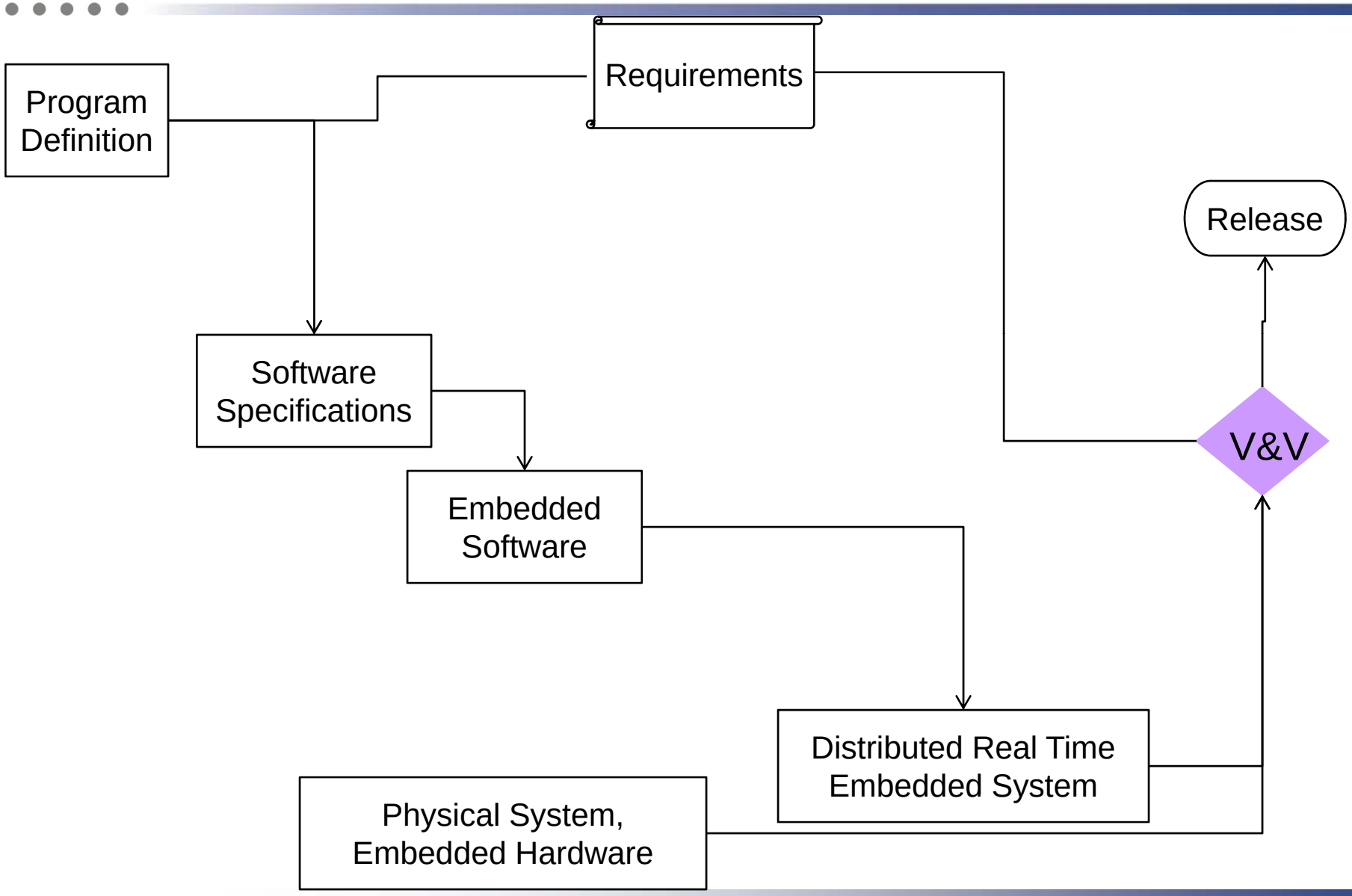
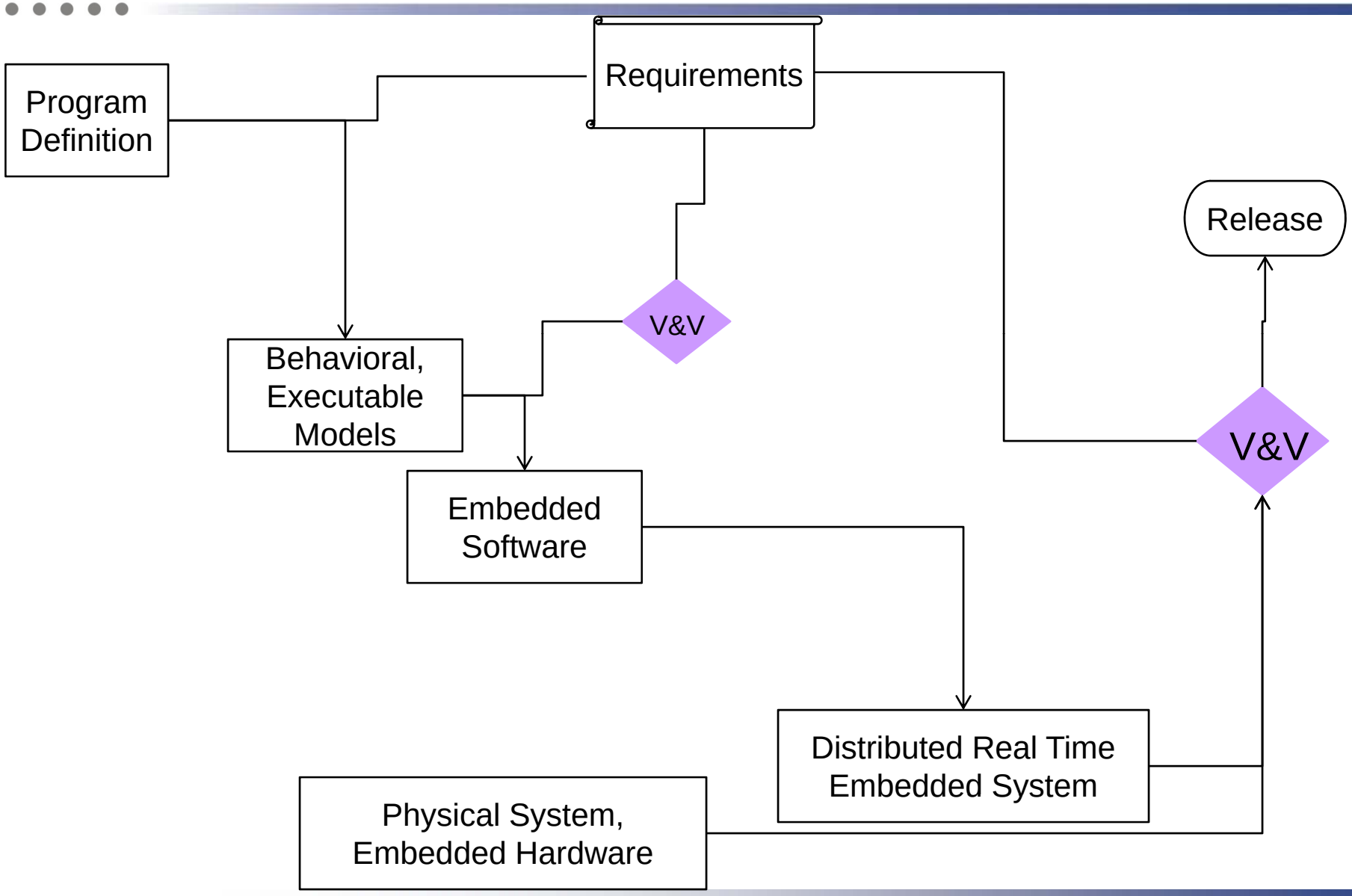
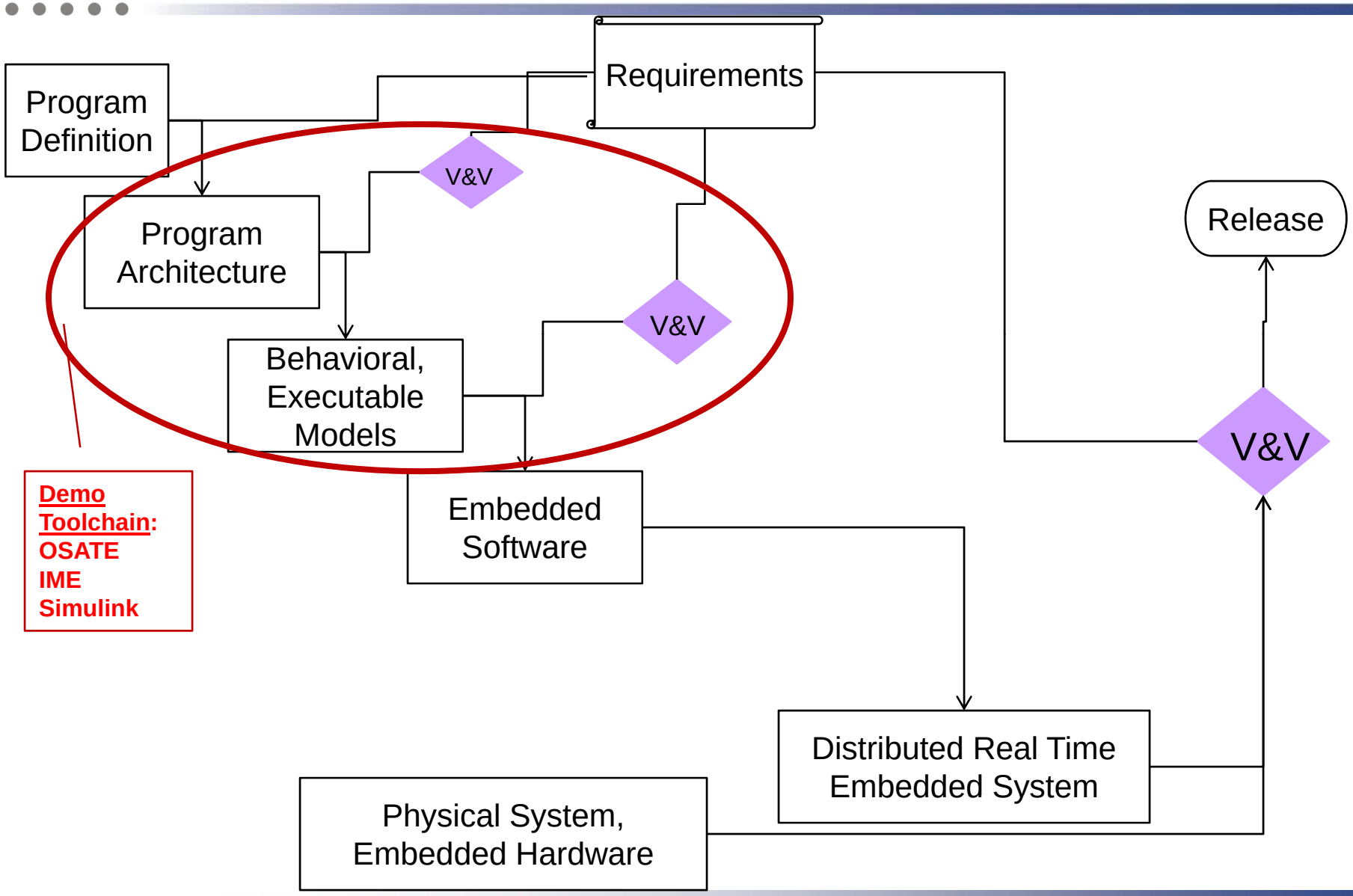
# Traditional Development vs. …



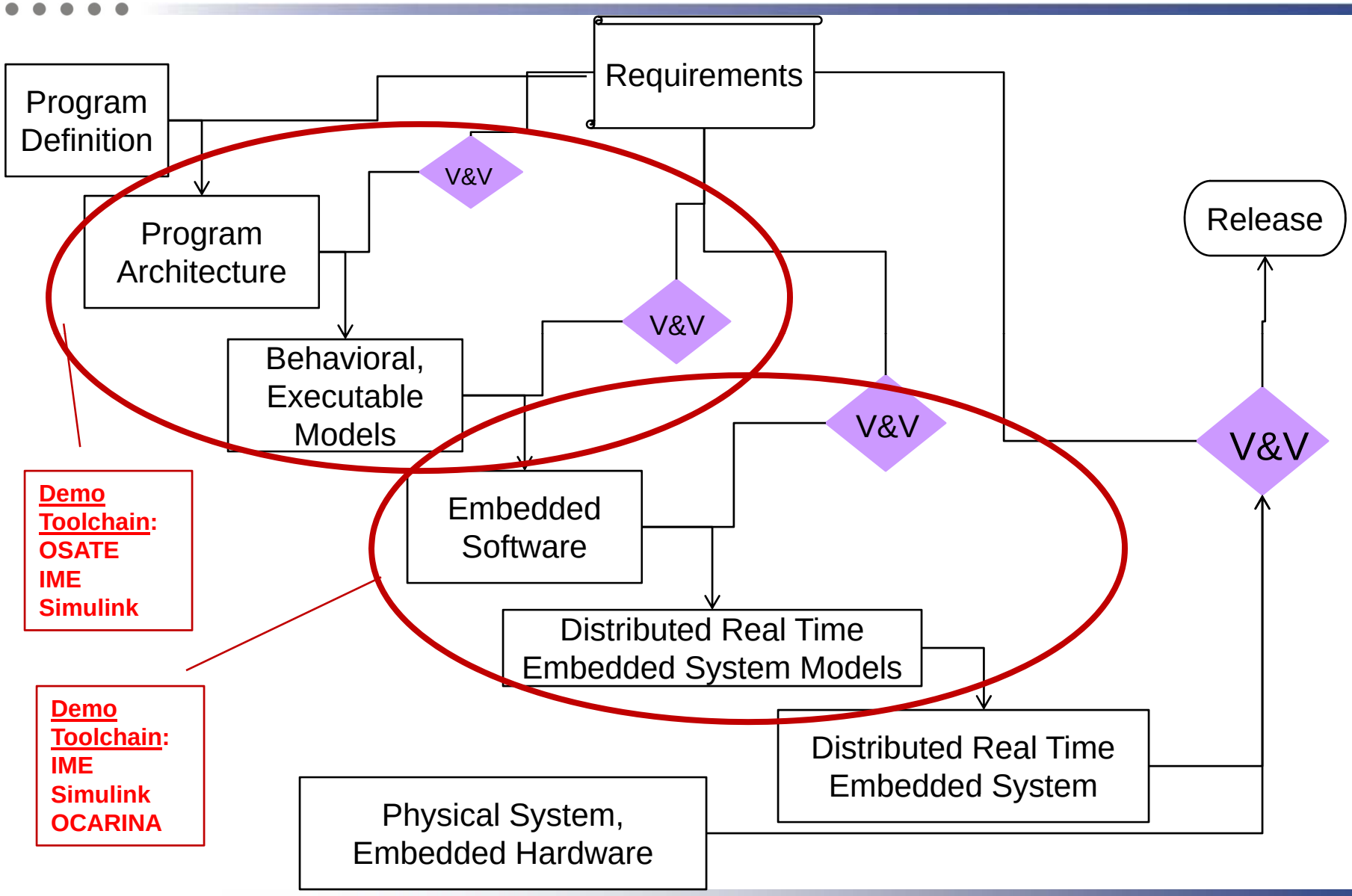
# Model Driven Development vs. …



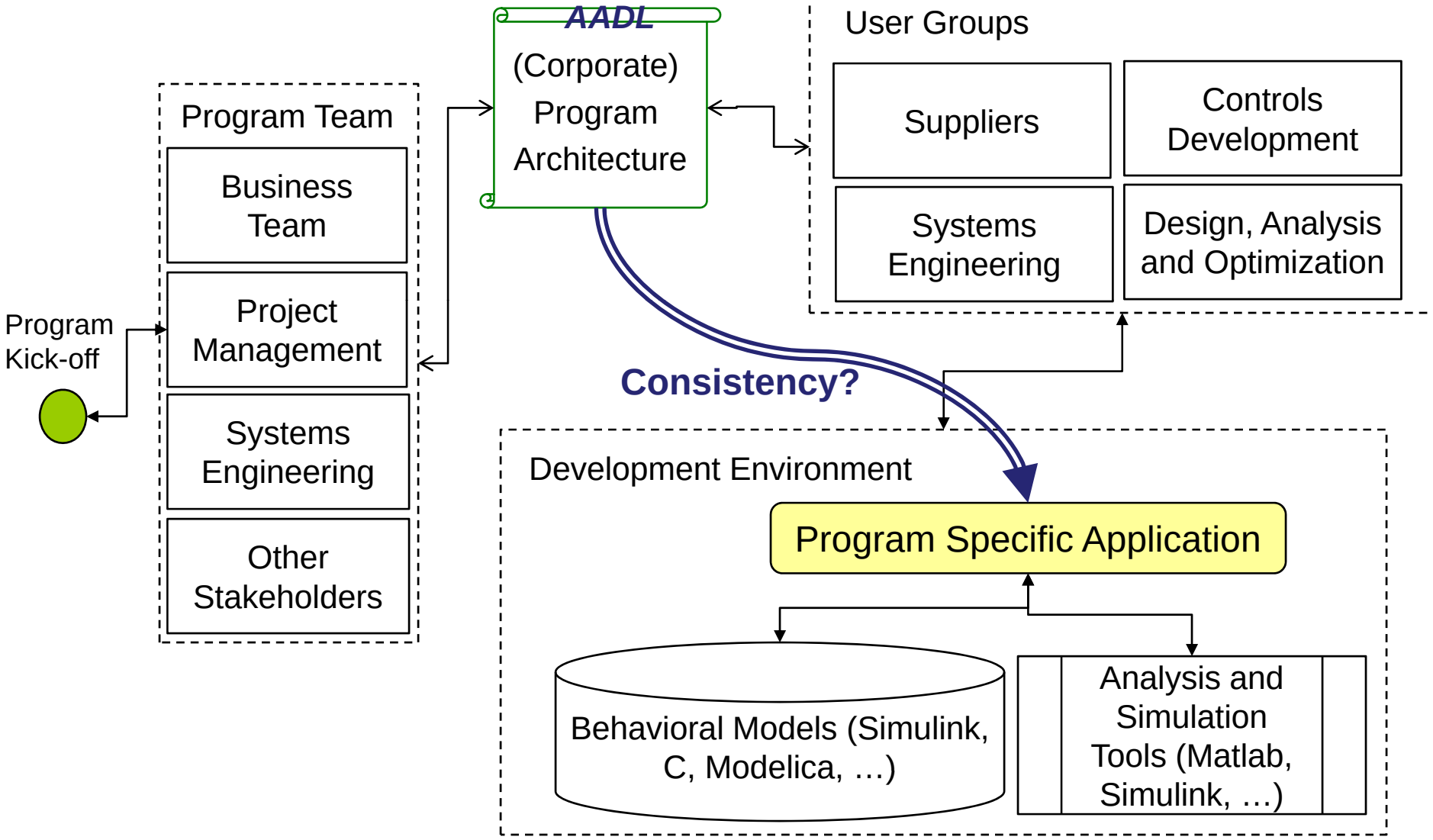
# Architecture Driven Development



# Architecture Driven Development



# Demo 1 Scenario (Apr Mtg)



# Demo 1 Workflow - Generation of Simulink Model Consistent with Corporate Architecture

**OSATE** AADL architecture consists of systems only

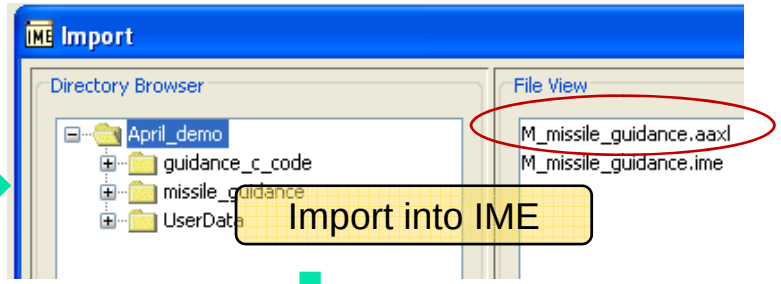
```
end A_missile_guidance_system;

system implementation A_missile_guidan
    subcomponents
        Airframe: system T_Airframe.I_
        Controller: system T_Controll
        TestInputsResults: system T_Te
    connections
        Airframe_Xe_Ze_to_TestInputsRe
        Airframe_Altitude_to_TestInput
        Airframe_alpha_to_Controller_a
        Airframe_mach_to_Controller_me
```

.aadl

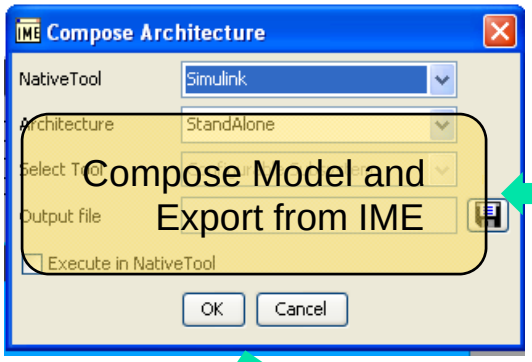
```
<?xml version="1.0" encoding="UTF-8"?>
<core:AadlSpec xmi:version="2.0"
    xmlns:xmi="http://www.omg.org/XMI" xmlns:cor
  <systemType name="A_missile_guidance_system"/>
  <systemImpl name="A_missile_guidance_system.I_
    <connections>
      <dataConnection name="Airframe_Xe_Ze_to_Te
          dstContext="/aadlSpec[@name=M_missile_
          src="/aadlSpec[@name=M_missile_guidanc
          dst="/aadlSpec[@name=M_missile_guidanc
```

.aaxl

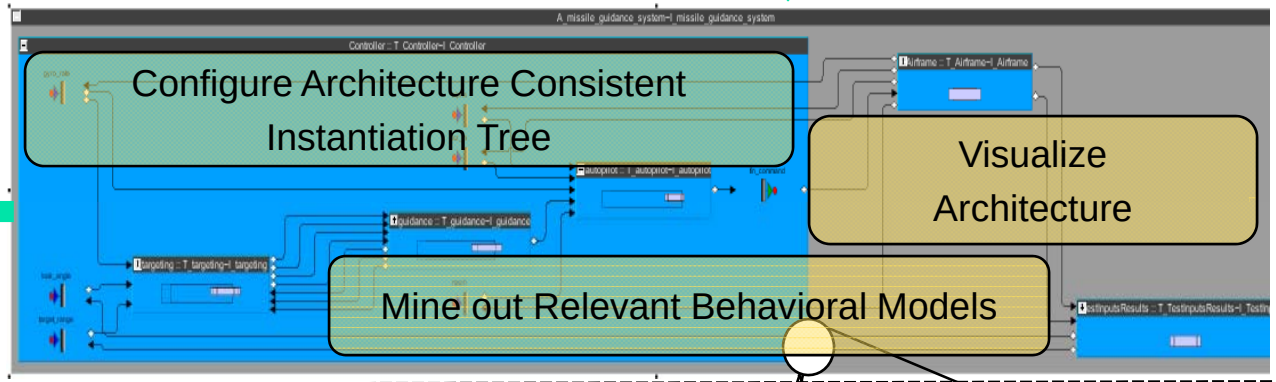



Import into IME

**IME (scope of Demo)**



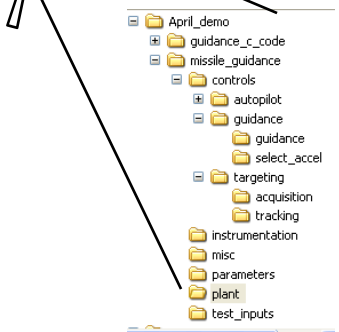

Compose Model and Export from IME



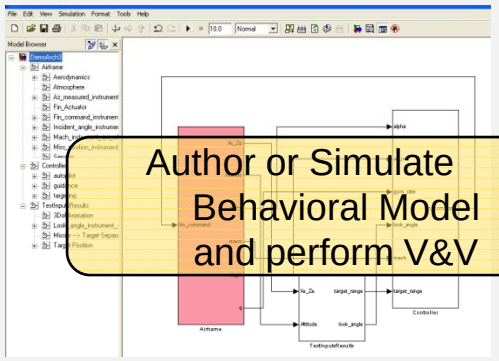
Configure Architecture Consistent Instantiation Tree

Visualize Architecture

Mine out Relevant Behavioral Models



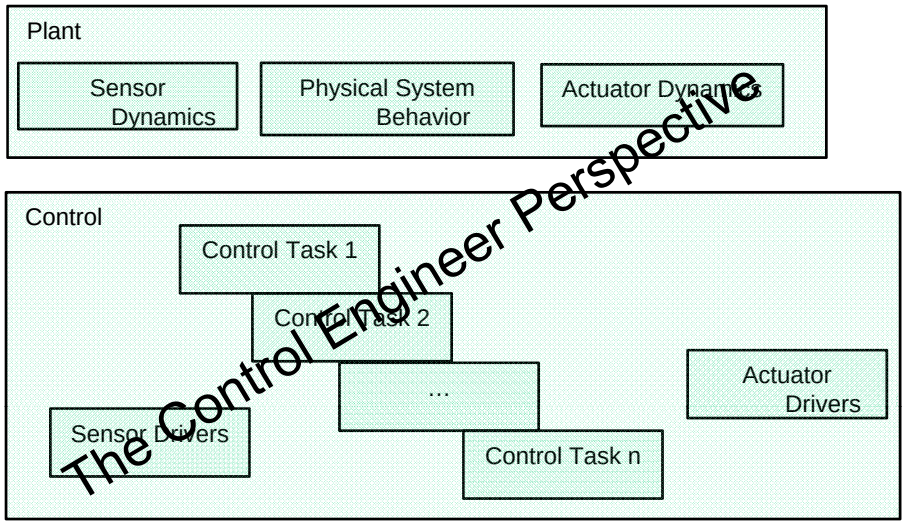

**Simulink**

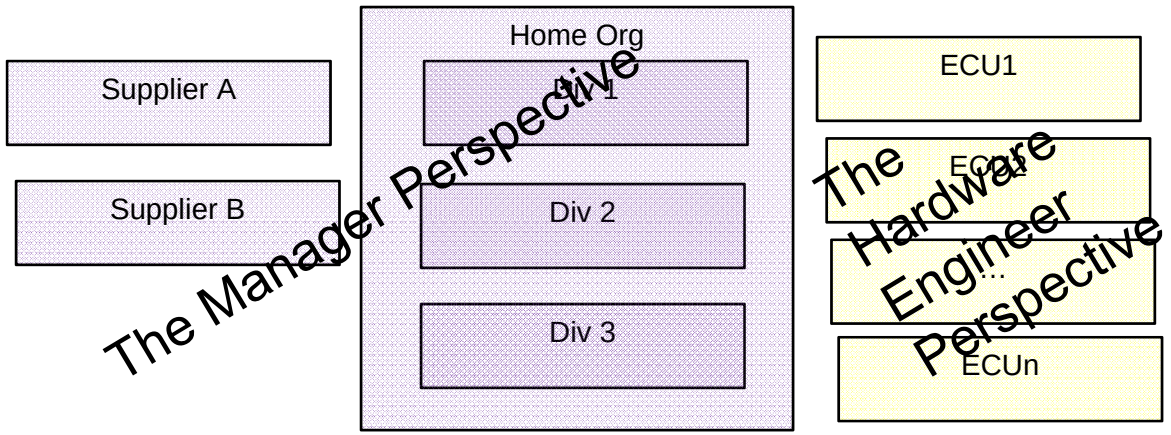


Author or Simulate Behavioral Model and perform V&V

# Multiple Architectural Views

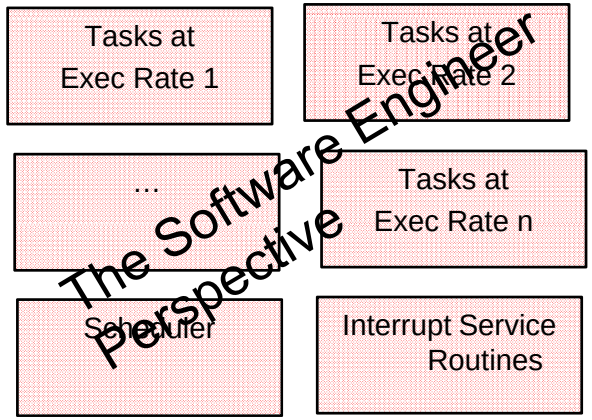
- Multiple, Valid, Architectural Views exist
- Different views or perspectives better suited for different analysis/development purposes



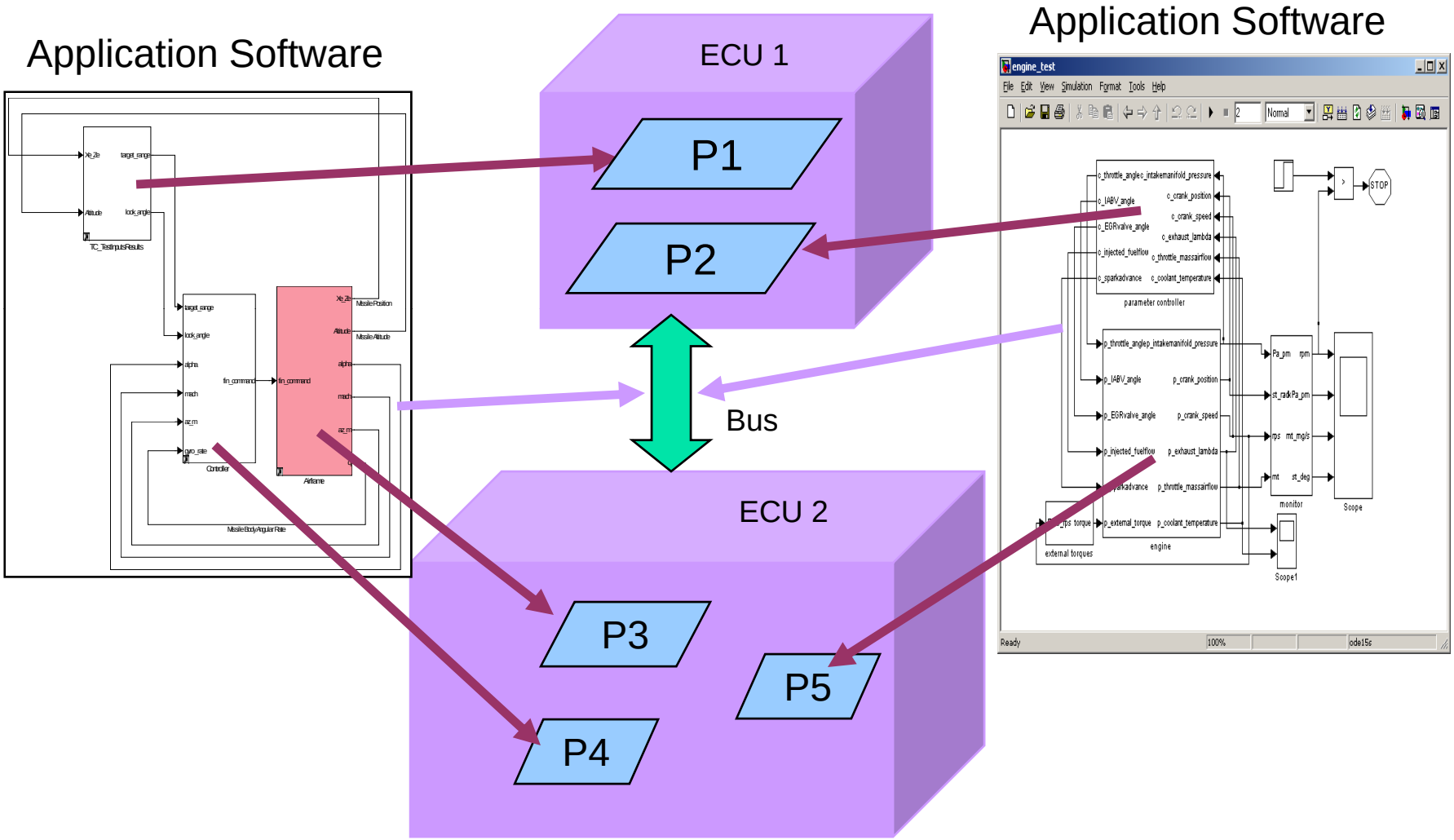





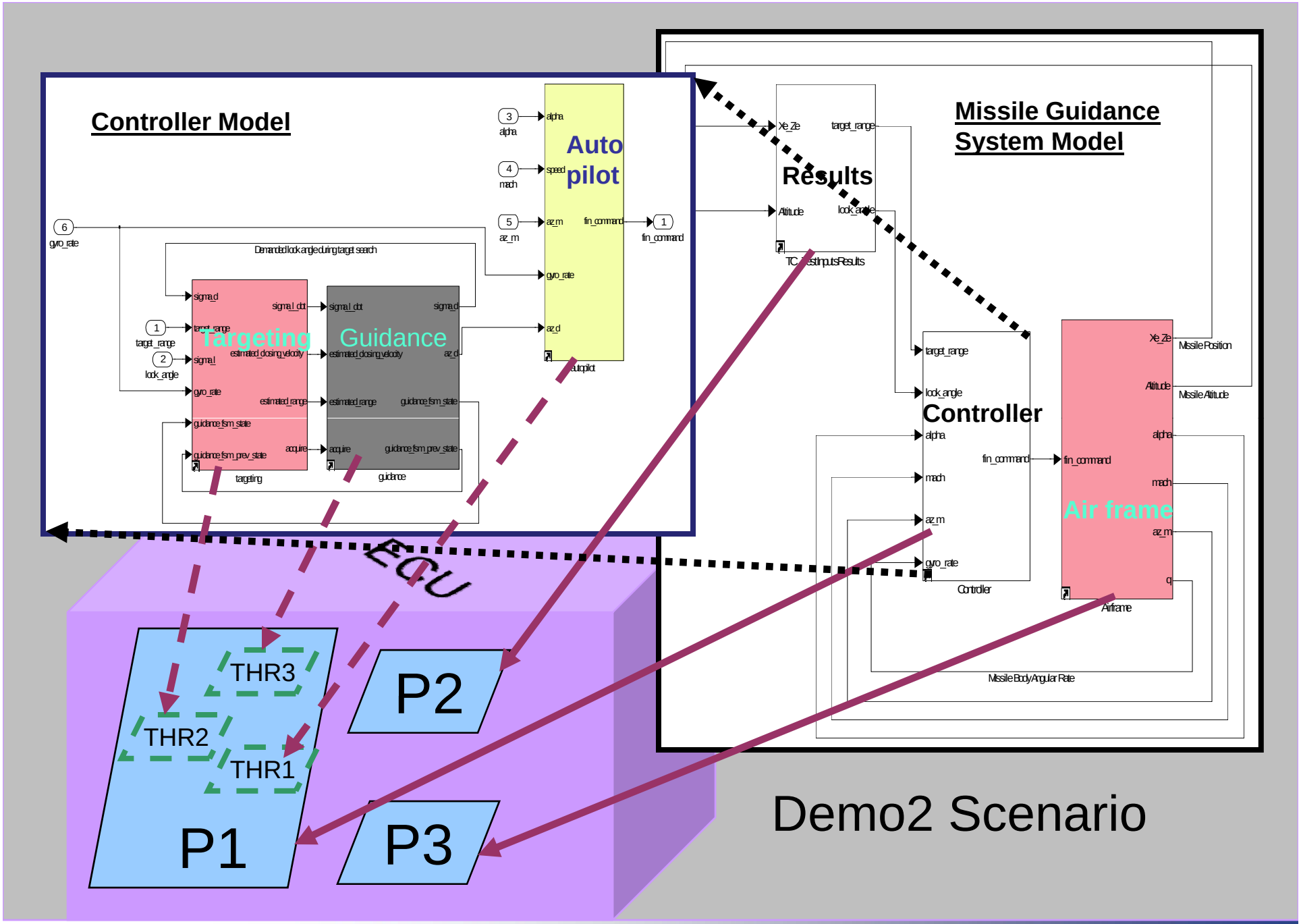




# Example Need for Multiple Architectural Views



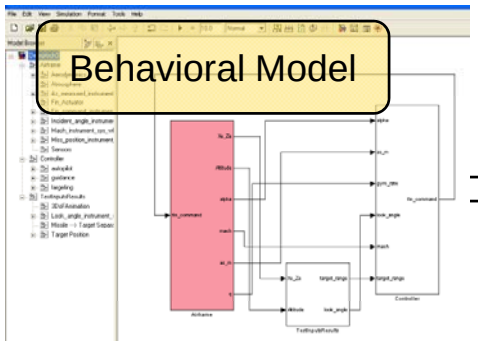

Distribute application software components among the different ECUs as separate tasks

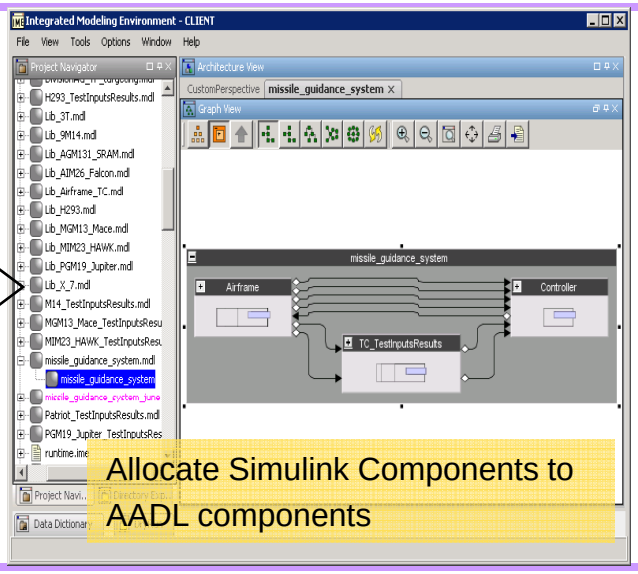

Controller Model
Auto pilot
Targeting
Guidance
Missile Guidance System Model
Results
Controller
Air frame
ECU
THR3
THR2
THR1
P1
P2
P3
Demo2 Scenario

# Demo 2 Workflow

Workflow in IME

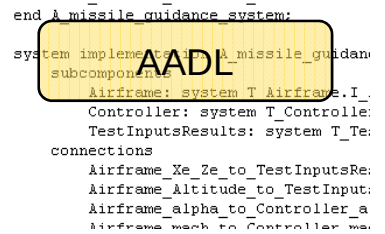
Workflow in Ocarina




Allocate Simulink Components to AADL components

AADL model with references to Simulink model

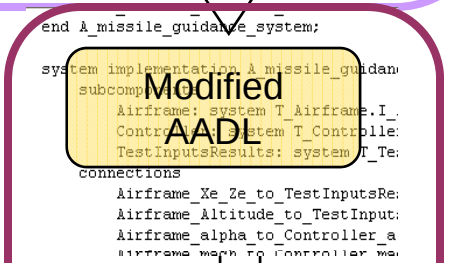



Real-time Workshop

Application Code

Distributed Embedded Software

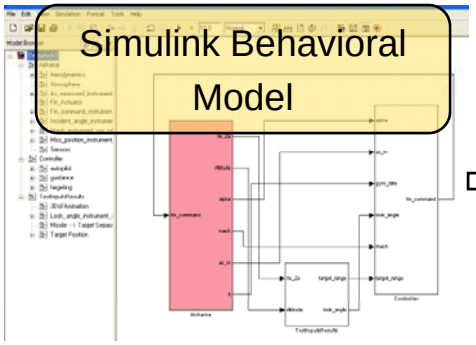
Add Missing Elements

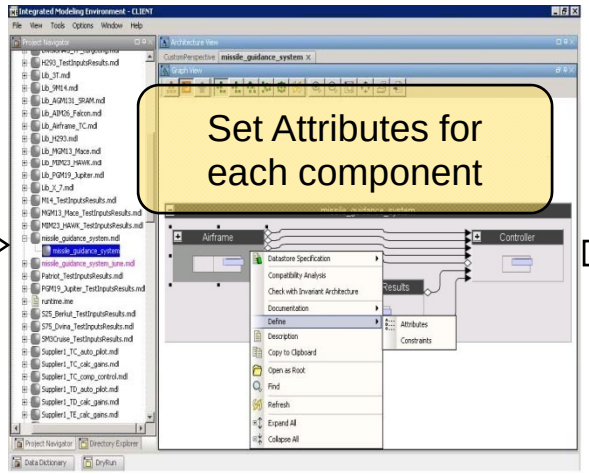


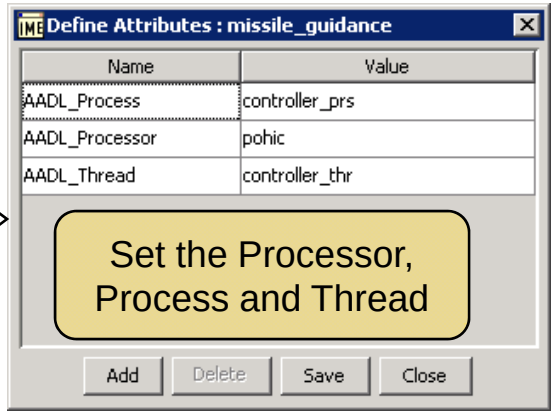

Embedded System Code

Ocarina

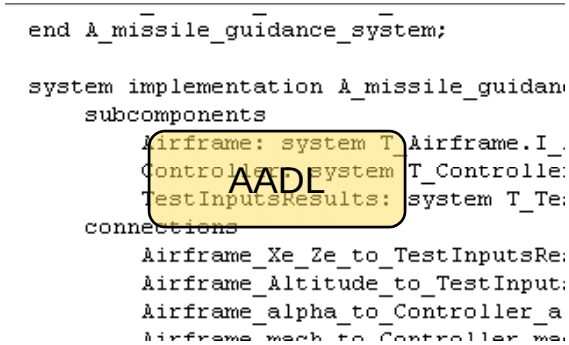
# Workflow in IME



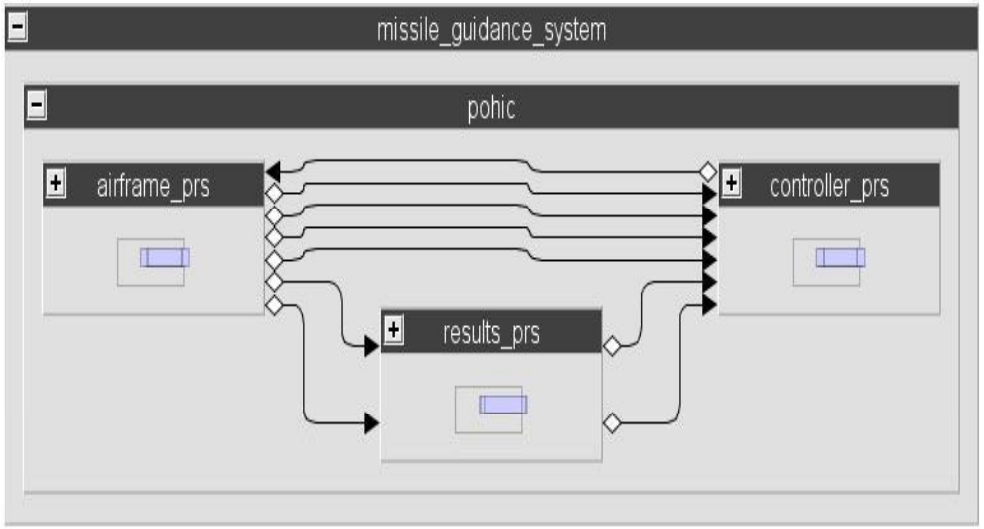



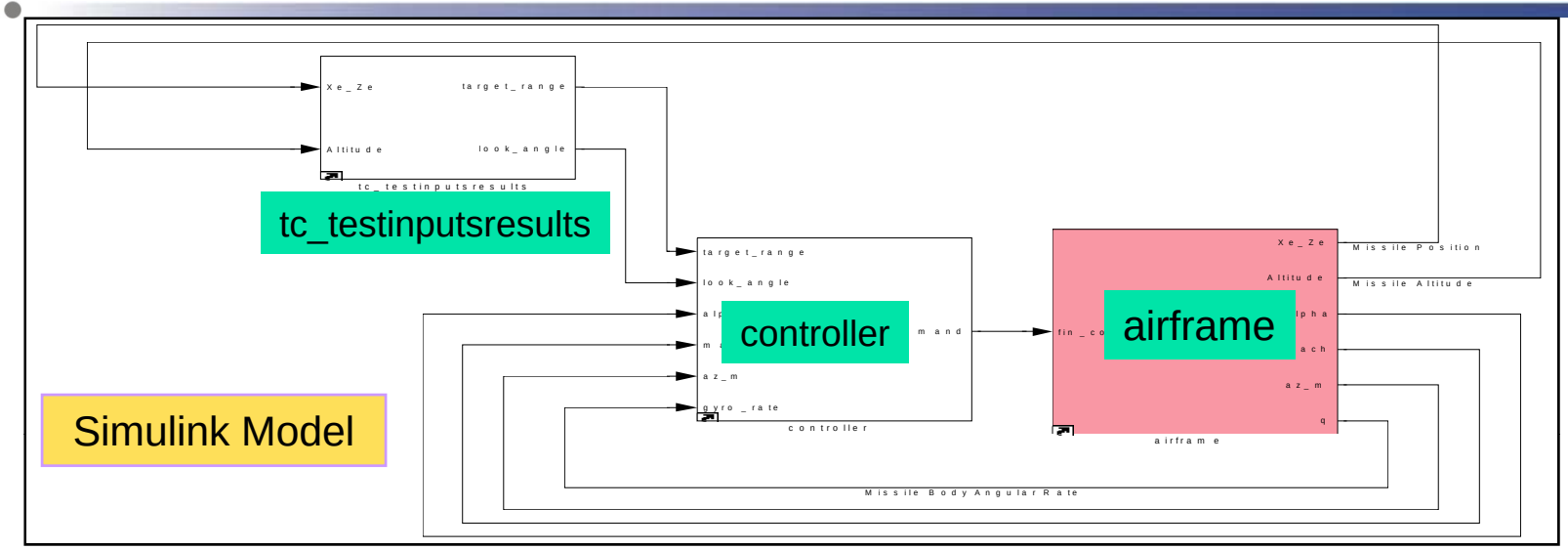

View in different Perspective

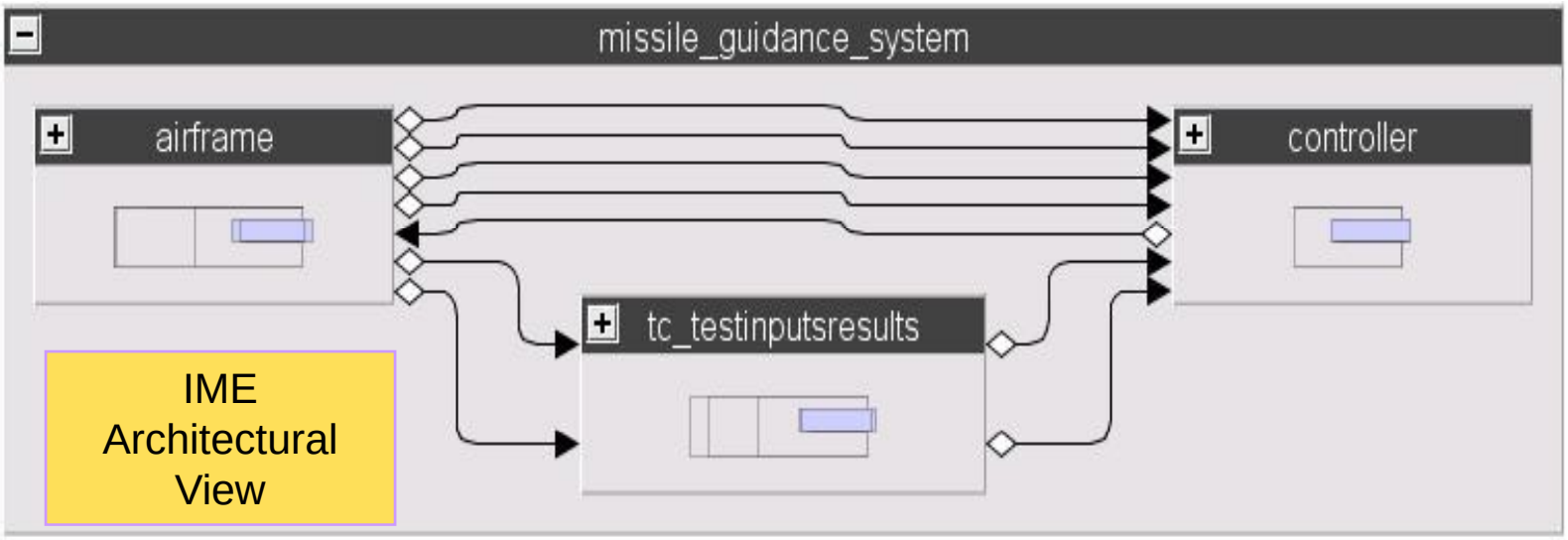


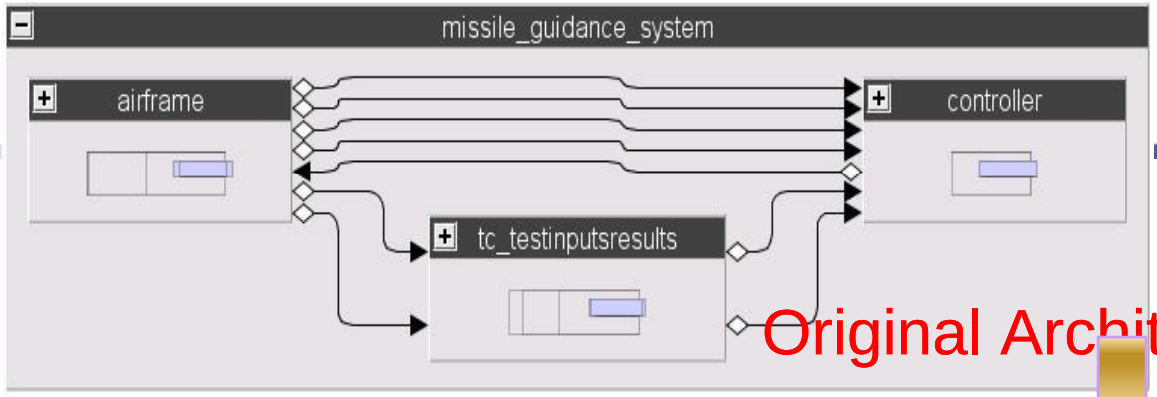

Export



# Application Software Architecture

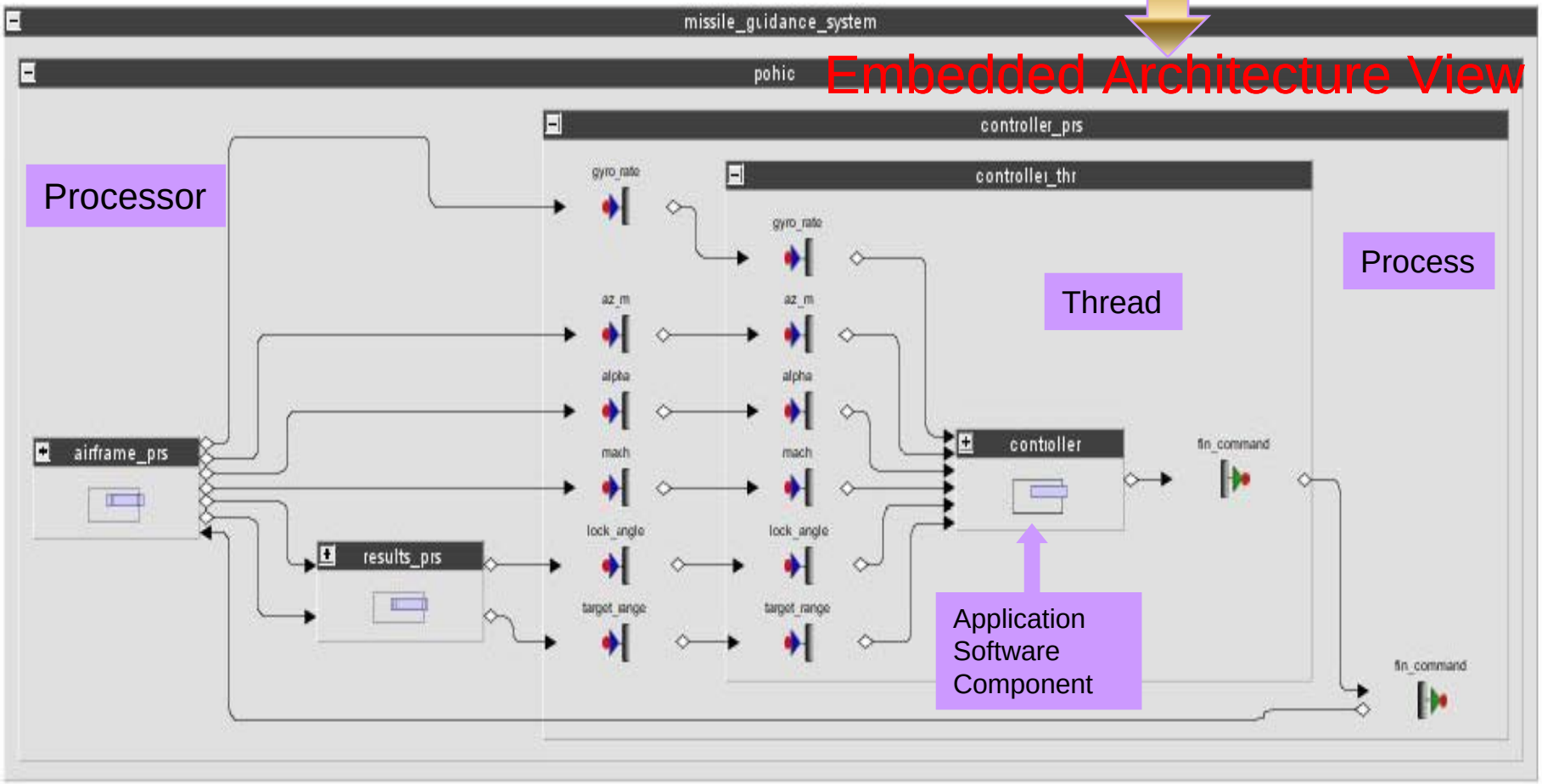


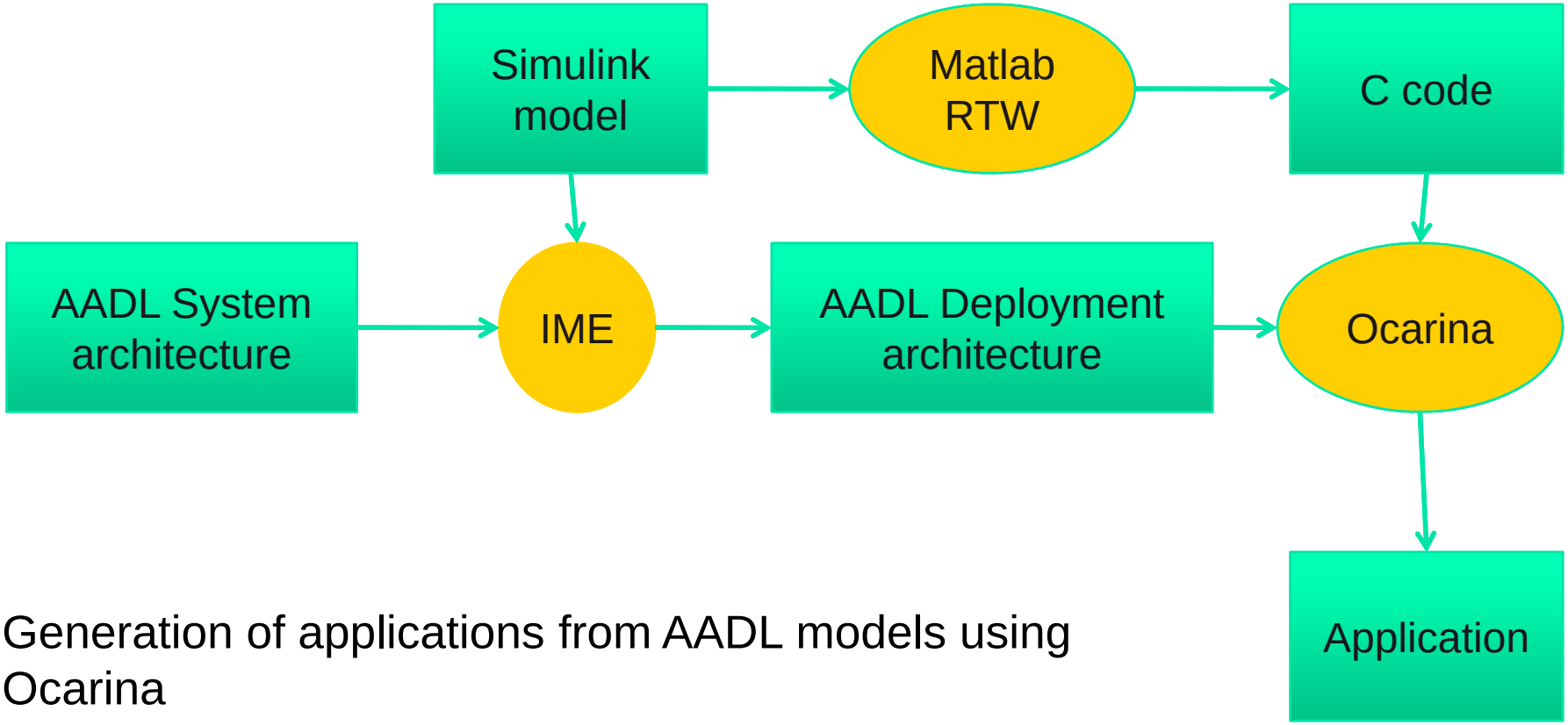



Original Architecture View

Embedded Architecture View

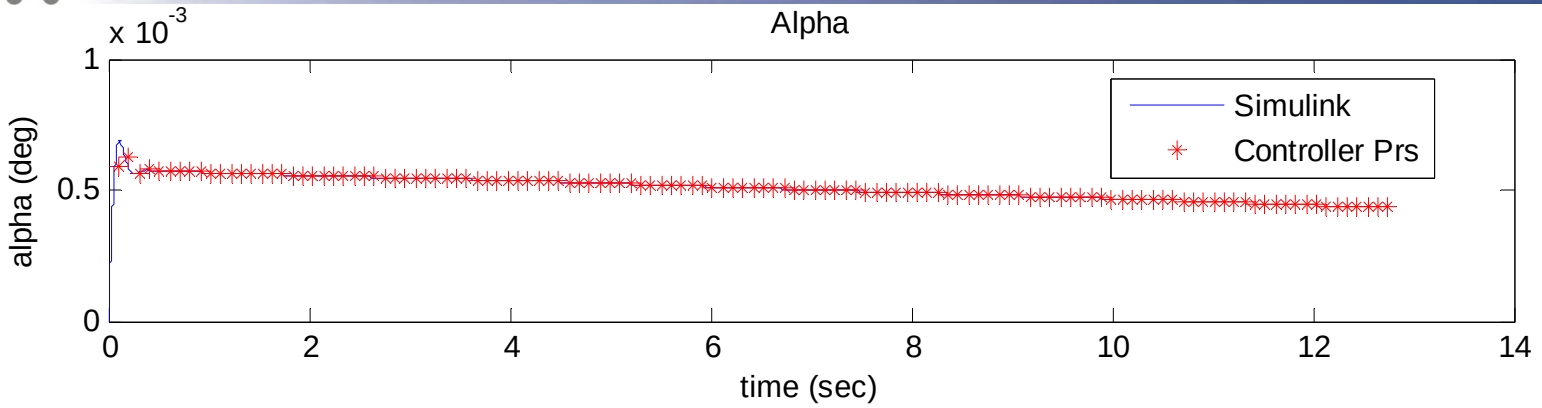


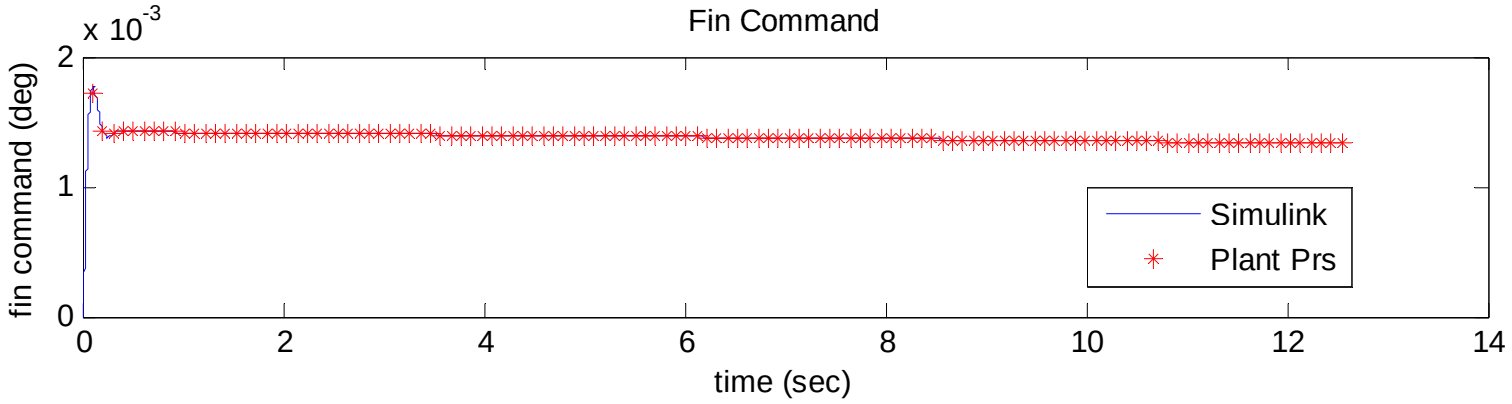
# Integrating Simulink and Ocarina

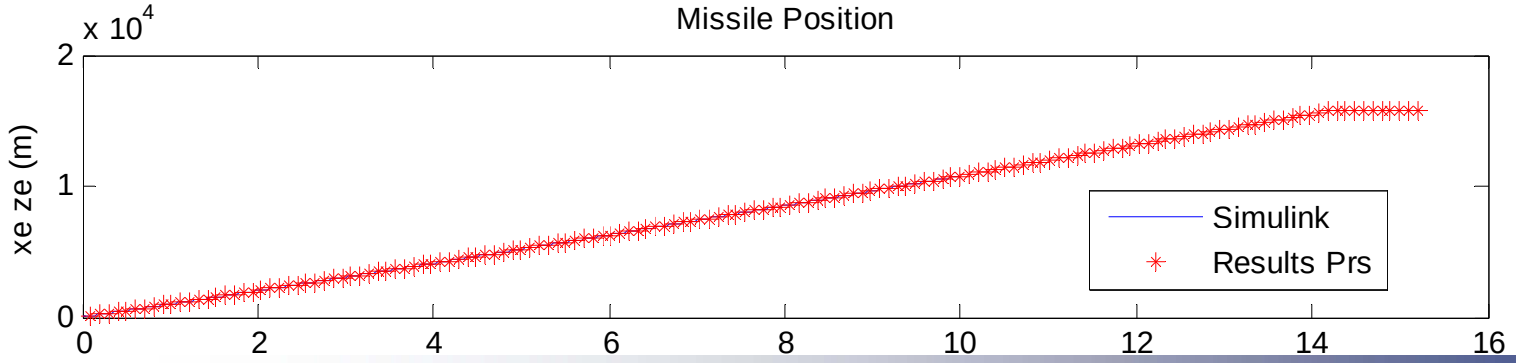



Generation of applications from AADL models using Ocarina

# Simulation Results



# Where next …

- Can we demonstrate an end-to-end process for Architecture Driven Development on an Industrial Scale Problem?
  - Combination of Models, Tools, and Hardware working in sync to demonstrate the true benefits.
  - Can we actually calculate the ROI on these?