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Getting Confidence
in Your Design Early!

Graser User Conference

Taipei

2016 7.14

跨界整合 翻轉設計

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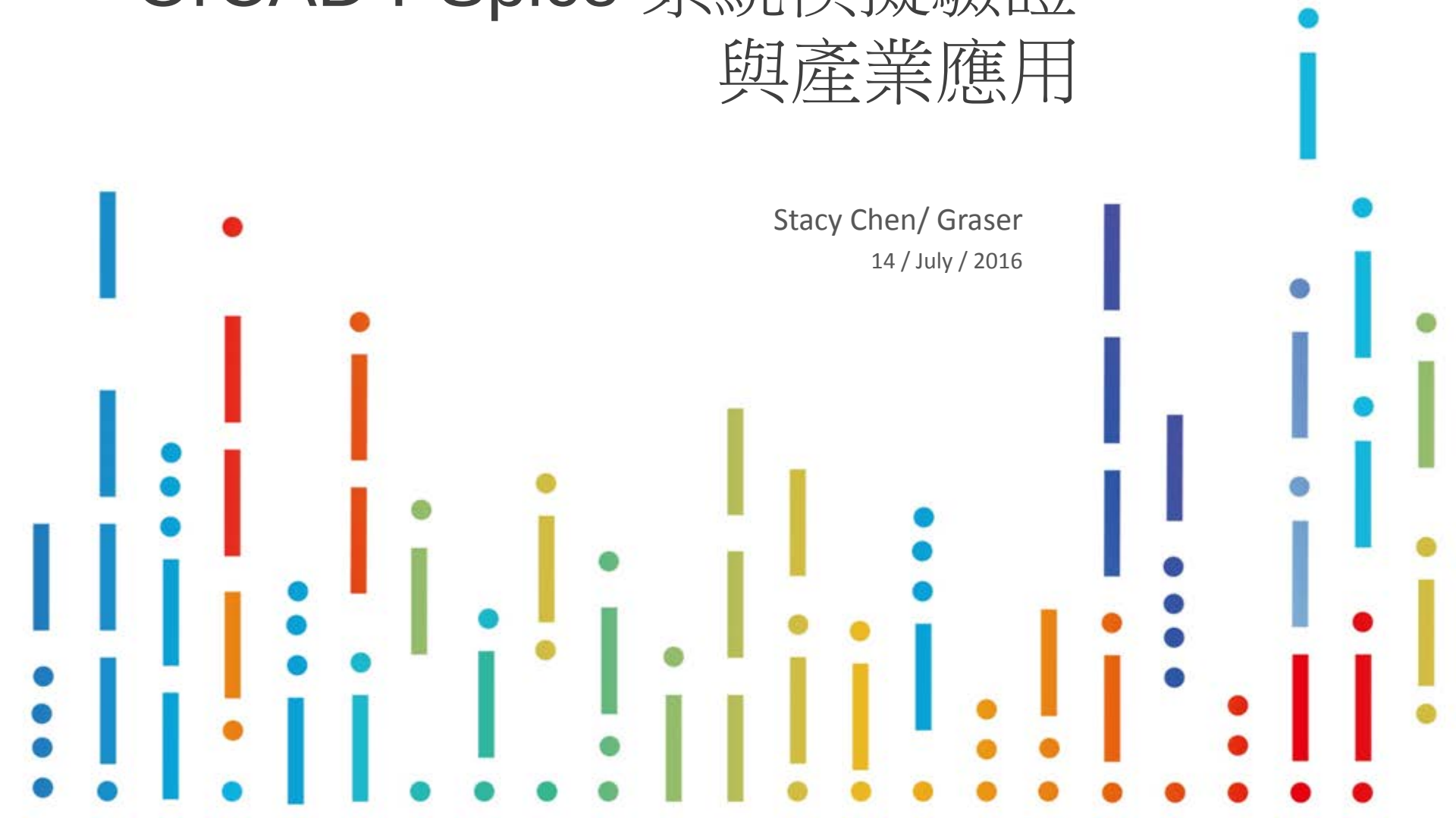
OrCAD PSpice 系統模擬驗證與產業應用

Stacy Chen/ Graser

14 / July / 2016



OrCAD PSpice System Solution and Industry Application

- OrCAD® PSpice® Technologies
- OrCAD PSpice Virtual Prototyping Systems
- OrCAD PSpice Advanced Analysis
- Industry Application

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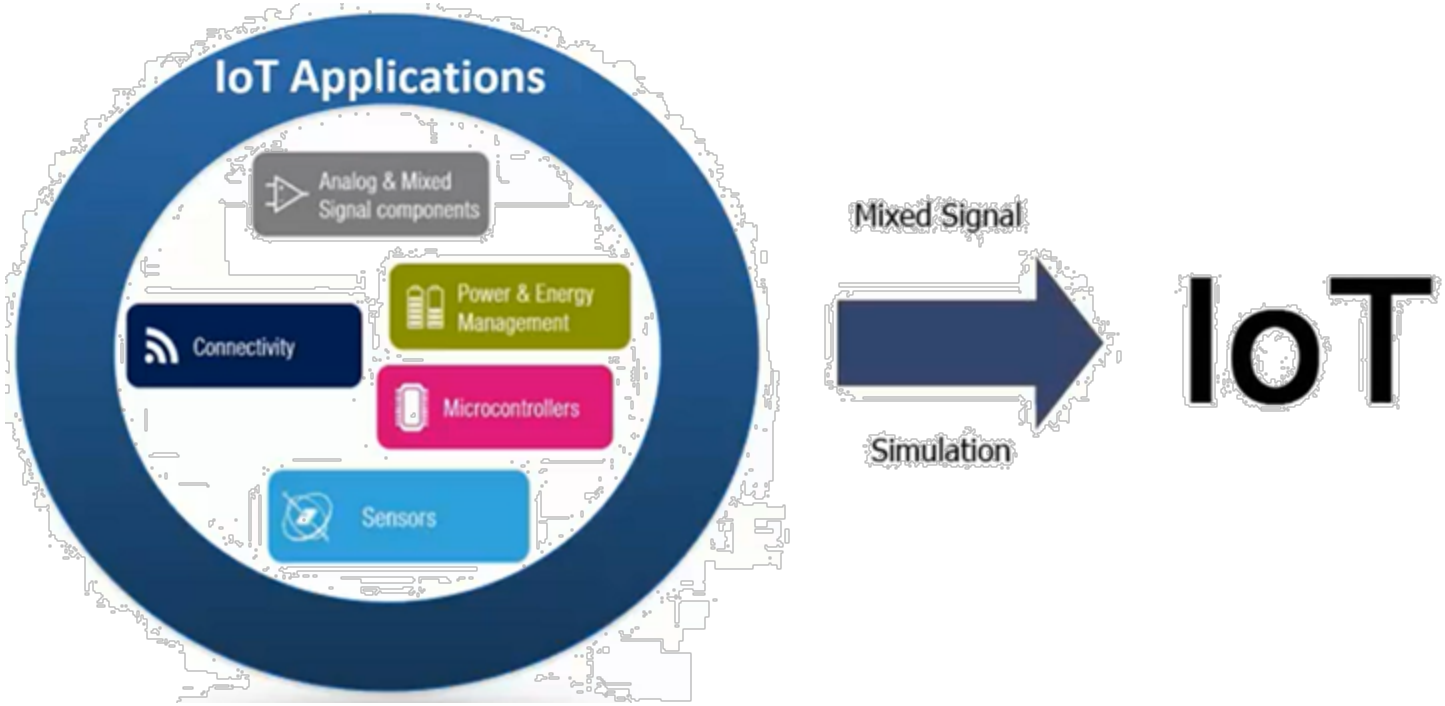
OrCAD PSpice Technologies

Internet of Things

Internet of Things



Challenges

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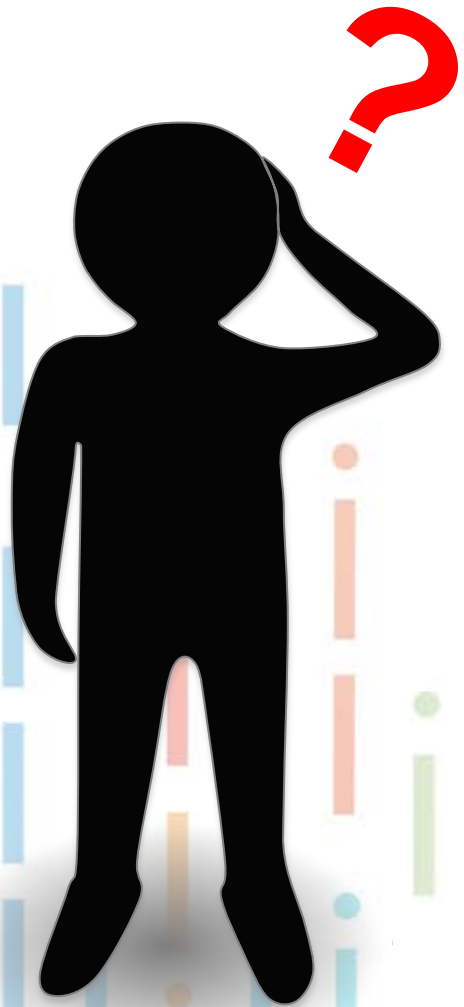


Reduce errors

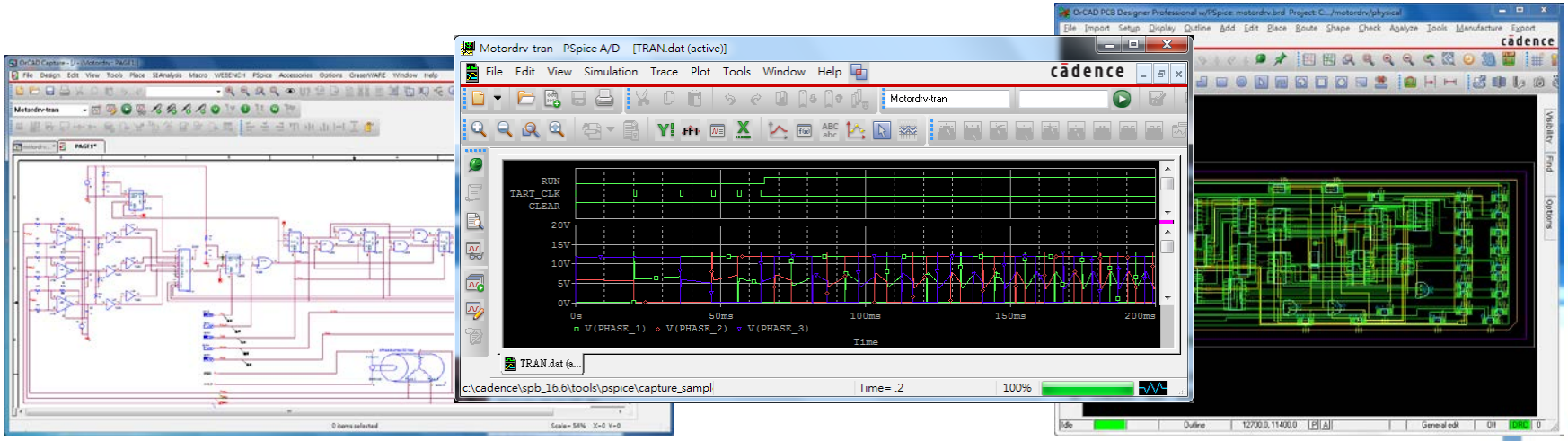
Increase reliability

Model development

Increase Design Productivity

OrCAD Design Solution

- Powerful and Widely Used Design Solution
  - Front-to-Back Integration
    - Fast and intuitive schematic design entry, OrCAD® Capture
    - **Mixed-signal simulator, OrCAD® PSpice®**
    - Comprehensive PCB solution, OrCAD® PCB Designer



Schematic
OrCAD Capture

Simulation
OrCAD PSpice

Layout
OrCAD PCB Designer

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OrCAD PSpice

- Mixed-signal simulator
  - Full integration with OrCAD® Capture improve productivity and data integrity.
  - Powerful waveform viewing and post-processing expression support speed review and analysis without having to rerun simulations.

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OrCAD PSpice

- Mixed-signal simulator
  - Multi-vendor models, built-in mathematical functions, and behavioral modeling techniques.
  - Support multi-modeling type,
    - Algorithmic Models: Matlab/C/C++
    - System Models: SystemC
    - Digital Models with IO/Timing/Constraint
    - Digital Function Model
    - Verilog-A
    - PSpice® Behavioral Models

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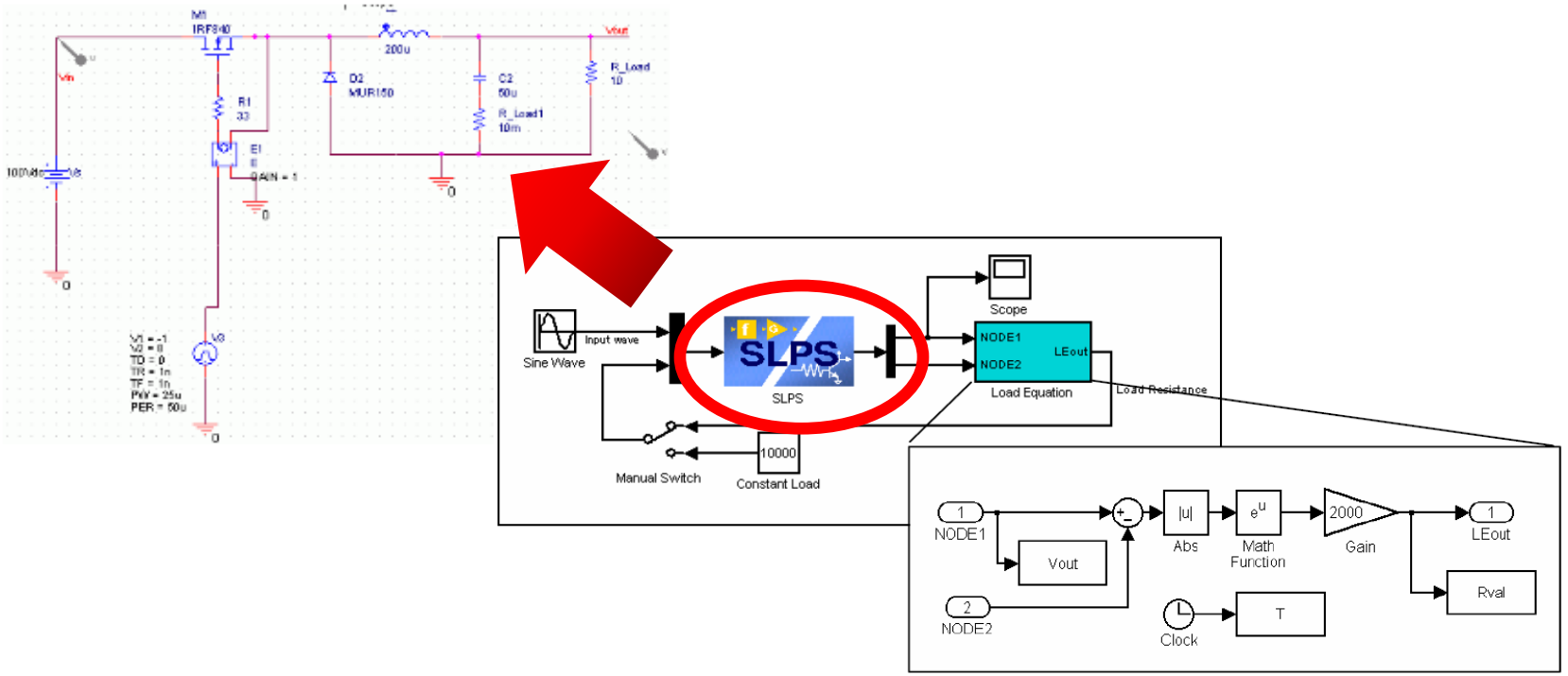
OrCAD PSpice Mixed Domain Integration

- OrCAD® PSpice® w/ Matlab
  - Systems Simulation
  - Integration with MATLAB Simulink brings two industry-leading simulation tools, electromechanical systems & electrical, in a co-simulation environment.



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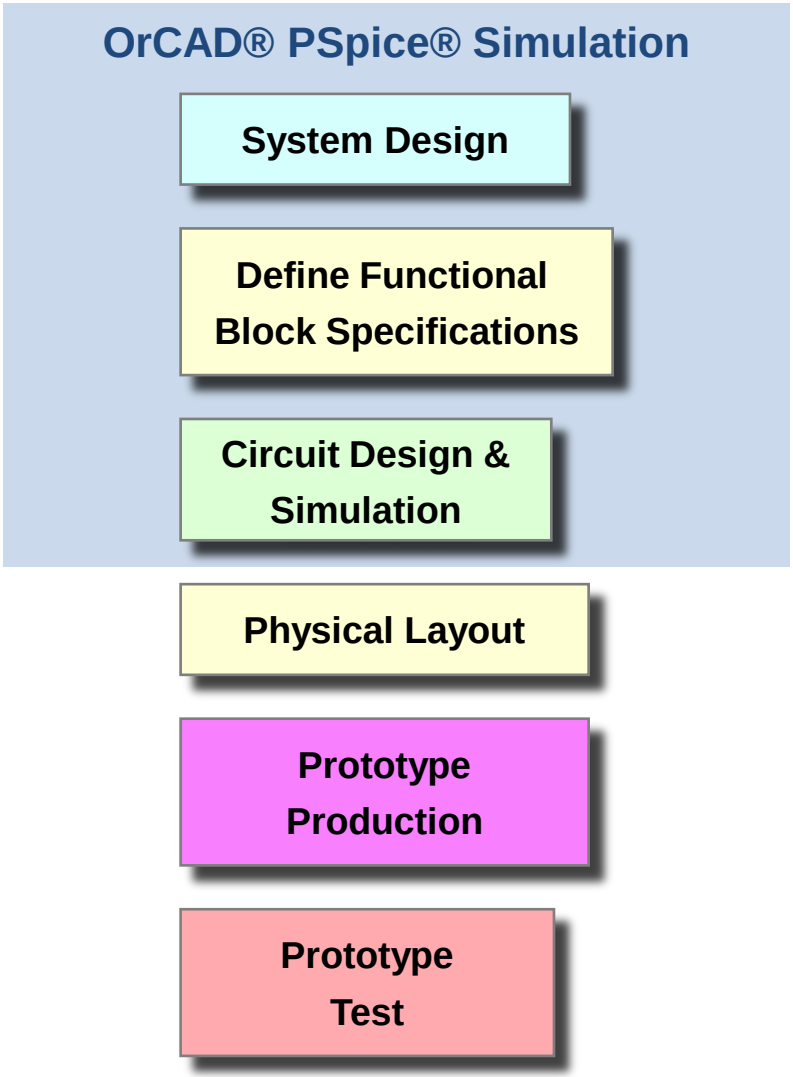
OrCAD PSpice
Virtual Prototyping Systems

OrCAD PSpice System Simulation Solution Flow



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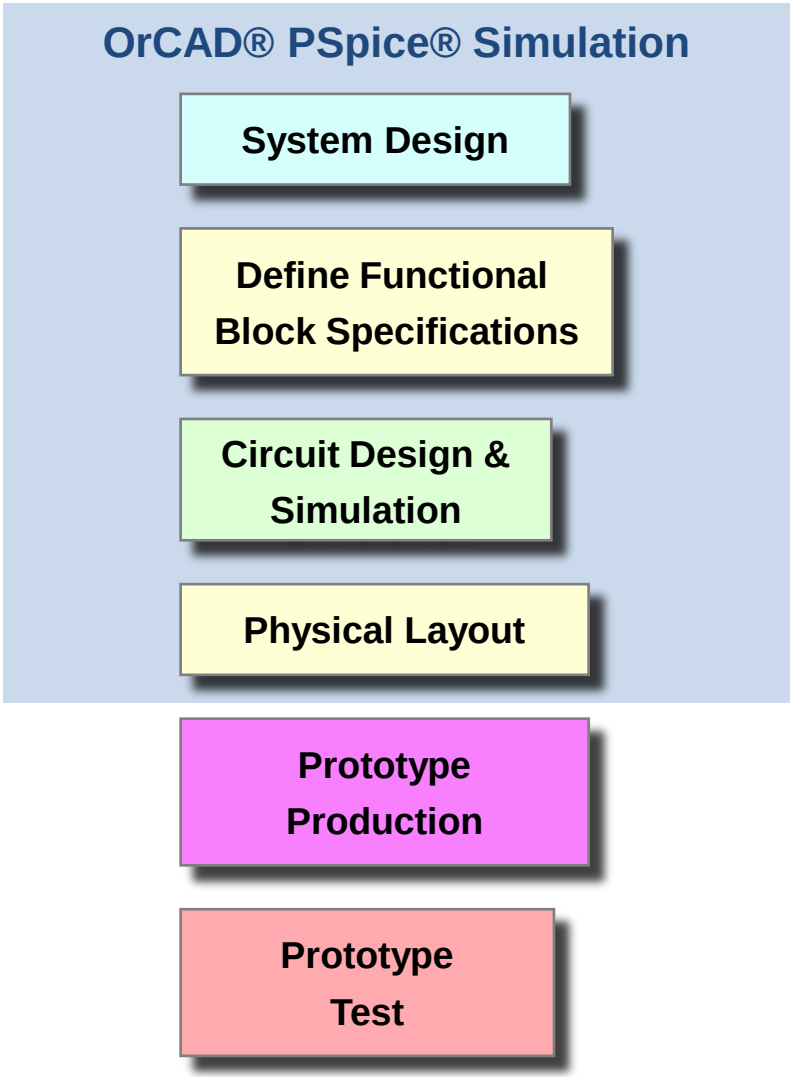
OrCAD PSpice System Simulation Solution Flow



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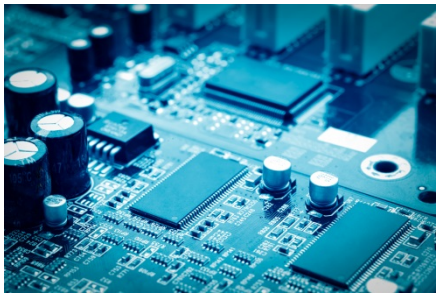
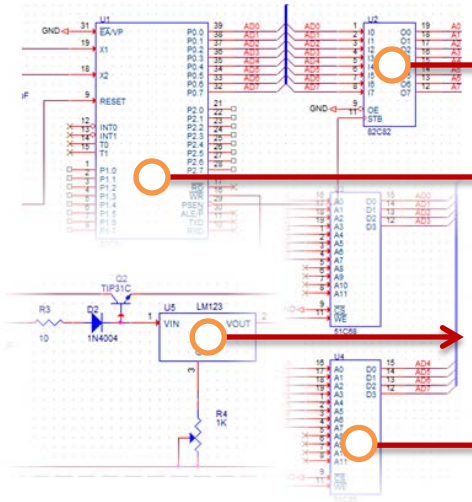
OrCAD PSpice Virtual Prototyping Systems



Components with different levels Abstraction Modeled in PSpice PCB simulation



PSpice Analog Behavioral

SystemC with Embedded S/W

PSpice Spice MacroModel

PSpice Functional Block defined in C

Model Abstractions

- Architectural
- Functional
- Behavioral
- Gate Level
- Circuit Level
- Physical Implementation

- **Multi-Level Block Abstractions**

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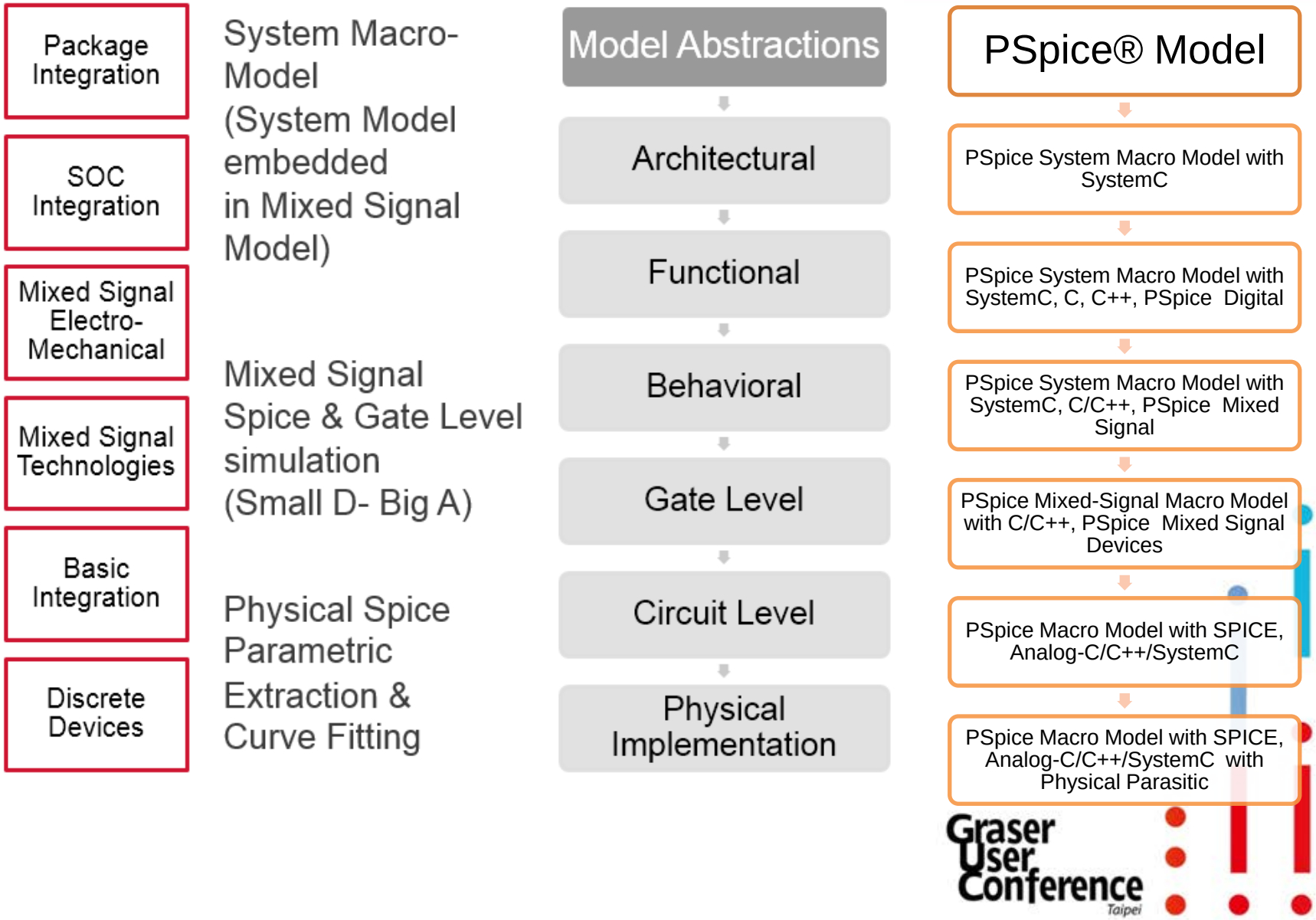
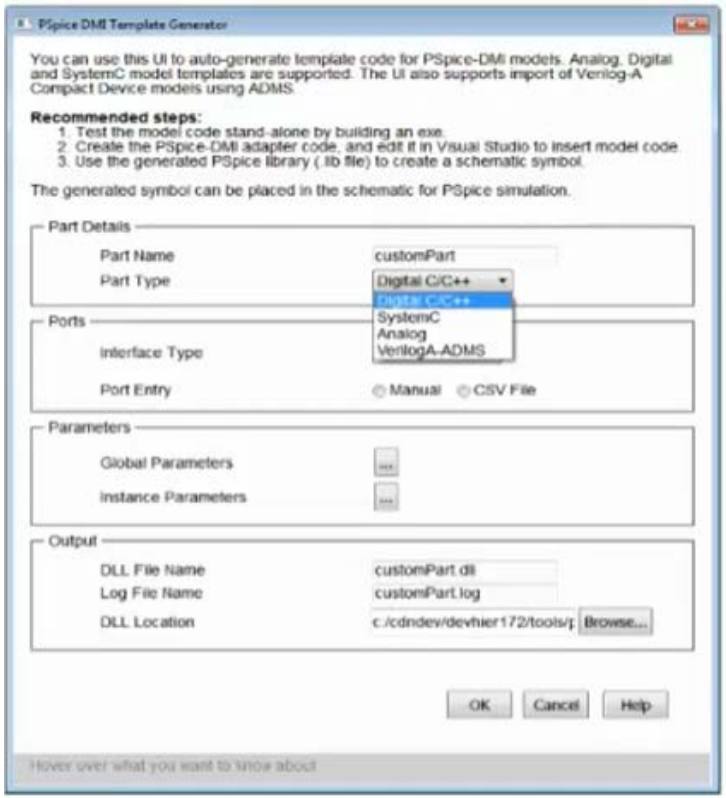
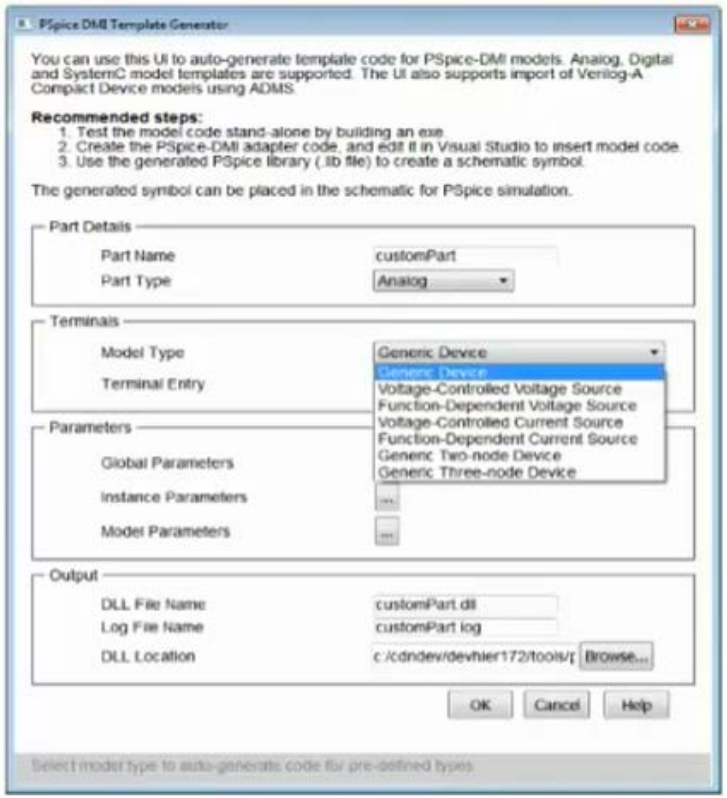
OrCAD PSpice Virtual Prototyping Systems



OrCAD PSpice Device Model Interface

- Generate PSpice® Adaptor code in PSpice Model Editor
  - Analog, Digital C/C++, SystemC and Verilog-A.





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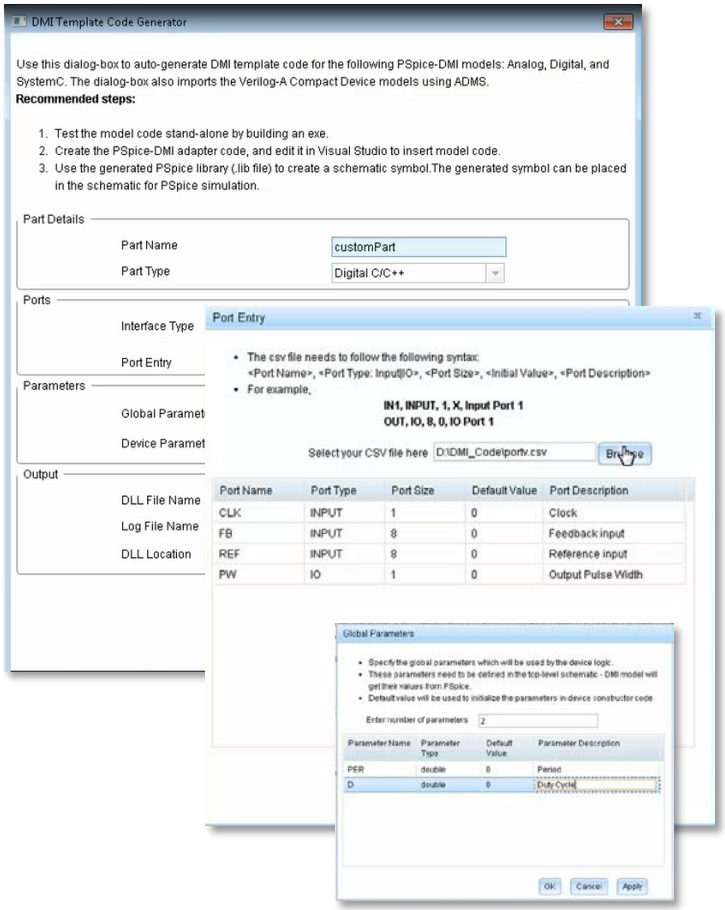
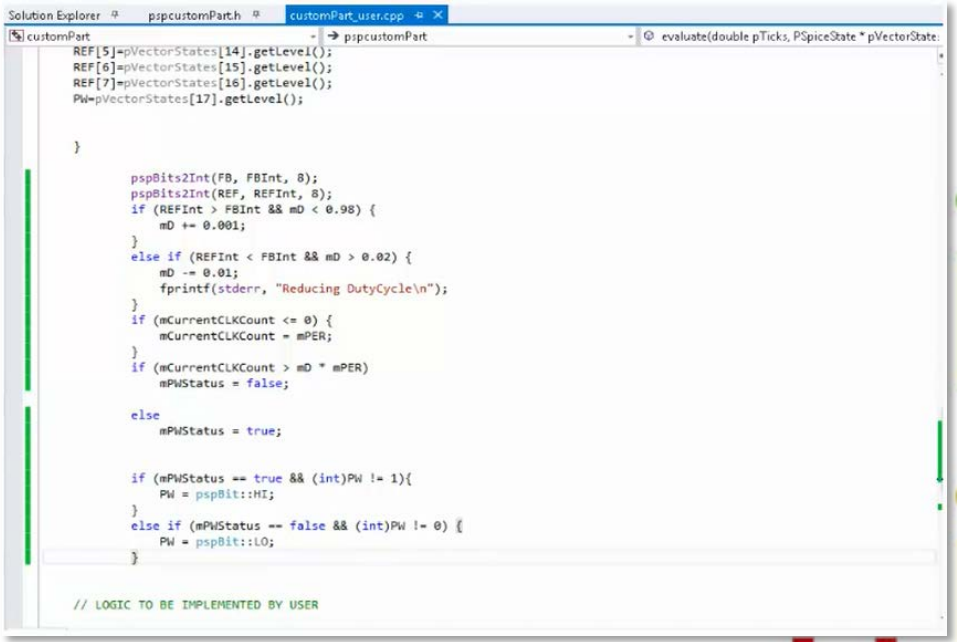
OrCAD PSpice Simulation

- Create Model

PSpice® DMI



Microsoft Visual Studio Community 2013



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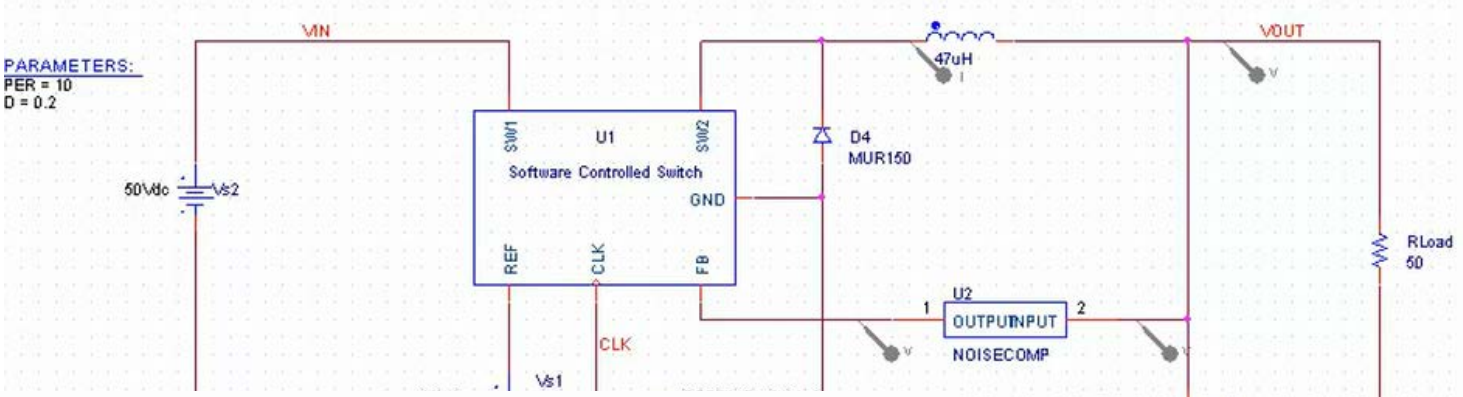
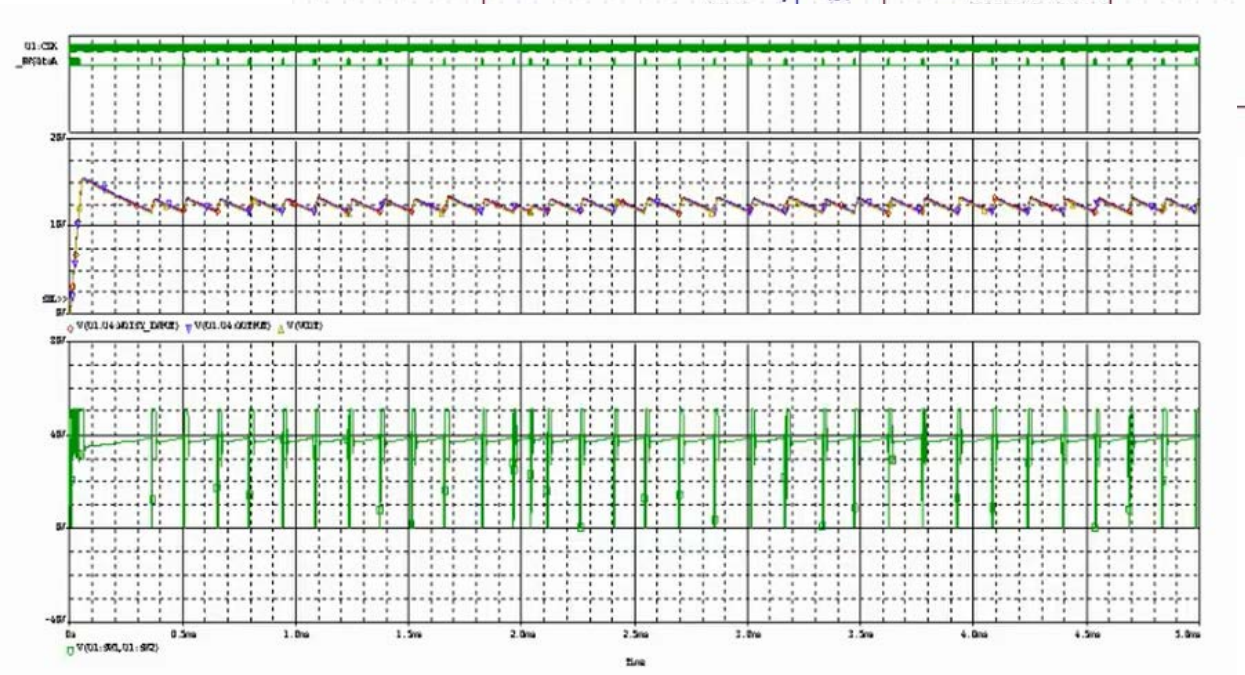
OrCAD PSpice Simulation

- Result





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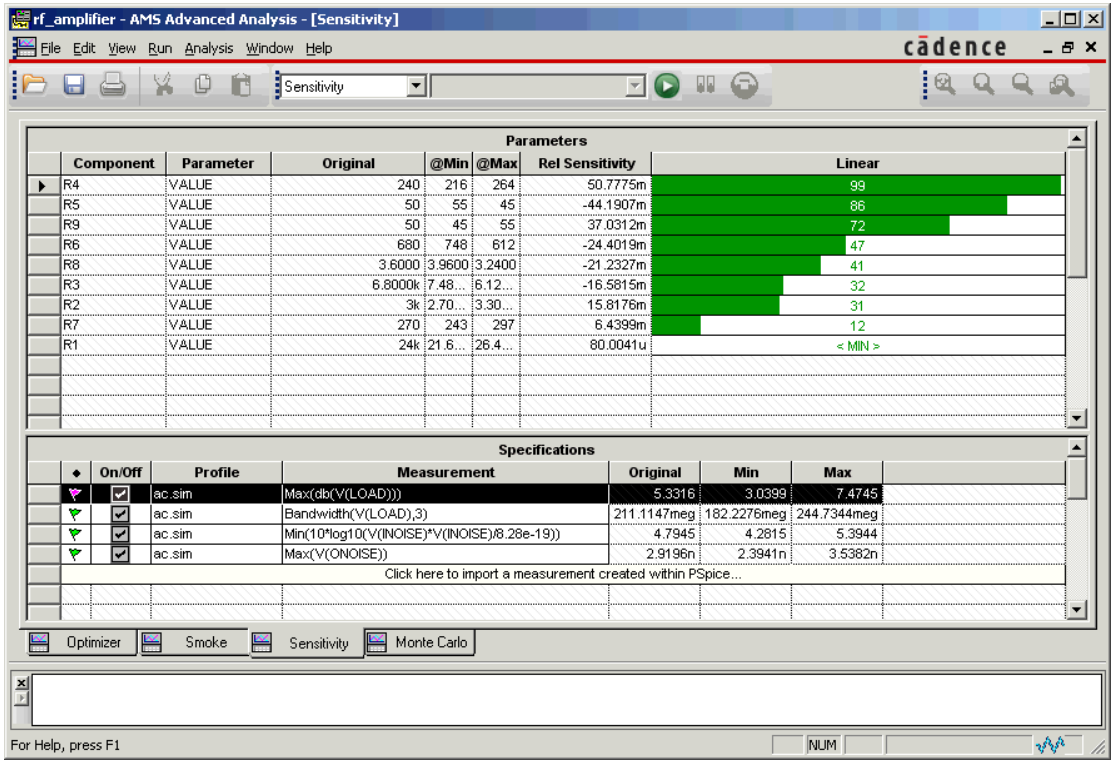
OrCAD PSpice Advanced Analysis

Powerful Advanced Analysis

- Combine OrCAD® PSpice® A/D functionality with the powerful Advanced Analysis environment.

Sensitivity Analysis

- Easily identify components impacting key circuit goals and specs.
- Estimate worst case performance of the circuit given the device tolerances.
- Identify components whose tolerance does not matter.
  - **Reduce cost** by choosing components with relaxed tolerance.



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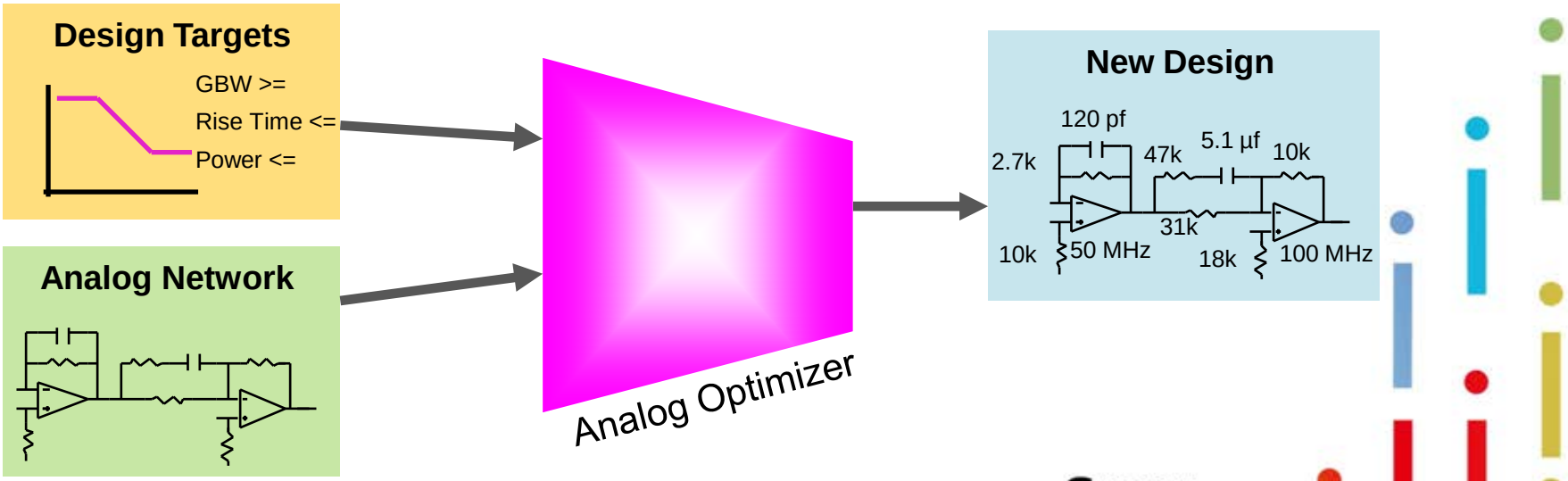
Circuit Optimization

- Engineer specifies the Circuit Topology and the desired goals.
- Optimizer does the rest. It calculates the optimum component values to use to meet the desired goals.
  - One of the **most powerful** analysis tool.
  - Identify components impacting key circuit goals.
  - Identify designs goals and **optimize your design** to meet/beat these goals.
  - Design goals examples: Gain, BW, Overshoot, Pd, Ripple.
  - Design goals can be described as a waveform or Specification.



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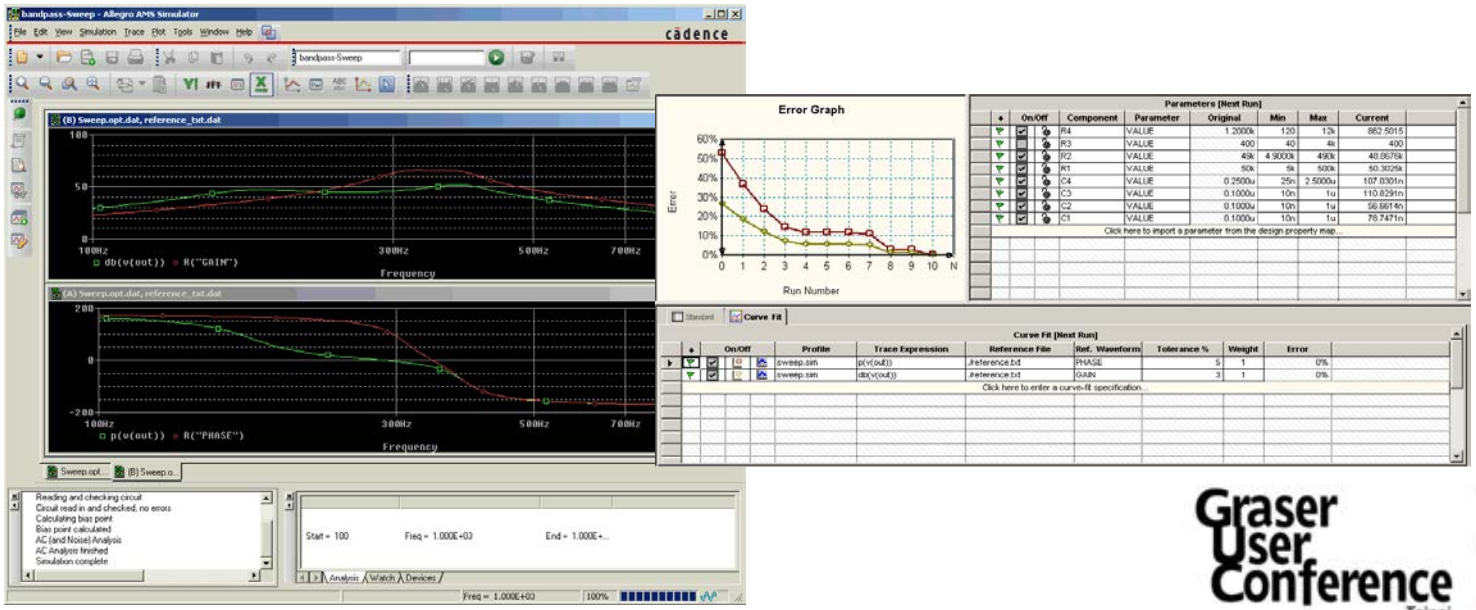
Optimizer

- Finds optimum combination of component values; automatically simulates, evaluates results, and adjusts component values to reach performance requirements.
- Can be used to retarget an existing design at new goals.
  - To meet requirements of newer circuits.
  - To meet regional requirements.
- Saves time for engineers by taking over the often “mindless” task of final optimization
- Can optimize to a set of goal functions and/or a set of curves.



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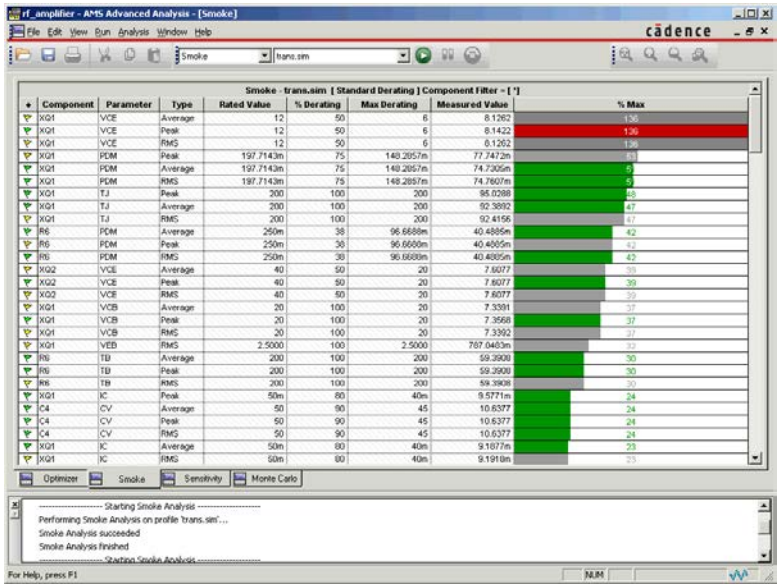
Smoke

- Checks components to see if they are approaching or exceeding their recommended safe operating limits.
- Allows users to specify their own derating criteria to ensure components are not stressed, or exceed safe operating limits.
- Determines a part's performance under various stresses and environmental conditions.
- Helps in thermal design aspect of electronics circuit.
- Calculate Peak, Avg. and RMS power.
- Cross-probe to automatically find listed parts in the schematic.



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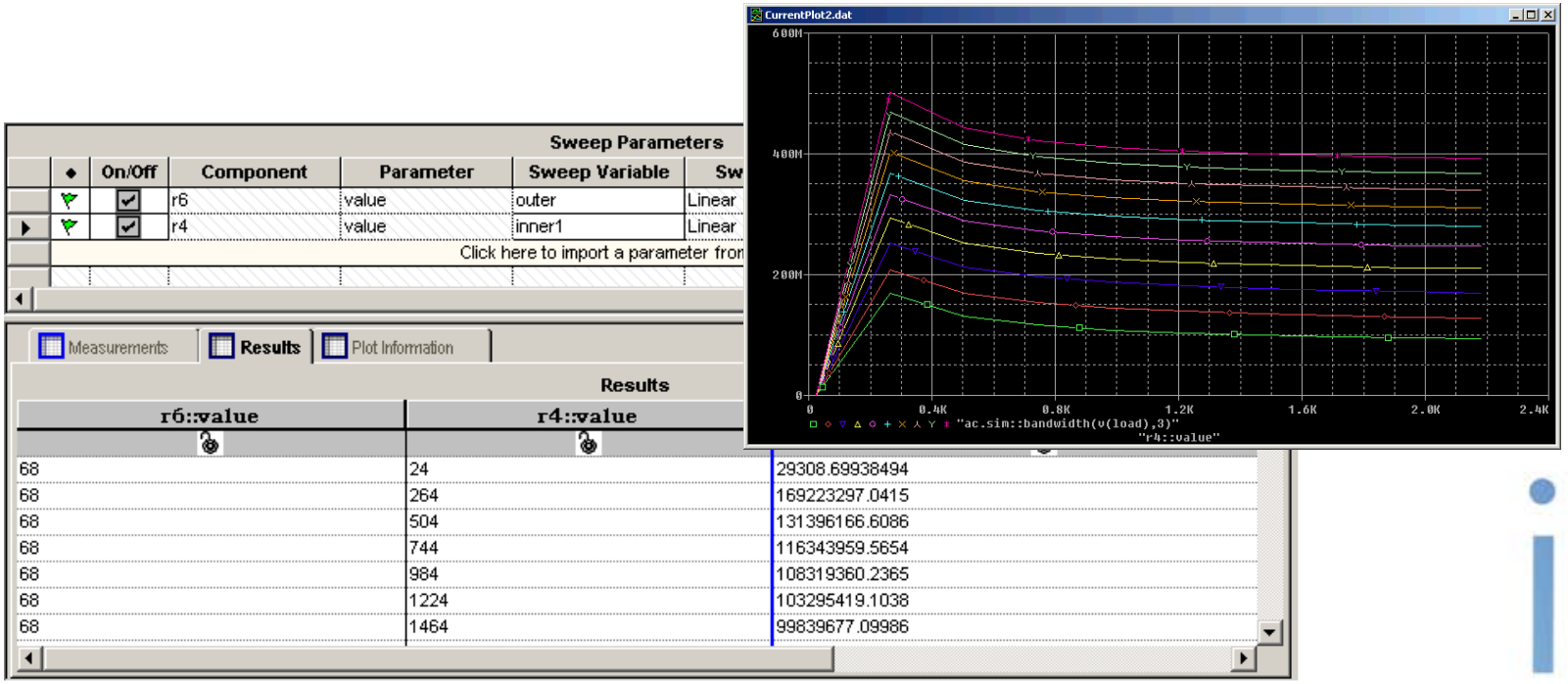
Parametric

- Sweep multiple (nested) parameters.
- Quickly view results and create families of curves.
- Ensure there is no unusual circuit behavior while sweeping the component values.



Sweep Parameters

	On/Off	Component	Parameter	Sweep Variable	Sw
	☑	r6	value	outer	Linear
▶	☑	r4	value	inner1	Linear
		Click here to import a parameter fror			

Measurements | Results | Plot Information

Results

r6::value	r4::value	
68	24	29308.69938494
68	264	169223297.0415
68	504	131396166.6086
68	744	116343959.5654
68	984	108319360.2365
68	1224	103295419.1038
68	1464	99839677.09986

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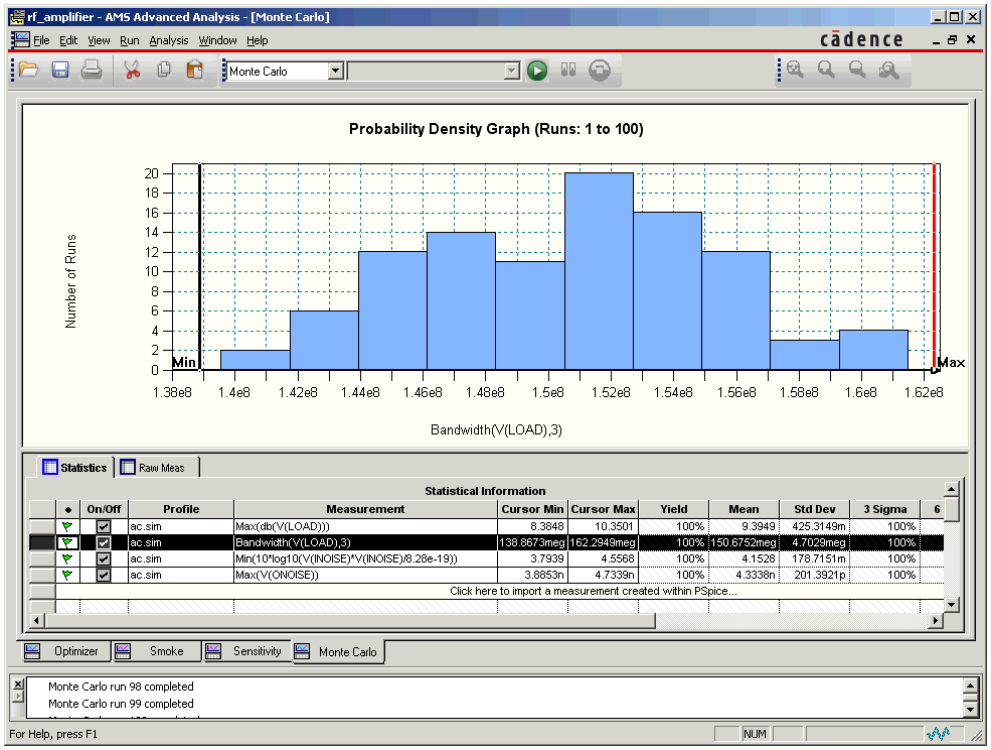
Monte Carlo

- Calculate Yield before going into manufacturing.
- Produce circuit performance statistics due to device variations.
- Set specification minimum and maximum, and estimate production yield before going to production.
- View graphical results as probability density histogram, or as cumulative distribution function.



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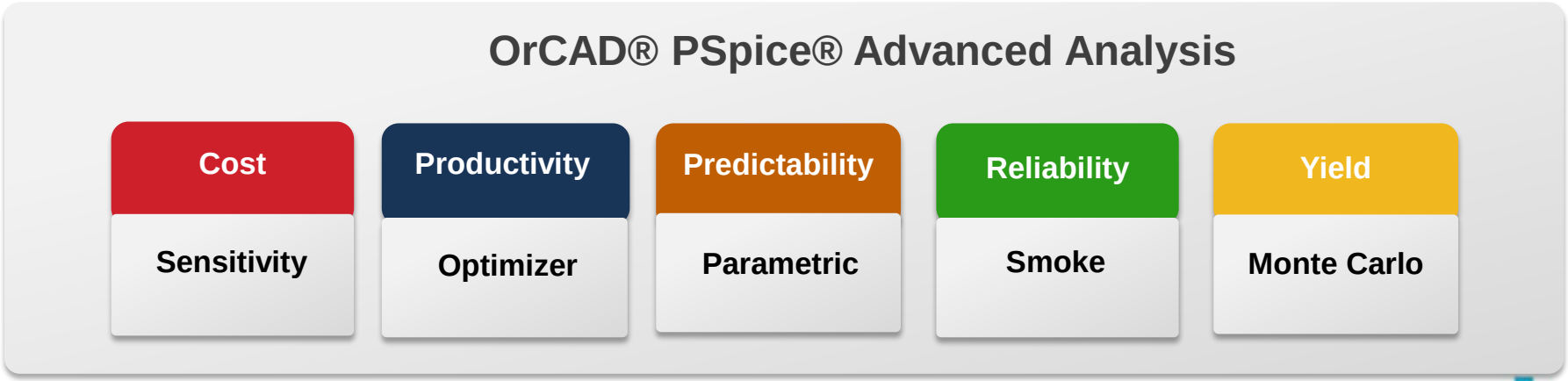
OrCAD PSpice Advanced Analysis

- Help customers optimize their design while maintaining their cost and yield.



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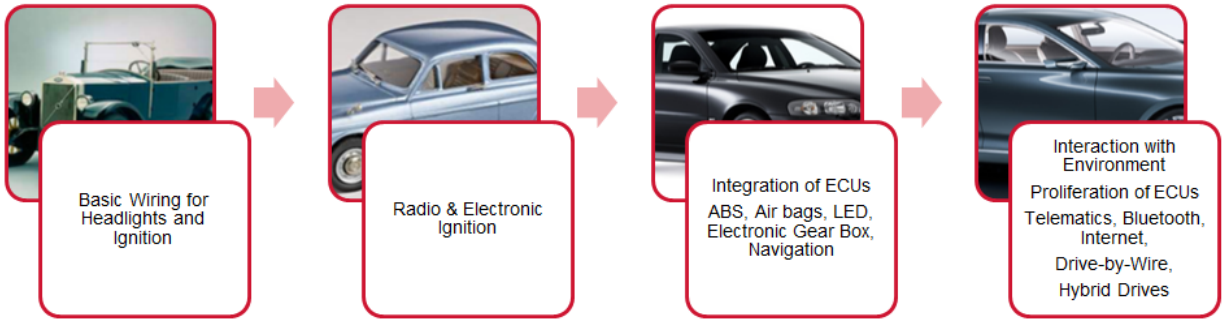
Industry Application

Automotive

- Automotive Engineering Design Challenges



Systems Modeling

ECU Logic Authoring

Power Electronics

Multi-Domain
Mixed Signal
Control Systems

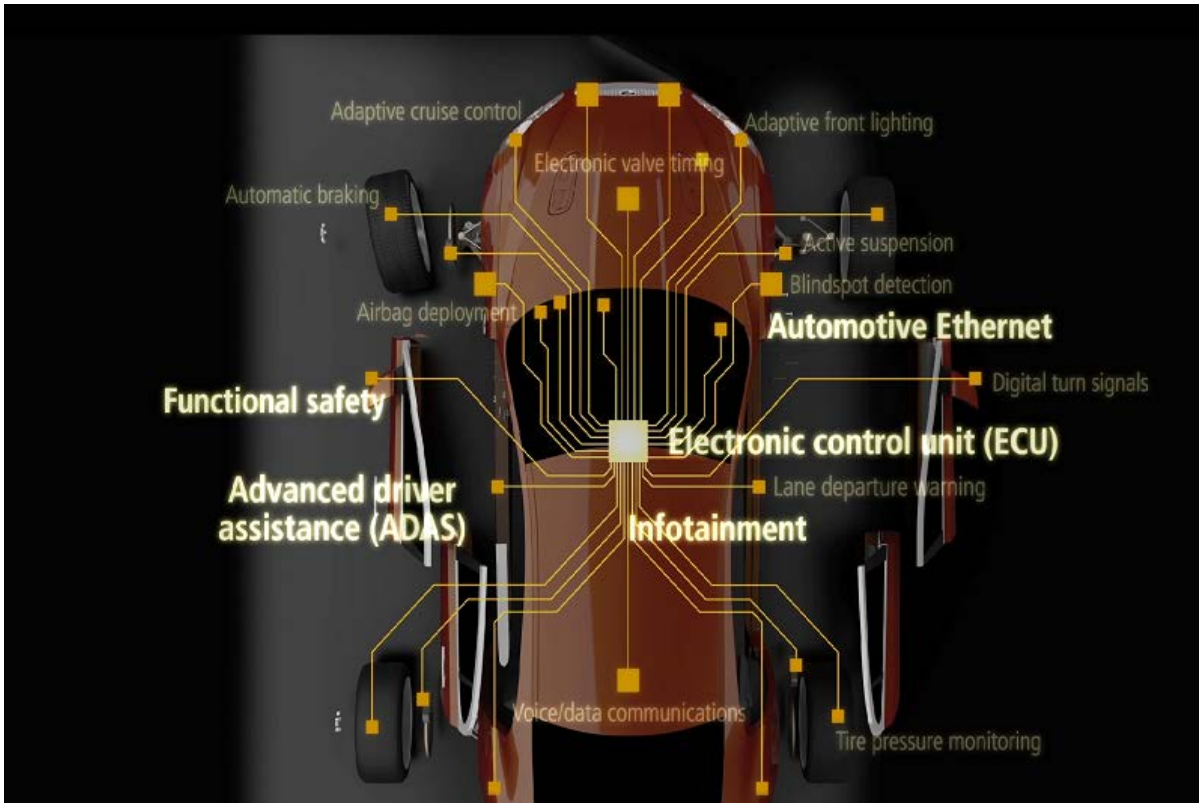
Sensors

Network Enabled

Embedded Software

Automotive

- Automotive Engineering Design Challenges



Systems Modeling

ECU Logic Authoring

Power Electronics

Multi-Domain Mixed Signal Control Systems

Sensors

Network Enabled

Embedded Software

Automotive

- Customer Key Challenges
  - Evaluate electronic interfaces for compatibility and robustness against various automotive conditions.
  - Identify and fix problem before Hardware Freeze.

- Adopt OrCAD® PSpice® Solution
  - OrCAD PSpice
  - OrCAD PSpice Advanced Analysis
  - OrCAD PSpice SLPS

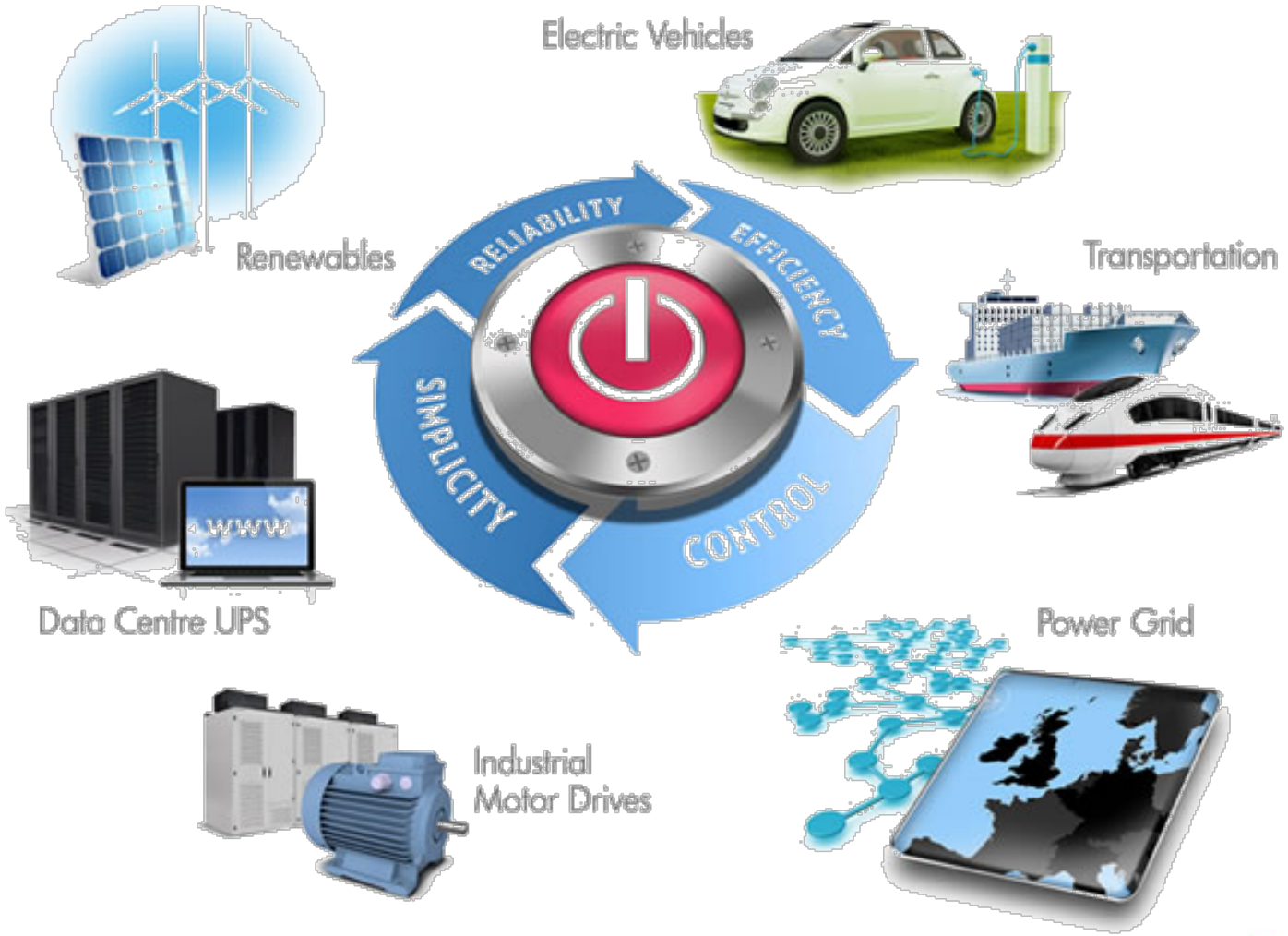
Automotive

- OrCAD® PSpice® Technology
  - Steady State Analysis
  - Transient Analysis
  - System Analysis/Subsystem Analysis
  - Simulate to identify below Failures
    - Short to battery
    - Short to ground
    - Jump start
    - Ground shift conditions
    - Reverse Battery condition
  - Worst Case Analysis
  - Monte Carlo Analysis
  - DC Sweep, Parametric Sweep, Temperature Sweep
  - Smoke Analysis

Automotive

- Results
  - Quickly identified stress on electronics components at different conditions.
  - Evaluated Power dissipation.
  - Simulated ECU subsystem with other automotive electronic subsystems.
  - Detected supplier design problems and vehicle interface error earlier on.
    - Saving time and money.
  - Met the rigorous quality and reliability standards.

Power Electronics



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Power Electronics

- Customer Key Challenges
  - High power = hard to characterize accurately in the lab.
  - Requires special models for transformer(nonlinear magnetic), power semiconductors.
  - Component stress.
  - Power electronics designers that need PCB routing effects included in their simulation.

- Adopt Cadence® Solution
  - OrCAD® PSpice®
  - OrCAD PSpice Advanced Analysis
  - Cadence® Sigrity™ solution

Power Electronics

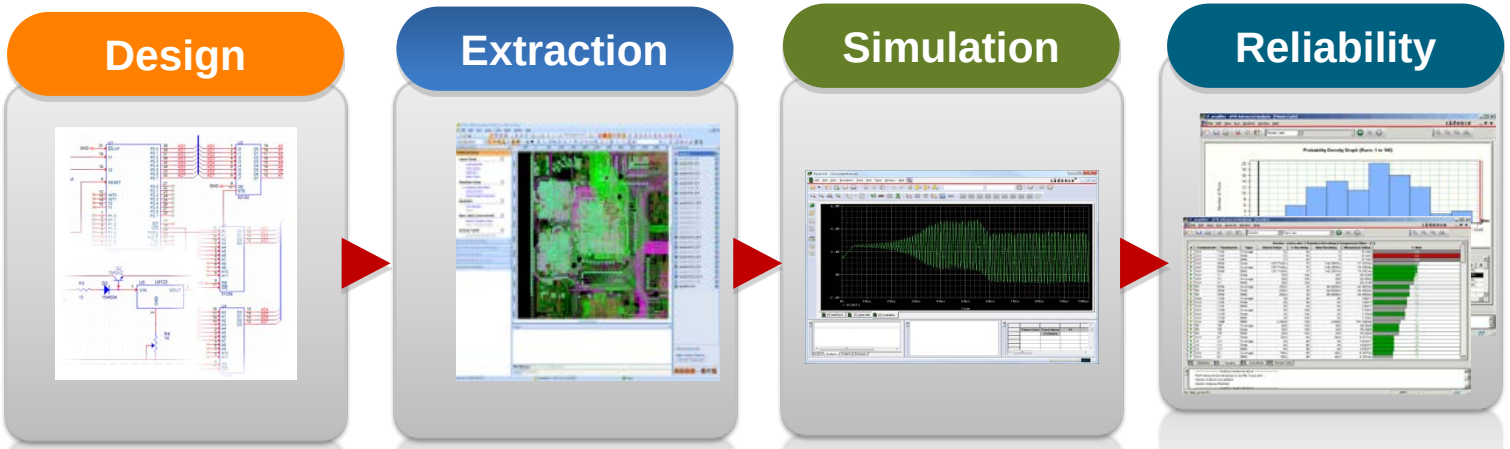
Cadence Solution

- OrCAD® PSpice® Technology
  - Allows mixed-signal simulation and system level analysis capabilities across different levels of abstraction.
  - Core loss calculator.
  - Ease of access to Industry's most comprehensive set of accurate data from manufacturers, which are included in more than 33,000 simulation-ready PSpice models.
  - PSpice Modeling Apps for Voltage Controlled Oscillators (VCOs), Piece-Wise Linear Sources (PWLs), PWMs, Transformers and several others simplify modeling
  - Smoke Analysis.
  - Monte Carlo Analysis

- Cadence® Sigrity™ Technology
  - Extract PCB routing effects.
    - Power electronics designers can simulate early validating design requirements are met.

Power Electronics

- Cadence® Solution
  - OrCAD® PSpice® and Cadence® Sigrity™



- Results
  - OrCAD PSpice verifies component stress.
  - Meet Time To Market targets.
    - Faster development process.
    - OrCAD PSpice delivers accurate results enabled First-Time-Right Design.

System Simulation Solution

- Summary
  - Increase Design Productivity by automating the design process using the PSpice Optimizer. Produce more optimized circuits than humans.
  - Reduce errors from re-entering the schematics when going from schematic to layout.
  - Increase reliability of the design by using the advanced analyses package. Reduce the number of costly Field Failures.
  - Excellent Model development capability Large analog/mixed level components in standard library.

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Thank You