The MathWorks Today
Technical Computing and Model-Based Design

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Design Automation

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The MathWorks

MathWorks
Aerospace and Defense Conference '07

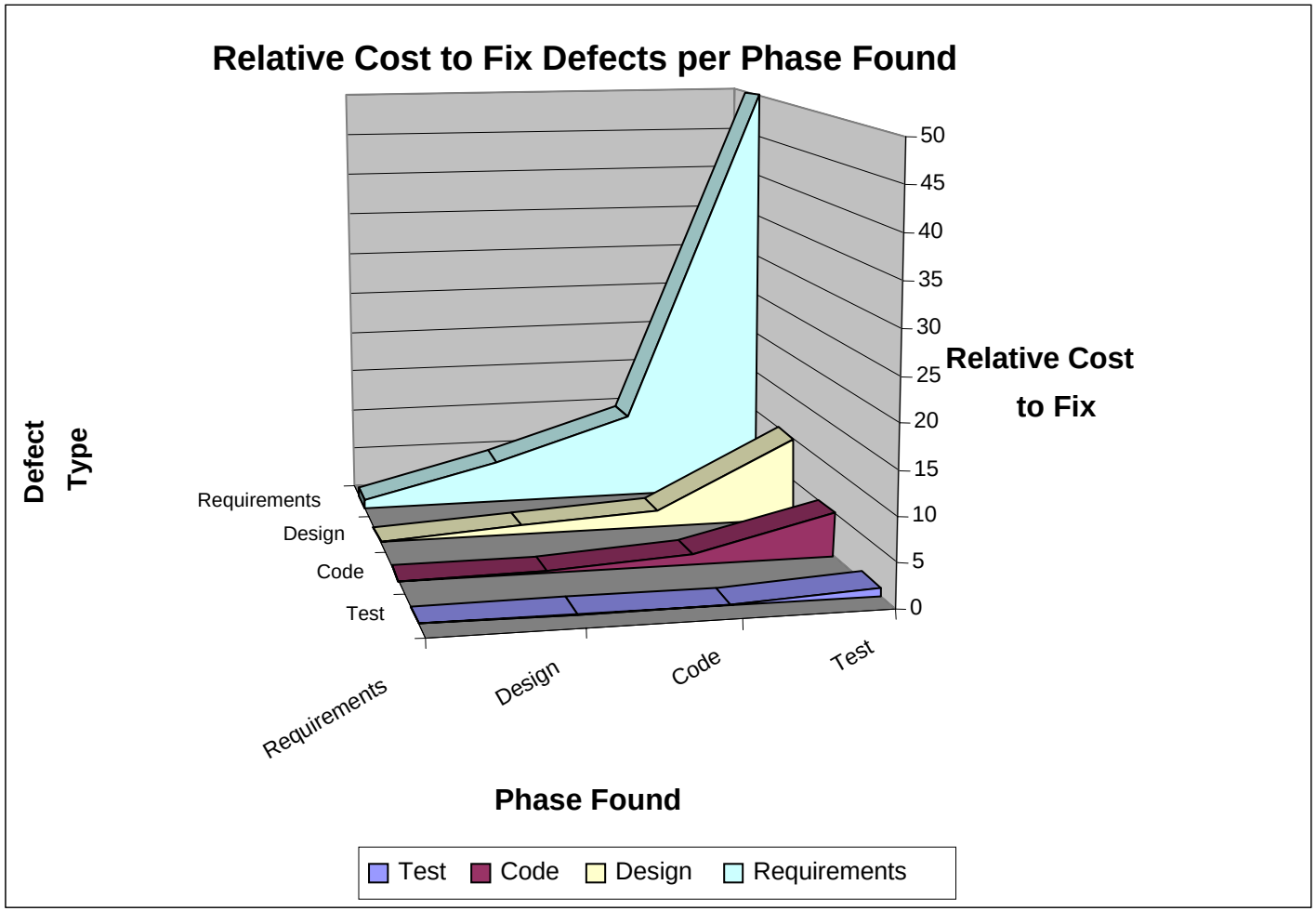
Common Themes in Aerospace

Time-to-market pressures, regulatory guidelines, risk management

Increased functionality, more complexity, difficult implementation choices

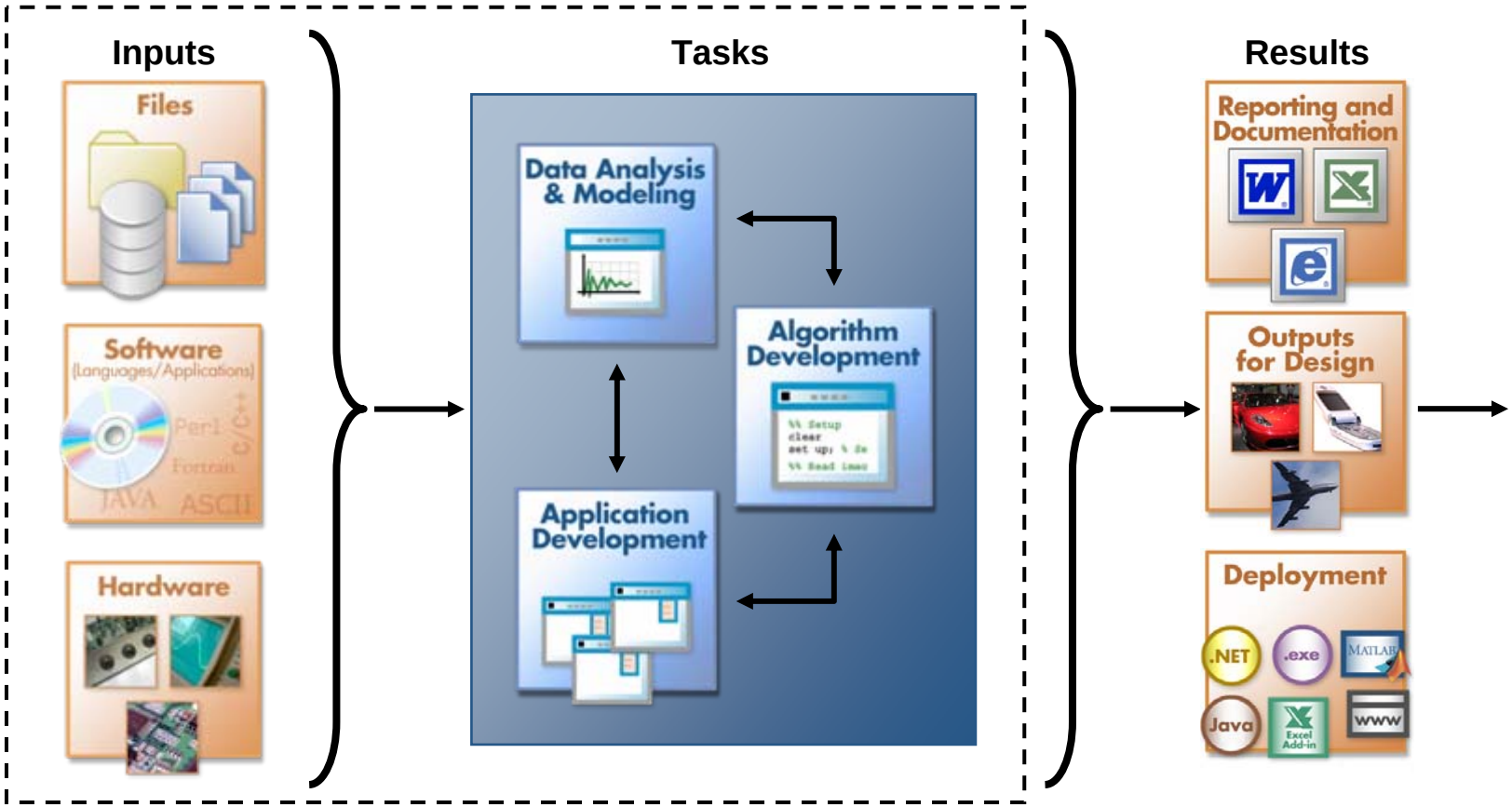
Distributed, multidisciplinary development teams

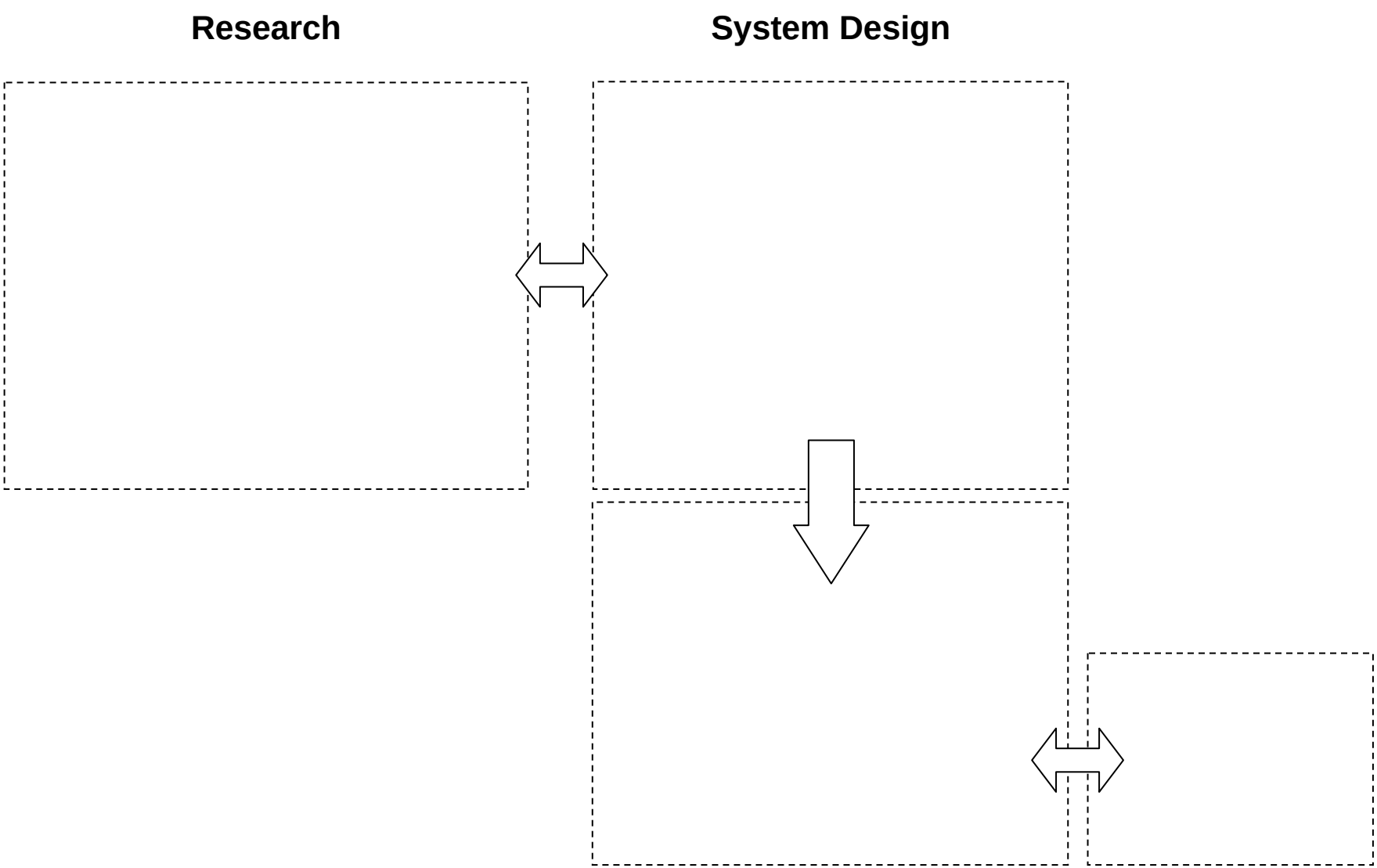
Differentiation by innovation



Source: Return on Investment for Independent Verification & Validation, NASA, 2004.

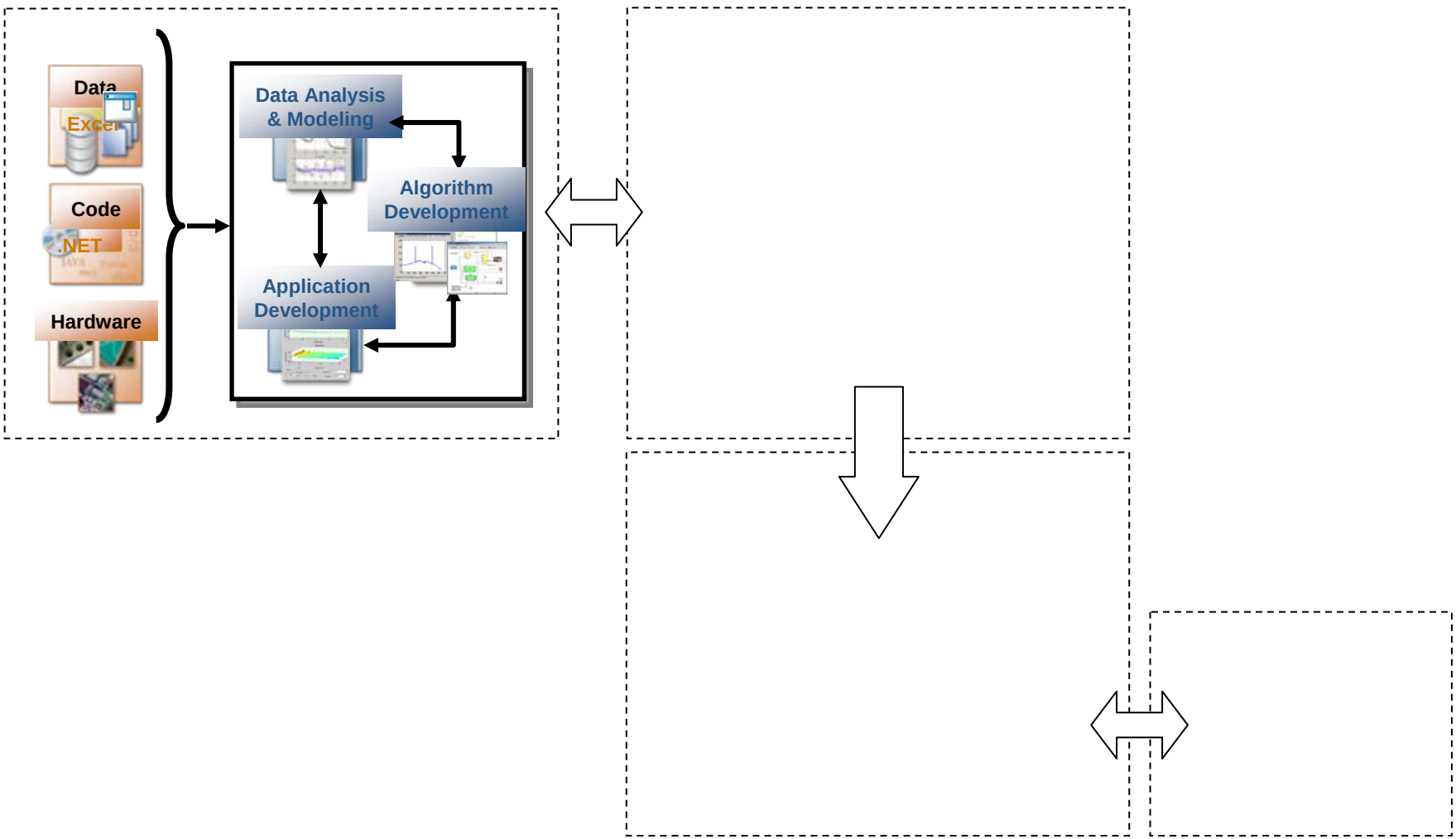
Technical Computing Workflow




Research
System Design
Implementation
Test

Research

System Design



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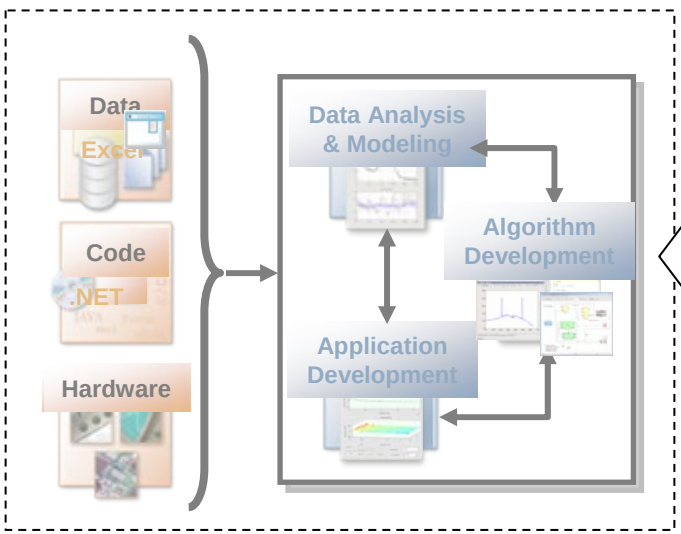

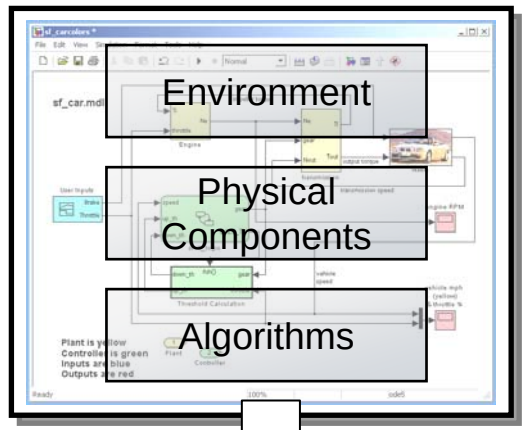

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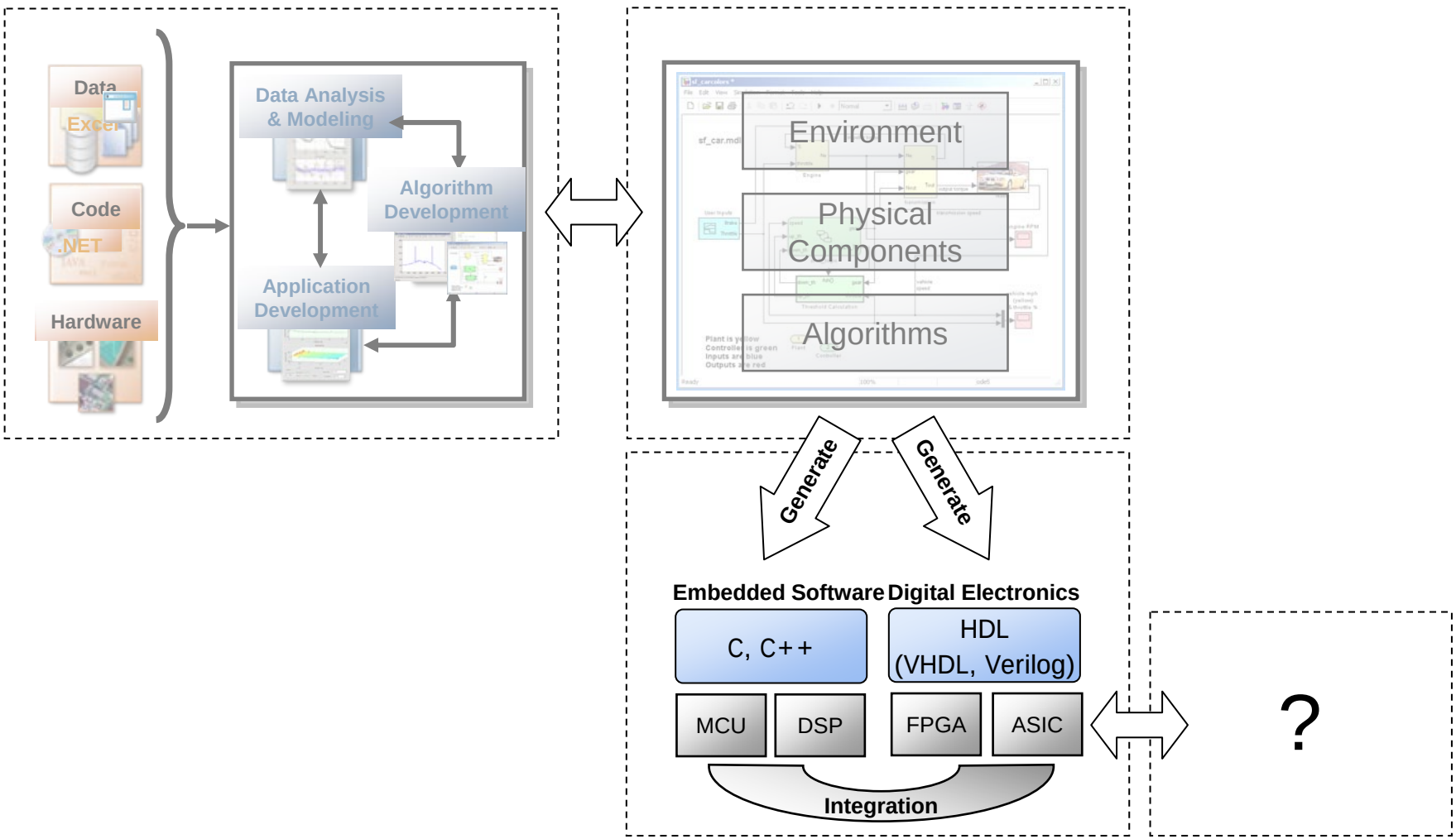
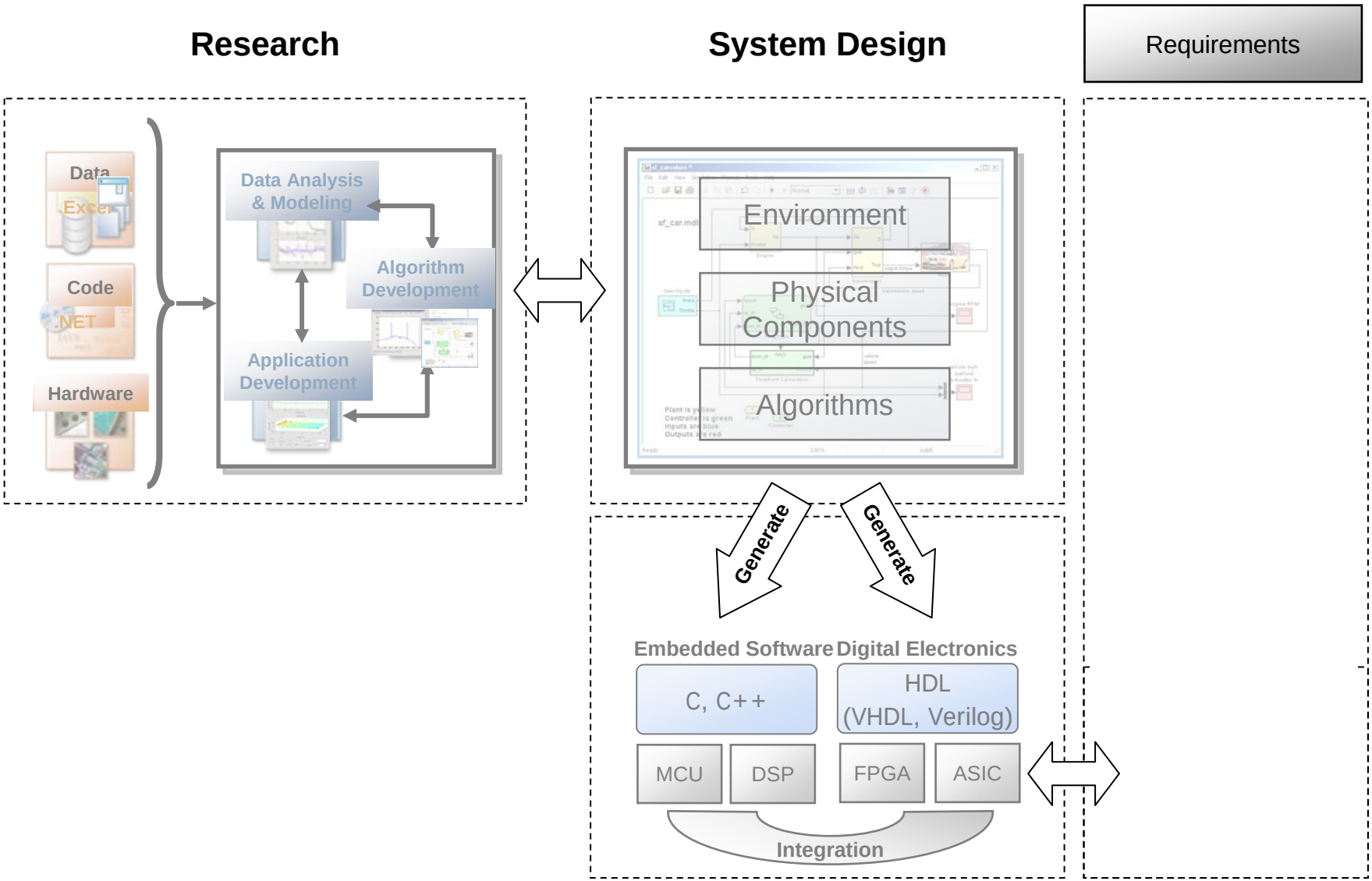


Implementation

Test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Successful adoption of Model-Based Design in Aerospace and Defense

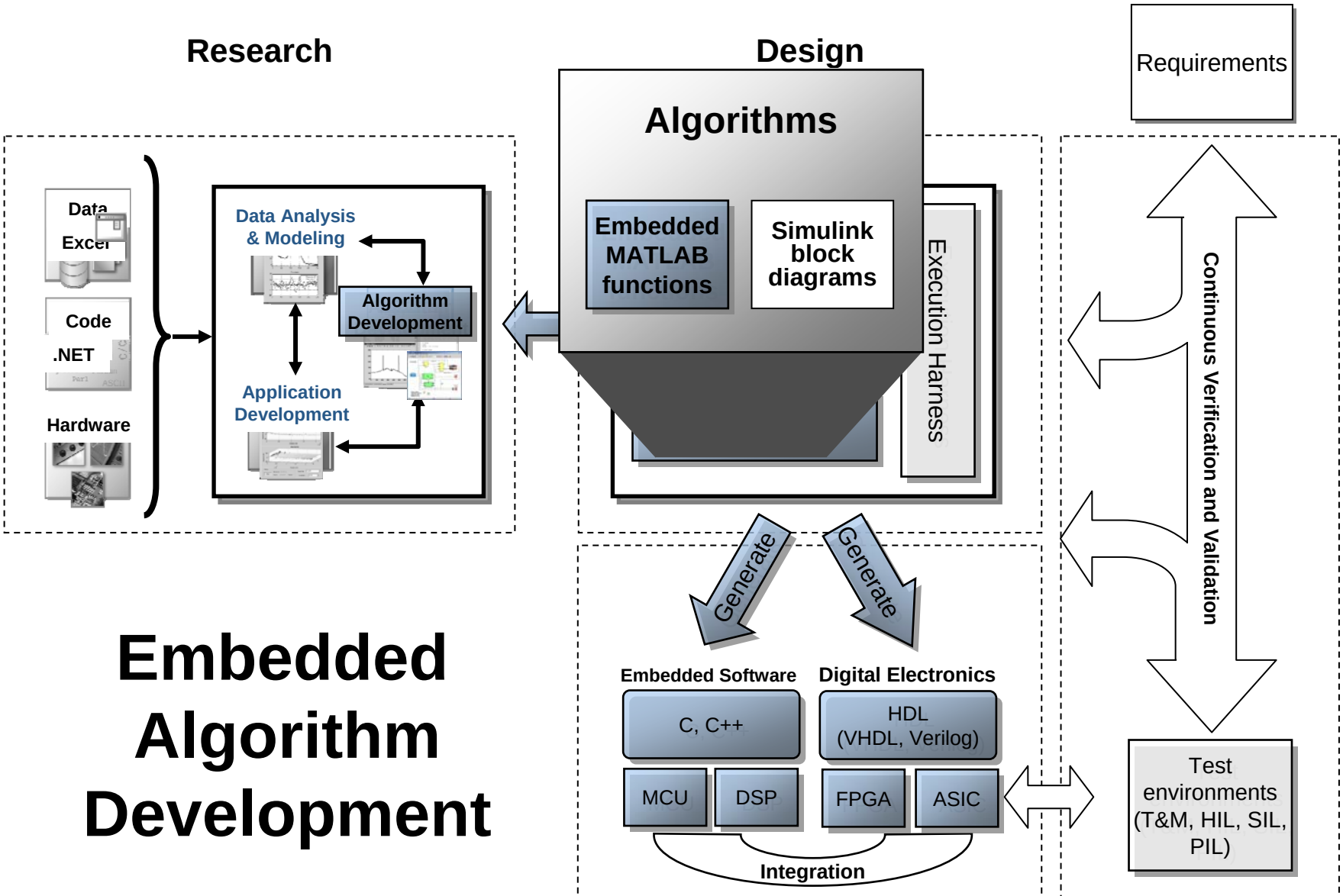
- Lockheed Martin
  - Flight control system for F-35 Joint Strike Fighter
  - Overall reduction in manhours/SLOC of ~40%
- Honeywell
  - Flight-control systems
  - Design times at Honeywell cut by 60%
- BAE SYSTEMS
  - Software-Defined Radio for satellite communications
  - Development time cut by 80%, Clocking and interfacing simplified
- Flying-Cam
  - Autonomous mini-helicopter controller
  - Development time reduced, error-free implementation
- NASA Hyper-X
  - Flight control software for X-43A scramjet vehicle
  - Development time reduced by months
- Swedish Space Corporation
  - Attitude and orbit control system for lunar satellite
  - System development reduced - 50%

Successful Adoption of Model-Based Design in Communications and Electronics

- Broadcom
  - UMTS processor development
  - Development time cut by half compared to C coding
- BridgeWave Communications
  - Building-to-building wireless Ethernet
  - Cut development time from eight months to five
- Realtek
  - Audio processing codec chip
  - Reported higher return on investment
- Yokogawa Electric
  - Optical network components
  - 50% improvement in development time
  - Coding errors fixed before hardware testing

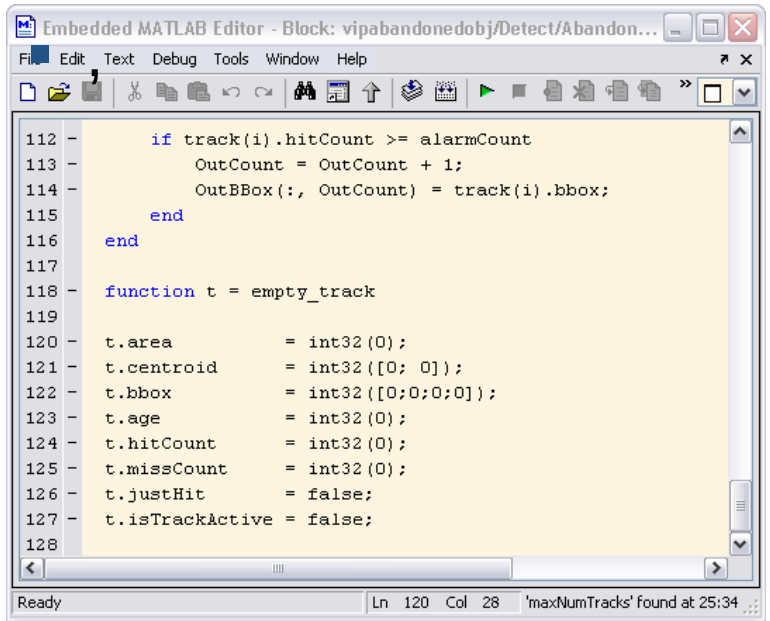
Key Technology Investment Areas

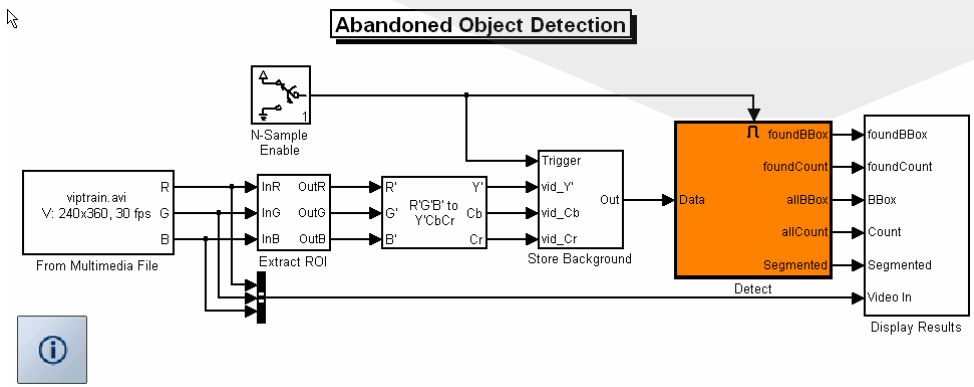
- Embedded MATLAB
- Multidomain Modeling and Simulation
- Video and Image Processing
- Verificaton and Validation
- Flight Code Generation
- HDL
- Distributed Computing



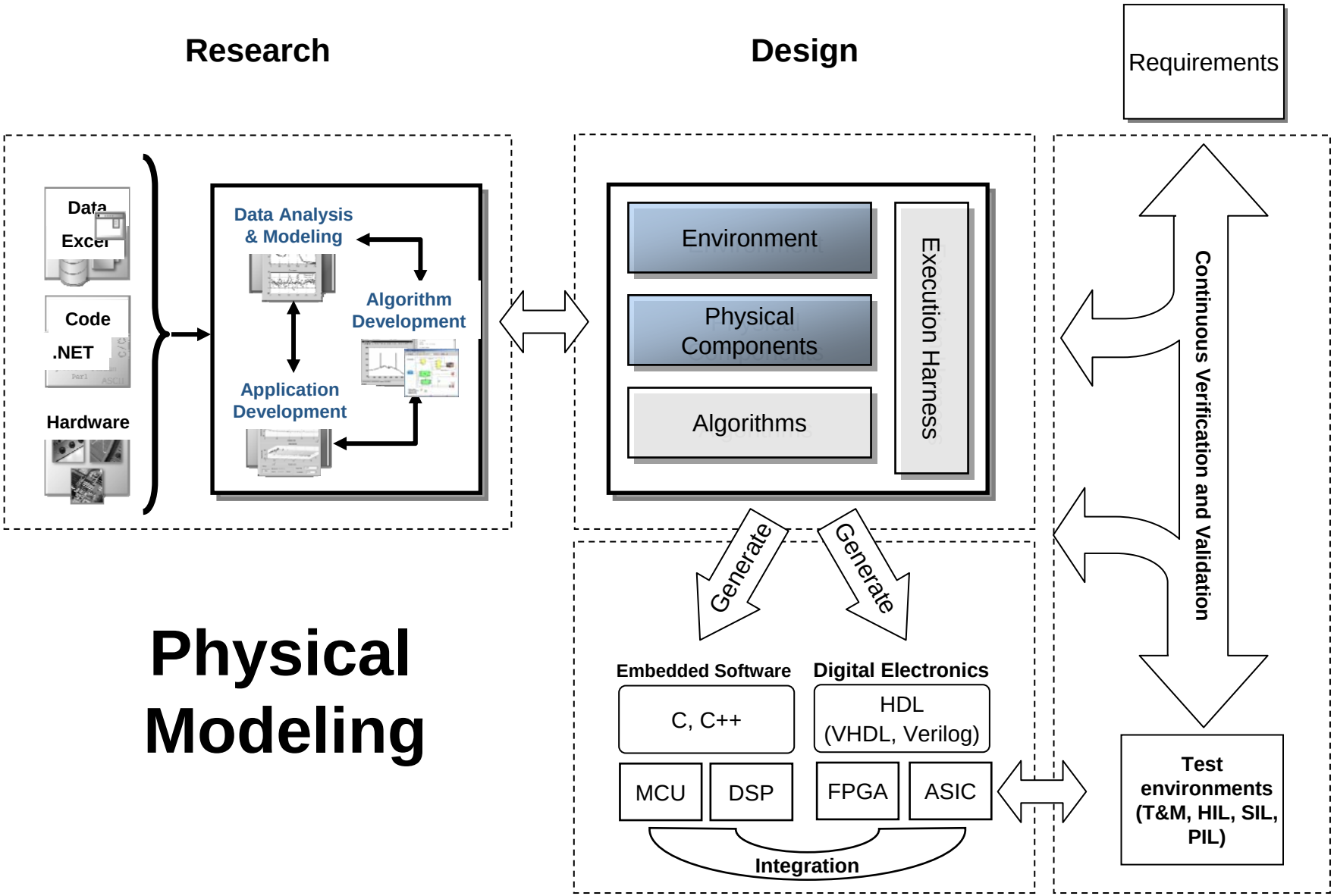
Embedded Algorithm Development

Embedded MATLAB



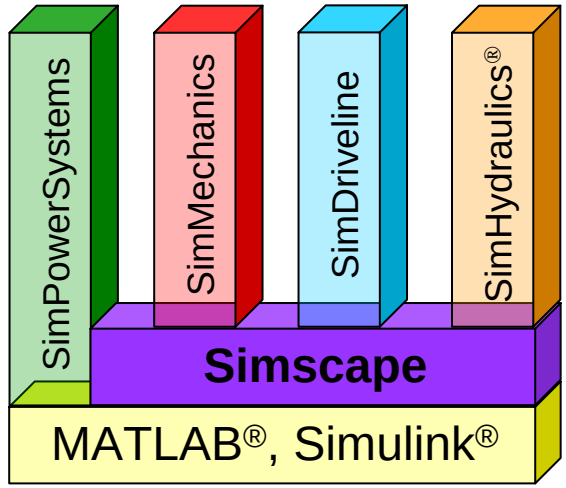


- Embedded Subset of MATLAB Language
- Floating and fixed-point
- Brings MATLAB algorithms into Simulink and Stateflow models
- C code generation with Real-Time Workshop

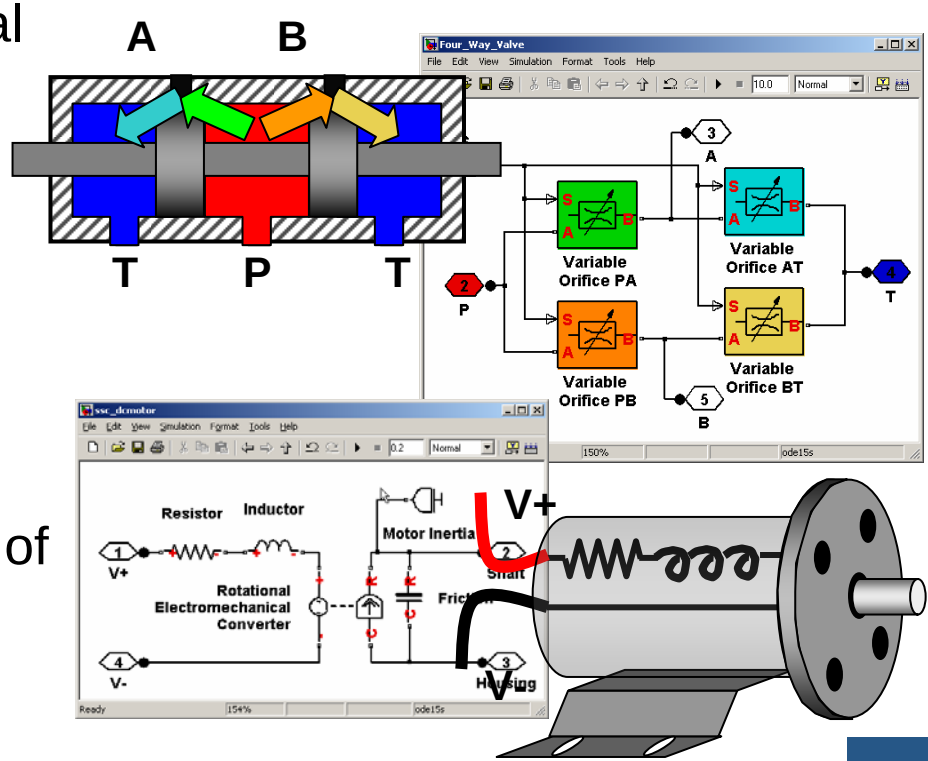


Physical Modeling

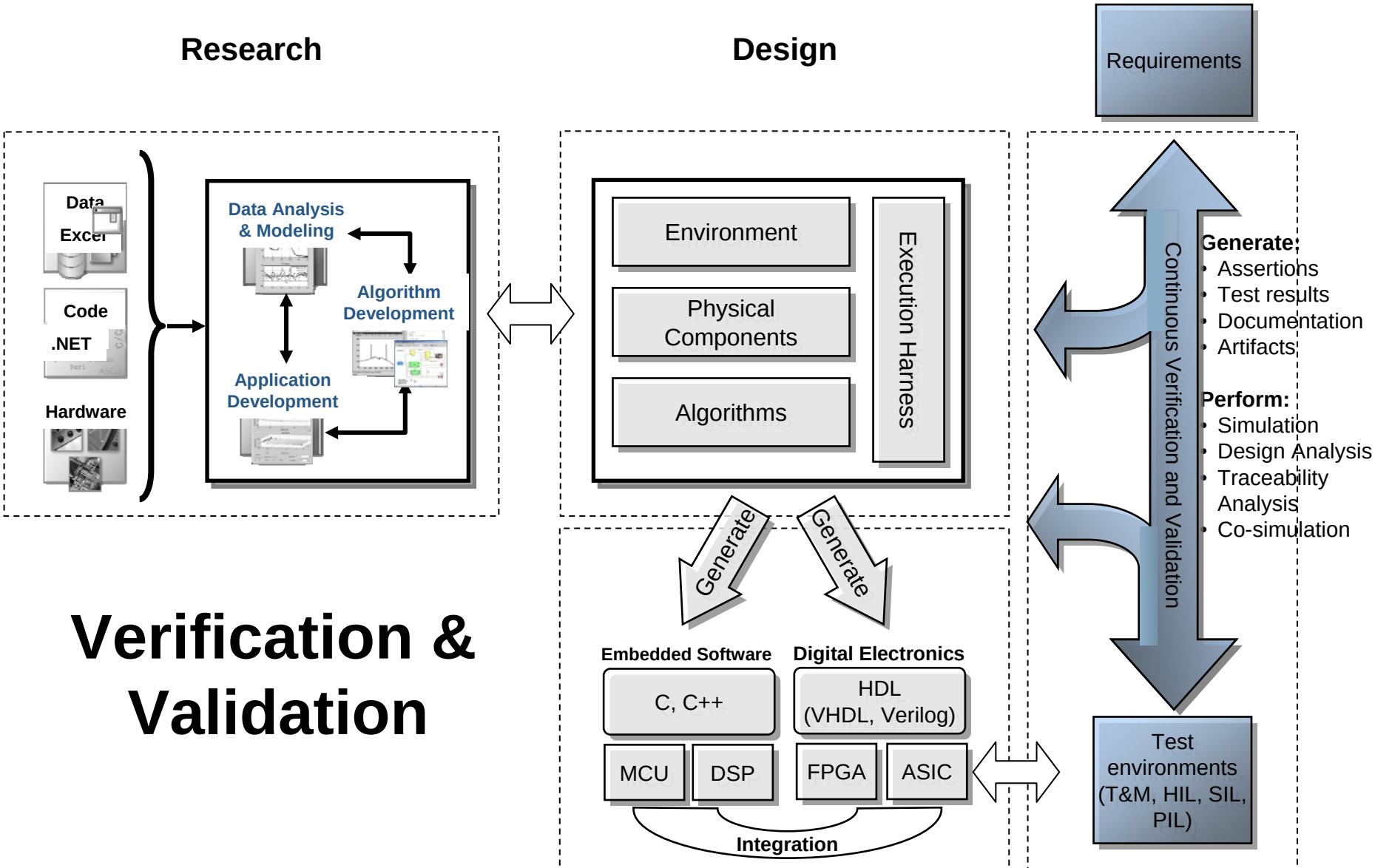
Introduction to Simscape



- Extension of Simulink® designed to model multidomain physical systems
- Eases process of modeling physical systems
  - Does not require deriving and programming the equations of motion for the system
- Used by system engineers and control engineers to build a model representing the physical structure of the system

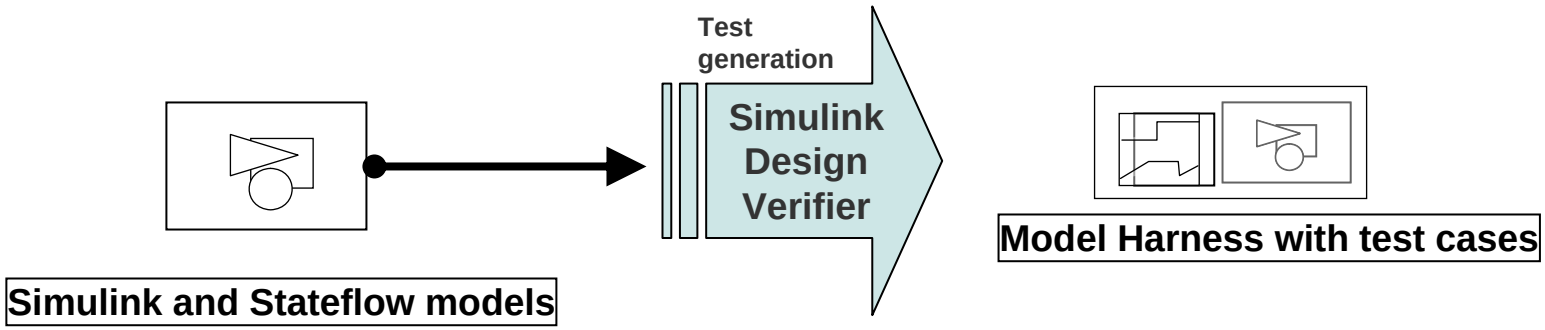


Verification & Validation

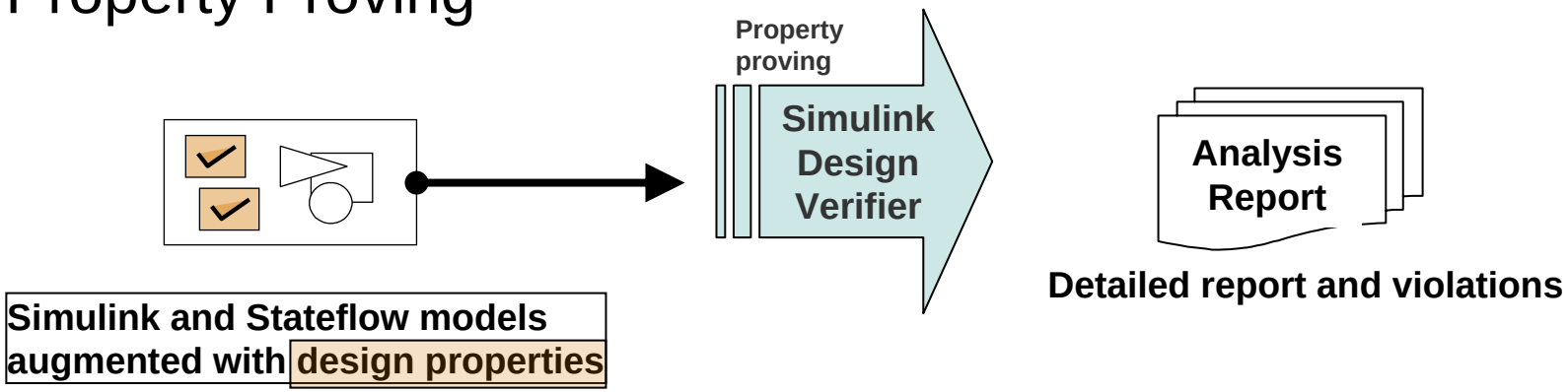


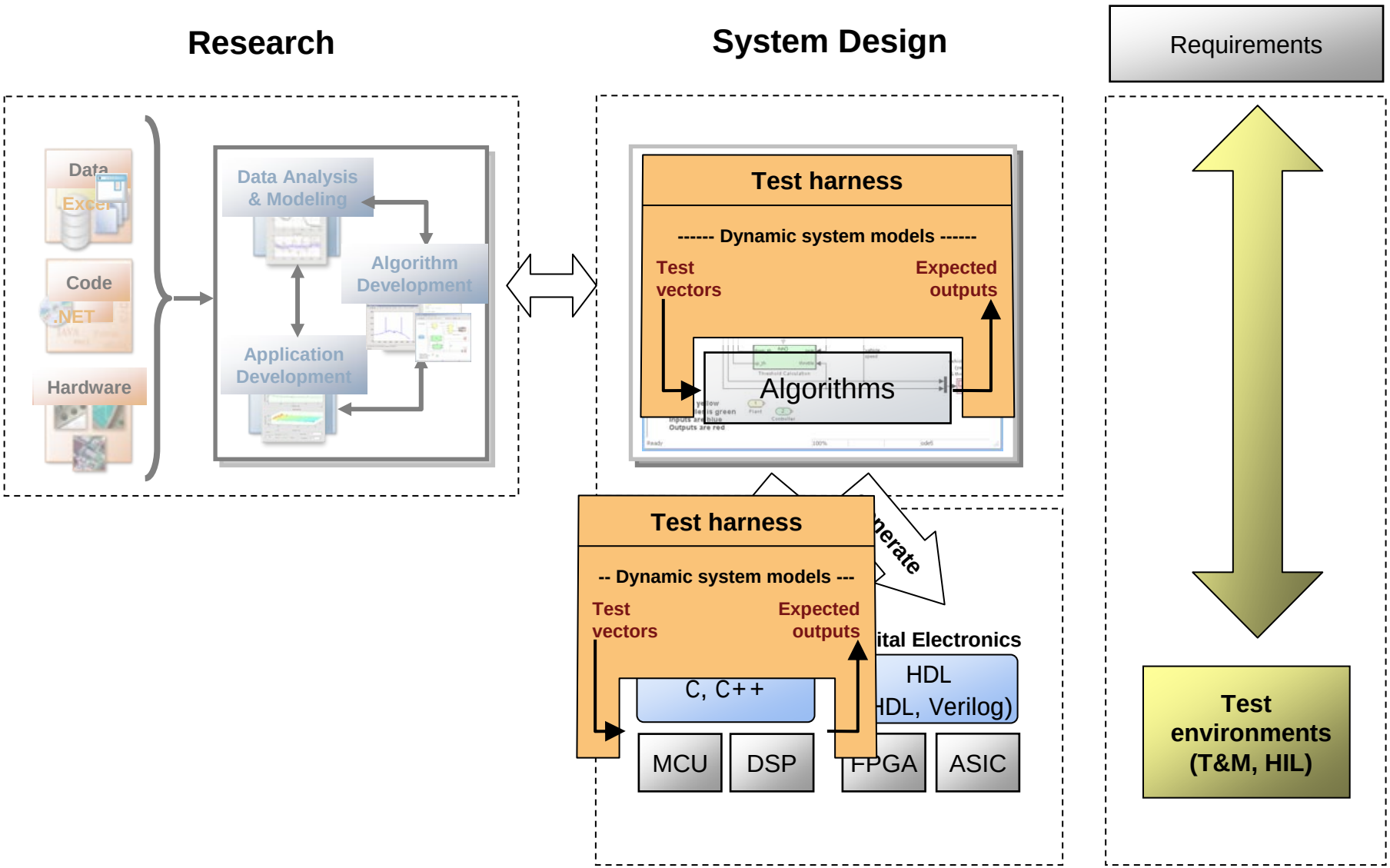
Simulink Design Verifier

- Test Generation



- Property Proving

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Test vectors
Expected outputs
Algorithms
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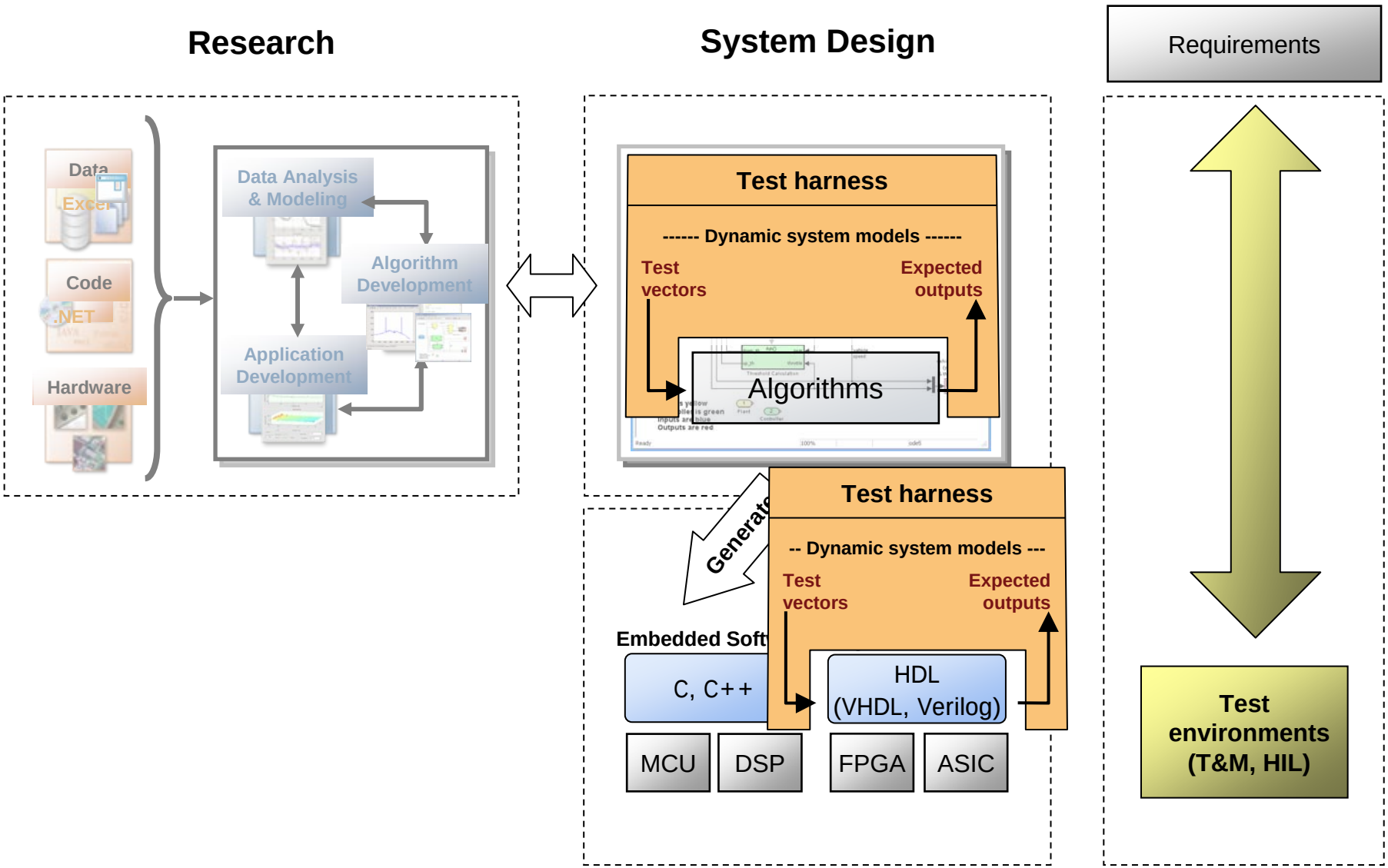
Test vectors
Expected outputs
C, C++
HDL
HDL, Verilog)
MCU
DSP
FPGA
ASIC
Test environments (T&M, HIL)
Implementation
Continuous V&V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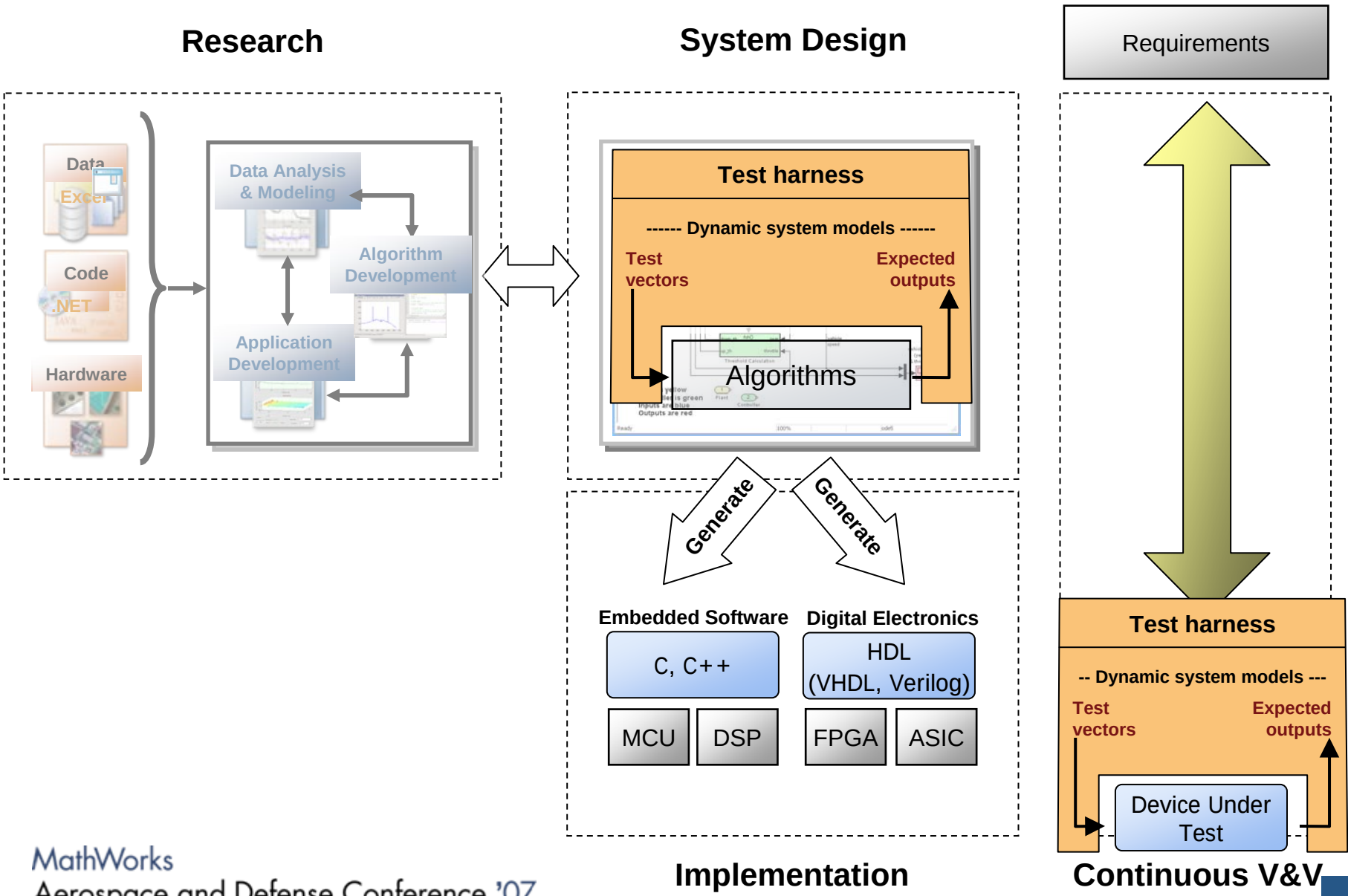
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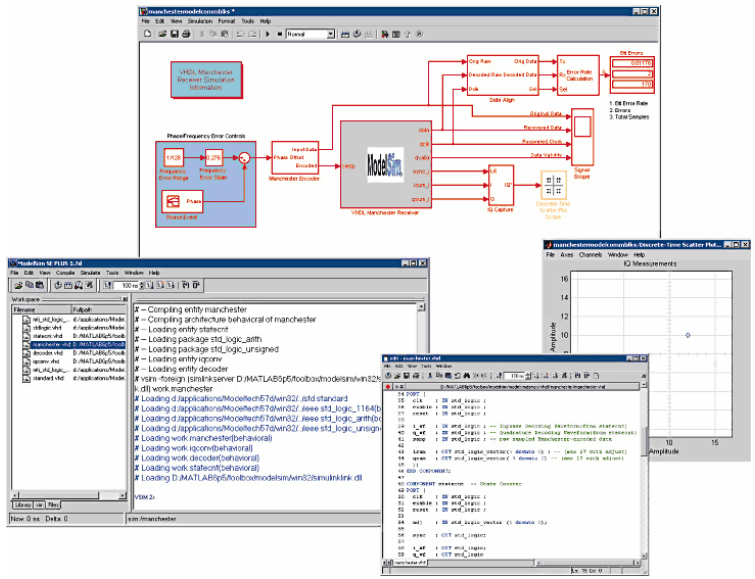
Test vectors
Expected outputs
Device Under Test
Continuous V&V

Verify Hardware and Embedded Software Implementation using Links

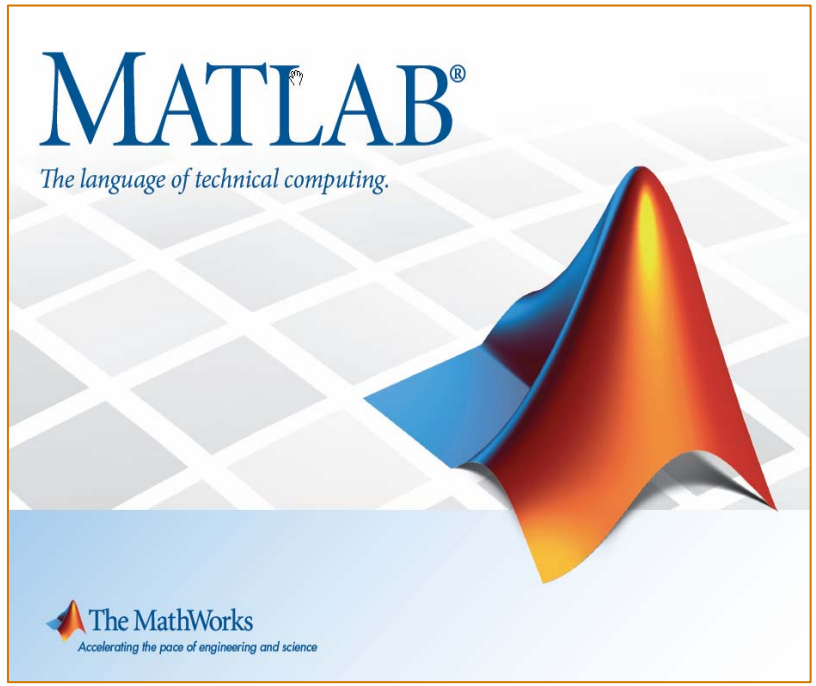
- Reuse test sequences
- Reuse model as testbench
- Cosimulate implemented component

Embedded Software	▪ TI Code Composer Studio ▪ Analog Devices VisualDSP++ ▪ Altium TASKING ▪ xPC Target
Digital Hardware	▪ Cadence® Incisive ® ▪ Mentor Graphics ModelSim



Improved Product Development and Delivery Processes

- Quality focus
  - Continuous product improvement
  - Fine-tuned development processes
- Twice-yearly releases
  - 2006
    - March **R2006a**
    - September **R2006b**
  - 2007
    - March **R2007a**
- Timely delivery
  - More vehicles to address customer input
  - Predictable release schedule



How can I participate in the MATLAB and Simulink community?

Use this conference to network

- Talk to MathWorks staff (badges or blue shirts)
  - Ask about the products and their uses
  - Tell us your requirements – we're here to talk to you!
- Meet people from other organizations
  - What are they doing with MathWorks products?
- Visit the exhibit hall
  - Get a demo
  - Learn from our partners